Draft Environmental Impact Statement

for the Revision of the Resource Management Plans of the Western Oregon Bureau of Land Management Districts

of Salem, Eugene, Roseburg, Coos Bay, and Medford Districts, and the Klamath Falls Resource Area of the Lakeview District

Volume I

BLM

Salem, Eugene, Roseburg, Coos Bay, Medford, and Klamath Falls Offices

August 2007

WESTERN OREGON PLAN REVISIONS

United States Department of the Interior
Bureau of Land Management
Oregon State Office
333 S.W. 1st Avenue
Portland, Oregon 97204

OFFICIAL BUSINESS
PENALTY FOR PRIVATE USE, $300

PRIORITY MAIL
POSTAGE AND FEES PAID
Bureau of Land Management
Permit No. G-76

BLM/OR/WA/PL-07/046+1792

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
Oregon State Office
P.O. Box 2965
Portland, Oregon 97208

IN REPLY REFER TO:
1610 (OR-930)

Dear Reader:

I am inviting you to participate in a planning process that we feel is important to you and your interests. We're setting the course for the future management of approximately 2.6 million acres of your public lands spread throughout the coastal mountains and on the west slopes of the Cascades in Oregon. Some of these lands may surround your community or may lie within the watershed that supplies your drinking water. These lands provide habitat for wildlife and places for all of us to recreate. And above all, most of these lands were set aside years ago to provide a steady source of forest products and revenue to support the economy of western Oregon and the 18 western Oregon counties. We need your help in deciding their future.

This document is the Bureau of Land Management's (BLM) Draft Environmental Impact Statement for the revision of the resource management plans of the western Oregon BLM Districts that have provided the management direction for those lands for the past 12 years. We are revising these six plans with this single Draft Environmental Impact Statement. There are three action Alternatives presented in this document.

We have selected Alternative 2 as our preferred alternative because this alternative would best fulfill our statutory mission and responsibilities. We are looking for input on the plan and the analysis of the effects of the alternatives. During the next 90 days, I hope you'll take the time to review this draft Environmental Impact Statement and send us your ideas and suggestions regarding this proposed revision of our resource management plans; however, please recognize the BLM's obligation to meet the laws and regulations that we have to follow. Your comments, along with ideas from our cooperators, will help craft our proposed resource management plans that will be analyzed in a Final Environmental Impact Statement.

Examples of comments that would be useful to the BLM in developing the proposed resource management plans are:

- How to increase the fire resiliency of the forests in the Medford District and the Klamath Falls Resource Area of the Lakeview District.
- How to manage the harvestable land base in such a way that will increase the rate of recovery of the northern spotted owl and the marbled murrelet in the short term, while still providing a consistent and stable timber supply.
- How to speed the redevelopment of structurally complex forests after regeneration timber harvesting.

- What management techniques might we use to lessen the effects to special status species?

As you share your interests and suggestions with us, your comments will be most useful to us if they address one or more of the following:

- errors in our analysis;
- new or missing information that would have a bearing on the analysis;
- a definition of a substantive and new alternative. An example would be an alternative composed of parts of the other alternatives that meets all the statutory requirements applicable to the lands managed by the BLM in western Oregon as described.

The end product of this planning process will be six approved resource management plans that will guide the management for the western Oregon BLM Districts for the next 10 to 15 years.

We will accept mailed comments at:

Western Oregon Plan Revisions
P.O. BOX 2965
Portland, OR 97208

You can also make comments online at the following website:
http://www.blm.gov/or/plans/wopr

Your comments must be postmarked before November 9, 2007.

If you have questions, please contact Alan Hoffmeister, Western Oregon Plan Revision Public Outreach Coordinator, at (503) 808–6629 or at orwopr@or.blm.gov

Thank you for your interest in the management of BLM-administered lands.

Sincerely,

Edward W. Shepard
State Director

United States Department of the Interior
Bureau of Land Management

Draft Environmental Impact Statement for the Revision of the Resource Management Plans of the Western Oregon Bureau of Land Management Districts

Prepared by
Oregon State Office
August 2007

State Director, Oregon

Salem District Manager

Coos Bay District Manager

Eugene District Manager

Medford District Manager

Roseburg District Manager

Lakeview District Manager

Table of Contents

Volume I

Preface XXXV

Summary **XLI**

Introduction XLIII

What is the purpose and need for the action being proposed? XLIV

What alternatives are being proposed? XLV

What are the environmental consequences of the alternatives? L

Chapter 1 – Purpose and Need **1**

Introduction 3

Purpose and Need for the Plan Revisions 3

Reasons for Revising the RMPs Now 4

Selecting a Preferred Alternative 7

Background 8

Planning Area 16

Planning Process 18

Collaboration 19

Relationship of the RMPs to Other Plans, and Programs 22

Chapter 2 – Alternatives **27**

Introduction 29

Management Common to All Action Alternatives 29

The Alternatives 64

Tables for Areas of Critical Environmental Concern 114

Tables for District-Specific Recreation Management Actions 119

Maps 154

Chapter 3 – Affected Environment 179

Introduction 181
Ecology 192
Socioeconomics 216
Timber 247
Special Forest Products 251
Botany 257
Invasive Plants 268
Wildlife 282
Fish 335
Water 359
Fire and Fuels 392
Air 401
Recreation 405
Wilderness Characteristics 417
Visual Resources 420
National Landscape Conservation System 422
Soils 425
Grazing 428
Wild Horses 433
Areas of Critical Environmental Concern and Research Natural Areas 435
Cultural Resources 439
Lands, Realty, Access, and Transportation 445
Energy and Minerals 454

Volume II

Chapter 4 – Environmental Consequences 473

Introduction 475

Ecology 494

Socioeconomics 534

Environmental Justice 554

Timber 557

Special Forest Products 590

Botany 593

Invasive Plants 611

Wildlife 633

Fish 723

Water 745

Fire and Fuels 765

Air 773

Recreation 775

Wilderness Characteristics 784

Visual Resources 789

National Landscape Conservation System 793

Soils 794

Grazing 798

Wild Horses 804

Areas of Critical Environmental Concern 807

Cultural Resources 811

Energy and Minerals 816

Chapter 5 – Coordination and Monitoring 819
Introduction 821
Public Contact and Scoping....822
Formal Cooperators....823
Government-to-Government Coordination....825
Consistency with Other Agency Plans and Programs....826
Section 7 Consultation under the Endangered Species Act....829
Preparers 830
Monitoring....845
Adaptive Management 848

Acronyms 851

Glossary 855

References 867

Index 923

Volume III

Appendix A. Legal Authorities 927
Settlement Agreement....929
Major Court Rulings....930
Major Legal Authorities....933

Appendix B. Ecology 939
Structural Stage Classification 941
Interagency Vegetation Mapping Project Data....946
Average Historical Conditions and the Historic Range of Variability 947
FRAGSTATS....949

Appendix C. Socioeconomics **953**

Analysis of Socioeconomic Effects 955

Appendix D. Timber **965**

Timber Valuation.....967

Ten-Year Scenario Quality Check 971

Appendix E. Botany **973**

Federally Listed and Candidate Plant Species 975

Digest of Actions Contained in Individual Recovery Plans for Federally-Listed Plant Species 977

Digest of Conservation Plans for Special Status Plants.....980

Habitat Groups.....984

Appendix F. Invasive Plants **1013**

Analytical methods used to determine relative risk to introduce invasive plant species between the alternatives. 1015

Appendix G. Wildlife **1023**

Management Opportunities on BLM-Administered Lands in the Recovery Plans for the Columbia White-tailed Deer (Columbia River population), Marbled Murrelet, and Bald Eagle. 1025

Data in Support of Northern Spotted Owl Analysis 1037

Marbled Murrelet Critical Habitat. 1060

Special Status Animal Species.....1065

Appendix H. Fish **1069**

Special Status Fish Species in the Planning Area 1071

Status Summaries and Evolutionary Significant Units for Threatened or Endangered Salmonids 1073

Intrinsic Potential Model and Large Wood Delivery Model 1082

Appendix I. Water **1093**
Water Planning Criteria 1095
Source Water Watersheds for Public Water Systems 1120
Best Management Practices 1132

Appendix J. Recreation **1189**
Interim Off-highway Vehicle Management Guidelines 1191
Planning Frameworks for Special Management Areas 1208

Appendix K. Wilderness Characteristics **1255**
Wilderness Characteristics Analysis 1257

Appendix L. Grazing **1261**
Standard Procedures and Design Elements for Range Improvements within the Klamath Falls Resource Area 1263
Grazing Allotments in the Klamath Falls Resource Area and Medford District 1270
Standards for Rangeland Health 1284

Appendix M. Areas of Critical Environmental Concern **1305**
Areas of Critical Environmental Concern 1307

Appendix N. Cultural Resources **1351**
Federally Recognized Native American Tribes in or with Interests in the Planning Area 1353

Appendix O. Lands **1359**
Land Tenure Adjustment Criteria....1361
Land Withdrawals and Land Tenure Zone 3 Lands 1363
Inventory of Communication Sites 1426
Analytical Methods to Determine Legal Public Accessibility of BLM Lands in the Planning Area 1430

Appendix P. Energy and Minerals 1435

Reasonably Foreseeable Mineral and Energy Developments 1437

Proposed Restrictions and Requirements on Mineral and Energy Exploration and Development Activity 1478

Appendix Q. Vegetation Modeling 1503

Introduction 1505

BLM Forest Inventory Data 1506

Use of the Inventory Data in the Modeling 1512

GIS – Defining the Land Base & Spatial Projections 1534

Forest Growth and Yield Modeling 1536

OPTIONS Modeling 1552

OPTIONS Products 1588

List of Tables

Table 1. Limited comparison of the key features of the four alternatives (for a complete comparison of the key features of the four alternatives, see the comparison table in *Chapter 2*) XLIX

Table 2. Total economic impacts by alternative LIII

Table 3. First decade revenues and costs and the present net value over 50 years LIII

Table 4. Suitable habitat within the late-successional reserves and the late-successional management areas LIX

Table 5. Acres of suitable habitat outside of the late-successional reserves and the late-successional management areas LX

Table 6. Off-highway vehicle designations under the alternatives LXIII

Table 7. Acres of wilderness characteristics maintained under the alternatives LXIV

Table 8. Total existing and potential ACECs designated by alternative LXV

Table 9. Relevant and important value categories that would receive no special management attention LXVI

Table 10. The BLM districts and Oregon counties included in the planning area of the resource management plan revisions 17

Table 11. Legal status of lands managed by the BLM in western Oregon 17

Table 12. Formal cooperators 19

Table 13. Recognized tribes within the planning area 20

Table 14. Other plan and resource coordination opportunities 25

Table 15. Areas open or closed to energy and mineral developments 32

Table 16. Allotments not available for livestock grazing in the Klamath Falls Resource Area 36

Table 17. Exclosures or other areas closed to grazing in the Klamath Falls Resource Area 37

Table 18. Allotments not available for livestock grazing in the Medford District 38

Table 19. Federally listed plants with recovery plans 46

Table 20. Special status species plants with conservation plans 47

Table 21. Acres of visual resource management (VRM) classes by district 55

Table 22. Lands with wilderness characteristics maintained under special management 59

Table 23. Snag and coarse woody debris (CWD) retention or creation for stands of larger trees (stand average diameter of QMD > 14 in.) 69

Table 24. Snag and coarse woody debris (CWD) retention or creation for stands of smaller trees (stand average diameter of QMD ≤ 14 in.) 69

Table 25. Criteria established for the riparian management area land use allocation under Alternative 1 70

Table 26. Timber offered for sale from regeneration harvest units 71

Table 27. Timber offered for sale from commercial thinning harvest units 72

Table 28. Snag and coarse woody debris (CWD) retention or creation for stands of larger trees (stand average diameter of QMD > 14 in.) 77

Table 29. Snag and coarse woody debris (CWD) retention or creation for stands of smaller trees (stand average diameter of QMD ≤ 14 in.) 77

Table 30. Snag and coarse woody debris (CWD) retention for salvaging of timber after a stand-replacement disturbance 78

Table 31. Zones and the zone-specific management actions of the riparian management area land use allocation under Alternative 2 79

Table 32. Timber offered for sale from regeneration harvest units 82

Table 33. Timber offered for sale from commercial thinning harvest units 82

Table 34. Criteria established for the riparian management areas of the lands that are adjacent to the Coquille Forest as part of Alternative 2 85
Table 35. Harvest interval, green tree retention, and snag and coarse woody debris (CWD) retention or creation levels per vegetation series for regeneration harvests under Alternative 3 91
Table 36. Harvest interval, green tree retention, and snag and coarse woody debris (CWD) retention or creation levels per vegetation series for partial harvests under Alternative 3 92
Table 37. Zones and the zone-specific management actions of the riparian management area land use allocation under Alternative 3 95
Table 38. Criteria established for the riparian management areas of the lands that are adjacent to the Coquille Forest as part of Alternative 3 98
Table 39. Comparison of the key features of the four alternatives 110
Table 40. Comparison of the key impacts of the four alternatives 112
Table 41. Existing and potential areas of critical environmental concern (ACECs) designated by alternative 114
Table 42. Areas of critical environmental concern under the alternatives 114
Table 43. District-specific special recreation management areas 120
Table 44. District-specific extensive recreation management areas 122
Table 45. District-specific recreation sites 123
Table 46. District-specific recreation trails 126
Table 47. District-specific potential recreation sites 129
Table 48. District-specific potential recreation trails 132
Table 49. District-specific backcountry byways 135
Table 50. District-specific potential backcountry byways 136
Table 51. District-specific environmental education areas 137
Table 52. District-specific recreation and public purpose leases 138
Table 53. District-specific off-highway vehicle area designations 139
Table 54. District-specific areas closed to off-highway vehicle use 140
Table 55. District-specific off-highway vehicle emphasis areas 143
Table 56. District-specific potential off-highway vehicle emphasis areas 144
Table 57. District-specific Oregon State scenic waterways 145
Table 58. District-specific designated wild and scenic rivers and river segments 146
Table 59. District-specific suitable wild and scenic rivers and river segments 147
Table 60. District-specific eligible wild and scenic rivers and river segments 148
Table 61. District-specific wilderness areas 152
Table 62. District-specific wilderness study and wilderness instant study areas 153
Table 63. District-specific miscellaneous National Landscape Conservation System designated lands 153
Table 64. Legal status of the lands administered by the BLM within the planning area 184
Table 65. structural stage subdivisions 198
Table 66. Current structural stage abundance on forested lands 207
Table 67. Current mean patch size by structural stage by province 210
Table 68. Current connectance on BLM-administered lands by structural stage by province 210
Table 69. 2005 county economy indicators 219
Table 70. 2005 county economy dependence on Secure Rural Schools and BLM effects 220
Table 71. 2005 county economy grouped income patterns 221
Table 72. Public services that county revenues support 226
Table 73. Total revenue, discretionary revenue, and O&C funding for fiscal year 2005 228

Table 74. BLM payments to counties within the planning area for selected years ($million) 231
Table 75. Percent public land in O&C counties 232
Table 76. 2005 timberland area and inventory within the planning area 233
Table 77. 2003 mill study log flows 235
Table 78. Current standing volume and acres of forested land 247
Table 79. Historic timber volume estimates 248
Table 80. Special forest products by category 256
Table 81. Number of documented and suspected plant and fungi special status species 260
Table 82. Federal status of federally listed plant species within the planning area 262
Table 83. Federally listed plant species with recovery plans 263
Table 84. Plant species with conservation agreements 264
Table 85. Plant species with conservation strategies 264
Table 86. Distribution of survey and manage species 265
Table 87. Number of invasive plant and noxious weed species on BLM-administered lands within the planning area 268
Table 88. Classification schedule for the habitat of the northern spotted owl 287
Table 89. Summary of current northern spotted owl habitat on BLM-administered lands within the planning area by province 289
Table 90. Summary of marbled murrelet nesting habitat on BLM-administered lands within the planning area 302
Table 91. Marbled murrelet population estimates for conservation Zones 3 and 4 304
Table 92. Summary of critical habitat units and marbled murrelet nesting habitat on BLM-administered lands within the planning area 307
Table 93. Potential bald eagle nesting habitat within the planning area 311
Table 94. Summary of the 2005 monitoring data for the bald eagle 312
Table 95. Bald eagle management areas within the planning area 312
Table 96. Critical habitat for the Pacific coast populations of the western snowy plover 316
Table 97. Animal special status species in BLM districts within the planning area 318
Table 98. Documented or suspected federally listed animal species within the planning area that are not typically found in forested habitat 319
Table 99. Habitat requirements for federally listed animal species within the planning area that are not typically found in forested habitat 319
Table 100. Bureau sensitive species and bureau assessment species found within the planning areas and grouped by habitat requirements to facilitate analysis 321
Table 101. Available fisher natal and foraging habitat on BLM-administered lands with in the planning area 326
Table 102. Bird occurrence within the montane and western forest habitat types of Oregon and Washington 326
Table 103. Analytical groups of land birds within the planning area 327
Table 104. Deer management areas within the planning area 331
Table 105. Elk management areas within the planning area 333
Table 106. Major risk factors by evolutionary significant unit 337
Table 107. BLM land ownership patterns and representative watersheds 348
Table 108. Temperature standards for fish species 357
Table 109. Major river basins within the planning area 361
Table 110. Miles of streams with BLM ownership within the planning area 364
Table 111. Stream type descriptions 364
Table 112. Miles of BLM streams on the Oregon Department of Environmental Quality (ODEQ) 303(d) list 365

Table 113. Shade zones 369
Table 114. Basic erosion rates for roads based on the underlying geology..... 374
Table 115. Potential fine sediment delivery from existing roads 377
Table 116. Fine sediment and ODEQ probabilistic stream surveys for third-order or less streams from 1994 to 2001..... 382
Table 117. Potential contaminant sources affecting waterbodies within source water watersheds 390
Table 118. Frequencies and severities of the natural fire regimes..... 392
Table 119. Current fire hazard ratings by percent of land within the districts of the planning area..... 398
Table 120. Classification of recreational settings by remoteness 406
Table 121. Classification of recreational settings by naturalness..... 407
Table 122. Legal public accessibility of BLM lands by district 410
Table 123. Current and projected levels of participation by recreation activity within the planning area from 2006 to 2016..... 413
Table 124. Distribution of recreational demand by setting for each recreation activity 415
Table 125. Lands with wilderness characteristics..... 418
Table 126. Acres of each visual resource inventory class by district 421
Table 127. National Landscape Conservation System designated lands by district..... 422
Table 128. Wild and scenic rivers by district 424
Table 129. Livestock grazing authorizations by district..... 428
Table 130. Rangeland health standards assessment results..... 430
Table 131. Range Improvements constructed or maintained from 1996 through 2006 431
Table 132. Designated and old potential areas of critical environmental concern by district..... 437
Table 133. New potential areas of critical environmental concern by district..... 437
Table 134. Value categories for designated and old potential areas of critical environment concern by district..... 438
Table 135. Value categories for new potential areas of critical environmental concern by district..... 438
Table 136. Heritage resources by district..... 439
Table 137. Acres of land tenure zones by district 445
Table 138. Road functional classifications by BLM district within the planning area 451
Table 139. Road standards by BLM district within the planning area 452
Table 140. Road surface type by BLM district 453
Table 141. Known and inferred mineral occurrence potential for the Salem District..... 456
Table 142. Known and inferred mineral occurrence potential for the Eugene District 457
Table 143. Known and inferred mineral occurrence potential for the Roseburg District 459
Table 144. Known and inferred mineral occurrence potential for the Coos Bay District 460
Table 145. Known and inferred mineral occurrence potential for the Medford District..... 461
Table 146. Known and inferred mineral occurrence potential for the Klamath Falls Resource Area of the Lakeview District 463
Table 147. Summary of the mineral occurrence potential within the planning area by resource type 472
Table 148. Acres of the restrictions that could affect the exploration and development of energy and mineral resources..... 472
Table 149. Estimated annual first decade levels of timber management activity by alternative 493
Table 150. Structural stage abundances by percentage of the BLM-administered forested lands by alternative..... 496
Table 151. Outcome of existing old forest by 2106 by alternative 509
Table 152. Structural stage abundances of the subalternatives and the reference analyses as a percentage of the BLM-administered forested lands by 2106 528

Table 153. Distribution of harvest by harvesting type and percentage of large, peeler-grade logs for the first 10 years 536
Table 154. Estimated annual payments to the counties for the first 10 years 537
Table 155. Annual payments to the counties for the first 10 years (based on 2005 levels) 538
Table 156. Sources of economic effects by alternative 540
Table 157. Total economic impacts that are associated with BLM timber harvests by alternative 541
Table 158. Counties in which the alternatives would compensate for other job losses 543
Table 159. Counties in which the alternatives would not compensate for other job losses 544
Table 160. Wood products counties with gains concentrated in sawmills 545
Table 161. Counties losing more than $10 million per year in Secure Rural Schools (SRS) payments ... 546
Table 162. County plywood output contraction by alternative 547
Table 163. BLM budget 550
Table 164. Annual expenditures for silviculture for the first 10 years by district 550
Table 165. Revenues and costs for the first 10 years and the present net value over 50 years by alternative 552
Table 166. Current composition of minority and low-income populations of the counties within the planning area compared to the state of Oregon 556
Table 167. Allowable sale quantity by district by alternative 560
Table 168. Nonharvest land base volume over the next 10 years 568
Table 169. Total annual volume by district over the next 10 years 569
Table 170. Acres harvested by age group compared with the size of the total harvest land base under the No Action Alternative 579
Table 171. Acres harvested by age group compared with the size of the total harvest land base under Alternative 1 580
Table 172. Acres harvested by age group compared with the size of the total harvest land base under Alternative 2 581
Table 173. Acres harvested by age group compared with the size of the total harvest land base under Alternative 3 582
Table 174. Acres of forest management activity and mature&structurally complex forest by alternative in the year 2016 592
Table 175. Federally listed and candidate plant species in the planning area 593
Table 176. Habitat groups, physiographic provinces, and land use allocations 595
Table 177. Forest management activities that affect plant populations over the next 10 years 596
Table 178. Projected Populations that would be affected by Forest Management over the next 10 Years 609
Table 179. Projected BLM sensitive and assessment species populations and occupied habitat by district 610
Table 180. Susceptibility comparison for the introduction of invasive plant species that are associated with timber harvesting in the fifth-field watersheds across the alternatives over the next 10 years 614
Table 181. Matrix to determine the relative risk for the introduction of invasive plant species that are associated with timber harvesting activities over the next 10 years 615
Table 182. Risk comparison for the introduction of invasive plant species associated with timber harvesting in the fifth-field watersheds across the alternatives over the next 10 years 617
Table 183. Susceptibility comparison for the introduction of invasive plant species into riparian habitats that are associated with timber harvesting in the fifth-field watersheds over the next 10 years 620
Table 184. Risk comparison for the introduction of invasive plant species into riparian habitats associated with timber harvesting in the fifth-field watersheds across the alternatives over the next 10 years 623

Table 185. Risk comparison for the introduction of invasive plant species associated with new road construction by fifth-field watershed over the next 10 years 625
Table 186. Northern spotted owl suitable habitat on BLM-administered lands by alternative, reference analysis, and subalternative 636
Table 187. Minimum acreage of large blocks of suitable habitat 639
Table 188. Suitable habitat within late-successional reserves/late-successional management areas 642
Table 189. Suitable Habitat within Late-successional reserves/Late-successional management areas by District/Province Divisions, as percent of habitat-capable acres..... 644
Table 190. Development of suitable habitat within Alternative 2 large blocks of late-successional management areas 645
Table 191. Acres of suitable habitat outside of late-successional reserves/late-successional management areas 655
Table 192. Total dispersal habitat on BLM-administered lands in areas of concern 667
Table 193. Suitable Habitat on BLM-administered Lands in areas of concern 667
Table 194. Year at which the threshold age would be reached under Alternative 3..... 675
Table 195. Available marbled murrelet nesting habitat on BLM-administered lands within the planning area..... 676
Table 196. Current road density on BLM-administered lands within deer habitat management units 687
Table 197. Road densities by 2016 for deer habitat management areas 688
Table 198. Current road density on BLM-administered lands in elk habitat management units 692
Table 199. Road densities in 2016 for all elk habitat management areas 693
Table 200. Available fisher natal and foraging habitat on BLM-administered lands within the planning area..... 698
Table 201. Habitat features and focal bird species of conservation concern in the eastside conifer plant group in central, eastside Oregon and Klamath Basin 703
Table 202. Habitat features and focal bird species of conservation concern in the western Oregon conifer forests..... 706
Table 203. Comparison of snag and residual tree retention by alternative..... 707
Table 204. Sage grouse habitat on the Gerber block, Klamath Falls Resource Area 709
Table 205. BLM special status animal species known or suspected to occur on BLM-administered lands within the planning area..... 712
Table 206. Federally listed candidate, threatened, and endangered species not associated with forested ecosystems 718
Table 207. Riparian management areas across all land use allocations under the alternatives 719
Table 208. Forest floor habitat quality rating criteria..... 721
Table 209. Harvest levels as percent of forest capable acres under each alternative..... 722
Table 210. Relative potential of fish productivity index in 100 years compared to basin-wide maximum.....733
Table 211. Projected acres of stand establishment forests on BLM-administered lands..... 745
Table 212. Potential delivery of fine sediment by new roads constructed by 2016 under the alternatives 760
Table 213. Principles of fire resiliency 767
Table 214. Fire severity, hazard, and resiliency by forest structural stage classifications 767
Table 215. Probability of mortality by tree diameter in an extreme fire event 772
Table 216. Prescribed burning emissions from timber harvesting activities in the northern and southern BLM districts within the planning area..... 773
Table 217. Acres of remoteness levels by alternative..... 779
Table 218. Acres of naturalness levels projected for the year 2016 by alternative..... 781
Table 219. Special management to maintain wilderness characteristics under all action alternatives 784

Table 220. BLM-administered lands with wilderness characteristics in the harvest land base by alternative 785
Table 221. BLM-administered lands with wilderness characteristics in late successional management areas and riparian management areas by alternative 786
Table 222. BLM-administered lands with wilderness characteristics maintained by alternative 787
Table 223. Visual resource inventory classes and management classes by alternative 789
Table 224. Harvest land base within each visual resource inventory class by alternative 790
Table 225. Percentage of existing visual resource quality maintained by alternative within areas inventoried as class II and III 791
Table 226. Residual detrimental soil disturbance compared to total acres harvested 795
Table 227. Livestock Grazing Authorizations by District and by Alternative 798
Table 228. Range Improvement Construction by District and by Alternative 800
Table 229. Changes in Livestock Forage Production by Alternative 802
Table 230. Changes in wild horse forage production by alternative 806
Table 231. Total existing and potential ACECs designated by alternative 809
Table 232. Existing and potential ACECs not designated by alternative 809
Table 233. Relevant and important value categories that would receive no special management attention 810
Table 234. Existing and potential ACEC value categories by BLM district within the 124 areas that were further analyzed for designation 810
Table 235. Percent of total cultural resource sites damaged under the alternatives over the next 10 years ... 814
Table 236. Current claims, notices, and plans of operations within the planning area 817
Table 237. Key project staff for the Western Oregon Plan Revision 831
Table 238. Comparison of different stand classification schemes and the structural stage classification used in this RMP/EIS. A more extensive comparison of classification schemes can be found in Franklin et al. 2002. 945
Table 239. Federally Listed and Candidate Plant Species 975
Table 240. Special Status Plant Species Habitat Groups 985
Table 241. Survey and Manage Species Habitat Groups 1006
Table 242. Susceptibility weights for harvest activity types for introduction of invasive species into riparian areas 1019
Table 243. Roadside susceptibility categories based on invasive plant distribution and road densities in fifth field watersheds. 1021
Table 244. Matrix to determine the relative risk categories of invasive plant introduction from new road construction and related activities 1022
Table 245. Aggregate results of all adjusted, suitable habitat (NRF1) acres addressed in section 7 consultation (both formal and informal) for the northern spotted owl; baseline and summary of effects by State, physiographic province and land use function from 1994 to April 12, 2004 (the first decade of the Northwest Forest Plan) (USFWS pers com. 2006). 1038
Table 246. Change in suitable spotted owl habitat from 1994 to April 12, 2004, resulting from Federal management actions (Mgmt) and natural events by physiographic province (USFWS pers. com. 2006). 1039
Table 247. Aggregate results of all adjusted, suitable critical habitat acres affected by Section 7 Consultation for the Northern spotted owl; baseline and summary of effects by state, Physiographic Province and land use function from 1994 to July 19, 2005 (USFWS pers. comm. 2006) 1040
Table 248. Change in northern spotted owl suitable critical habitat from 1994 to December 10, 2004, resulting from Federal management actions and natural events by physiographic province. (USFWS pers. comm. 2006) 1041

Table 249. Suitable Habitat within Critical Habitat Units OR-9 – OR-23, by alternative..... 1044
Table 250. Suitable Habitat within Critical Habitat Units OR-24 – OR-38, by alternative..... 1045
Table 251. Suitable Habitat within Critical Habitat Units OR-39 – OR-50, by alternative..... 1046
Table 252. Suitable Habitat within Critical Habitat Units OR-51 – OR-60, by alternative..... 1047
Table 253. Suitable Habitat within Critical Habitat Units OR-61 – OR-76, by alternative..... 1048
Table 254. Marbled murrelet nesting habitat summarized by critical habitat unit and alternative..... 1061
Table 255. Documented and suspected occurrence of Bureau special status animal species (as of March 14, 2005) within the planning area of the Western Oregon Plan Revision..... 1065
Table 256. Federally Threatened or Endangered Fish Species and Critical Habitat Designation within the Planning Area..... 1071
Table 257. Bureau Sensitive and Bureau Assessment Fish Species Present in the Planning Area. 1072
Table 258. Vegetation Hydrologic Maturity Assignment to Land Cover Class..... 1096
Table 259. Vegetation Hydrologic Maturity Assignment to Land Cover Class..... 1101
Table 260. Vegetation hydrologic maturity and snow water equivalent ratios..... 1102
Table 261. Basic Erosion Rates..... 1106
Table 262. Groundcover Correction Factor for Cut and Fill Slopes..... 1107
Table 263. Factors for Road Tread Surfacing..... 1107
Table 264. Traffic and Precipitation Factor..... 1107
Table 265. Projected Permanent Roads by Alternative[1]..... 1111
Table 266. Factor definition table..... 1112
Table 267. Potential sediment delivery, by Alternative from roads..... 1113
Table 268. Primary Shade Zone Distance of Riparian Trees (In Feet)..... 1117
Table 269. Comparison of Alternatives Not Meeting Effective Shade for Perennial Streams..... 1119
Table 270. Source water watersheds with BLM-administered lands in the planning area..... 1120
Table 271. Best management practices for roads and landings..... 1135
Table 272. Best management practices for timber harvest activities..... 1154
Table 273. Best management practices for silvicultural activities..... 1159
Table 274. Best management practices for fire and fuels management..... 1161
Table 275. Waterbar spacing by gradient and erosion class..... 1166
Table 276. Best management practices for surface source water for drinking water..... 1167
Table 277. Best management practices for recreation..... 1169
Table 278. Best management practices for grazing..... 1173
Table 279. Best management practices for minerals exploration and development..... 1175
Table 280. Best management practices for spill prevention and abatement..... 1179
Table 281. Best management practices for restoration..... 1181
Table 282. Proposed Klamath Falls Range Improvements by Allotment..... 1263
Table 283. Klamath Falls Resource Area Grazing Allotments..... 1271
Table 284. Medford Grazing Allotments..... 1279
Table 285. Areas of Critical Environmental Concern..... 1308
Table 286. Existing land withdrawals and recommendations for continuance..... 1364
Table 287. Land Tenure Zone 3 Lands..... 1413
Table 288. Inventory of Communication Sites..... 1426
Table 289. Fluid Mineral Development Potential..... 1437
Table 290. Saleable Mineral Development Scenario Summary for 2008-2018..... 1438
Table 291. Locatable Mineral Development Scenario..... 1438

Table 292. Mist Gas Field 10-year Production 1460
Table 293. Isthmus Slough Group near Federal Mineral Rights 1463
Table 294. South Slough Group near Federal Mineral Rights. 1463
Table 295. Lower Coaledo Group near Federal Mineral Rights. 1463
Table 296. Riparian modeling rules by alternative 1564
Table 297. Alt 3 Landscape Areas, Habitat Threshold Ages and Assessment Area Names 1570
Table 298. GIS Modeling Data Categories 1571
Table 299. Alt 2 Short Rotation Subalternative - Minimum Harvest Ages by Species Group and Site (Productivity) Class 1573
Table 300. Green tree retention percent by land use allocation for the No Action analysis 1574
Table 301. Late Successional Management Areas tree retention percent by Sustained Yield Unit / Retention Zone. 1576
Table 302. Regeneration harvest percent volume tree retention for green tree, snag, and coarse woody debris creation by species group. 1577
Table 303. Stand treatment age and retention used to blend yield curves for intermediate harvests. .. 1577
Table 304. Partial Harvest Retention plus Supplemental Retention for Snag and Coarse Woody Debris Creation 1578
Table 305. Forest Maturity Criteria - Proposed Minimum Harvest Agesat 90% CMAI by Species Group and Site (Productivity) Class 1580
Table 306. Alternative 3 Minimum Stand Treatment Ages for Partial and Regeneration Harvests 1581
Table 307. Stand treatment age and percent retention used to blend yield curves for intermediate harvests. 1584
Table 308. Initial, regeneration and resulting blended yield curves. 1585
Table 309. Northern Spotted Owl Habitat Projections 1591
Table 310. Hierarchy of allocations 1603

List of Figures

Figure 1. Land use allocations under the alternatives XLVIII
Figure 2. BLM projected county payments compared to historic payments LII
Figure 3. Percentage of BLM-administered lands in the harvest land base by alternative LIV
Figure 4. Total allowable sale quantity by alternative for the planning area LV
Figure 5. Nonharvest land base volume over time LV
Figure 6. Northern spotted owl suitable habitat on BLM-administered lands by alternative and reference analysis LIX
Figure 7. Entire planning area of the resource management plan revisions 16
Figure 8. Steps in the planning process (highlighted boxes indicate public involvement) 18
Figure 9. Major ownerships within the planning area 181
Figure 10. Physiographic provinces within the planning area 183
Figure 11. BLM surface ownership by legal authority within the planning area 184
Figure 12. Sample portion of the intermingled checkerboard of private and BLM-administered lands 185
Figure 13. Areas of the Northwest Forest Plan and the planning area 186
Figure 14. Road density across all land ownerships within the planning area 187
Figure 15. Example of geospatial data from the Forest Operations Inventory database 188
Figure 16. Fifth-field watersheds within the planning area 189
Figure 17. Two example watersheds showing various BLM ownership patterns 190
Figure 18. BLM, Forest Service, and private ownership as a percent of the fifth-field watersheds within the planning area 191
Figure 19. Disturbance map from the Northwest Forest Plan's *Late-Successional Forest Monitoring Report* 195
Figure 20. Percent of BLM-administered land within each of the physiographic provinces within the planning area 197
Figure 21. Physiographic provinces and BLM lands within the planning area 197
Figure 22. Stand establishment forest without structural legacies 199
Figure 23. Young forest without structural legacies 200
Figure 24. Mature forest with multilayered canopies 200
Figure 25. Structurally complex forest 201
Figure 26. Oregon population growth by county group 217
Figure 27. Coos and Washington county wage and salary income as a percent of total income 218
Figure 28. County economies with high wood products sector location quotients (LQ) 222
Figure 29. Change in the socioeconomic well-being scores from 1990 to 2000 in the northern portion of the planning area 224
Figure 30. Change in the socioeconomic well-being scores from 1990 to 2000 in the southern portion of the planning area 225
Figure 31. Fiscal year 2005 county expenditures 227
Figure 32. Fiscal year 2005 revenues for the O&C counties 227
Figure 33. Fiscal year 2005 discretionary spending for the O&C counties 229
Figure 34. BLM payments to counties for fiscal years 1985 to 2005 230
Figure 35. Harvest by land owner within the planning area 233
Figure 36. Willamette Valley Douglas fir delivered log prices and BLM volume and average stumpage 234
Figure 37. Log imports from Canada to Washington and Oregon ports 236
Figure 38. Oregon sawmill consumption by diameter class 237
Figure 39. Log consumption by product in western Oregon 238

Figure 40. Western Oregon sawmills by capacity 238
Figure 41. Lumber production in Oregon and Washington 239
Figure 42. Western plywood production 240
Figure 43. U.S. panel production 240
Figure 44. Log exports from western United States ports 241
Figure 45. Employment in Oregon's forest products sector (2005) 242
Figure 46. Employment in Oregon's forest products industry (1969 to 2005) 243
Figure 47. Western Oregon BLM budget for selected fiscal years 244
Figure 48. BLM budget by district and state office for selected fiscal years 245
Figure 49. Full-time equivalent positions by BLM district and state office 245
Figure 50. Number of BLM full-time equivalent positions by county 246
Figure 51. Acres of forested lands within the planning area for 2006 by 10-year age class 248
Figure 52. Peeler versus sawlog grade of Douglas fir logs by district within the planning area 249
Figure 53. Percent of BLM lands within the planning area with management history that are suitable for sustained timber production 250
Figure 54. Trend in the total number of permits issued over five years by BLM district 253
Figure 55. Special status species density shown as hot spots and cold spots 259
Figure 56. Populations and occupied habitat of special status species on O&C and public domain lands within the planning area 261
Figure 57. Number of special status species by habitat group 266
Figure 58. Distribution of Canada thistle 270
Figure 59. Distribution of dyer's woad 271
Figure 60. Distribution of false brome 272
Figure 61. Distribution of Japanese and giant knotweed (left) and the Himalayan knotweed (right) 273
Figure 62. Distribution of leafy spurge 274
Figure 63. Distribution of meadow knapweed 275
Figure 64. Distribution of Scotch broom (left) and French (right) brooms 276
Figure 65. Distribution of diffuse knapweed (left) and spotted knapweed (right) 277
Figure 66. Distribution of yellow starthistle 278
Figure 67. Reported infestations of representative invasive species within the planning area 279
Figure 68. Distribution categories of invasive species for the fifth-field watersheds within the planning area 280
Figure 69. Designated critical habitat units for the northern spotted owl within the planning area 286
Figure 70. Areas of concern for the northern spotted owl 295
Figure 71. Marbled murrelet conservation zones 298
Figure 72. Range of the marbled murrelet within the planning area 300
Figure 73. Marbled murrelet population estimates in conservation Zones 3 and 4 304
Figure 74. Critical habitat for the marbled murrelet within the planning area 308
Figure 75. Locations of the Pacific coast population of the western snowy plover on BLM Lands within the planning area 313
Figure 76. North Bank Habitat Management Area in the Roseburg District 330
Figure 77. Deer habitat management areas on BLM lands within the planning area 332
Figure 78. Elk habitat management areas on BLM lands within the planning area 334
Figure 79. Listed fish species and evolutionary significant units within the planning area 336
Figure 80. Percentage of miles of fish-bearing streams on and off BLM lands within the planning area 339
Figure 81. Percentage of miles of high intrinsic potential streams on and off BLM land per evolutionary significant unit within the planning area 339
Figure 82. Number of road and stream crossings in the Evans Creek Watershed 341

Figure 83. Example of deep pool and habitat diversity caused by large wood 342
Figure 84. Example of a stream with high wood volume 343
Figure 85. Relative importance and spatial variability of wood recruitment processes 344
Figure 86. Probability of debris flow from intermittent streams 345
Figure 87. Current riparian conditions by BLM district 346
Figure 88. Changes in western Oregon vegetation types 347
Figure 89. Representative watersheds 348
Figure 90. Current and maximum large wood contribution by ownership 350
Figure 91. Proportion of current large wood contribution compared to maximum potential 350
Figure 92. Current and maximum potential fish productivity index 352
Figure 93. Proportion of current fish production compared to the maximum potential 354
Figure 94. Miles of treated anadromous or listed fish streams by the BLM districts within the planning area 355
Figure 95. Normal annual precipitation 360
Figure 96. Contrasting BLM ownership in the Evans Creek and Eagle Creek watersheds 363
Figure 97. 303(d) listed streams within the planning area 366
Figure 98. Angular canopy density and buffer widths for small streams within the planning area 367
Figure 99. Angular canopy density and stream shade 367
Figure 100. Stream shade and change in water temperature 368
Figure 101. Relationship of primary and secondary shade zones 369
Figure 102. Riparian tree heights by physiographic province and percent of BLM area 370
Figure 103. Geology within the planning area 374
Figure 104. Road distribution in a representative watershed 376
Figure 105. Watersheds with the highest fine sediment delivery from roads 377
Figure 106. Relative landslide susceptibility in a representative watershed 378
Figure 107. Timber productivity capability classification withdrawn areas in a watershed 379
Figure 108. November 1996 precipitation return period for western Oregon 381
Figure 109. Precipitation hydroregions within the planning area 384
Figure 110. Subwatersheds that are currently susceptible to peak flows in the rain-dominated hydroregion ... 385
Figure 111. Subwatersheds currently susceptible to peak flows in the rain-on-snow-dominated hydroregion . 387
Figure 112. Source water watersheds percentage on BLM lands within the planning area 391
Figure 113. Incidence of forest fires within the planning area between 1994 and 2004 395
Figure 114. Ratings of fire hazards within the planning area 397
Figure 115. Current fire hazard ratings by percent of land within the Salem District 398
Figure 116. Current fire hazard ratings by percent of land within the Eugene District 398
Figure 117. Current fire hazard ratings by percent of land within the Roseburg District 399
Figure 118. Current fire hazard ratings by percent of land within the Coos Bay District 399
Figure 119. Current fire hazard ratings by percent of land within the northern portion of the Medford District 399
Figure 120. Current fire hazard ratings by percent of land within the southern portion of the Medford District 400
Figure 121. Current fire hazard ratings by percent of land within the Klamath Falls Resource Area of the Lakeview District 400
Figure 122. Air quality management areas within the planning area 402
Figure 123. Remoteness levels for a portion of the Klamath Falls Resource Area of the Lakeview District 407
Figure 124. Stand visualizations for each classification of naturalness 408
Figure 125. Proportion of BLM lands by district with secured or unsecured legal public access 410
Figure 126. Secured and unsecured legal public access to a portion of the BLM's land base in the Coos Bay District 411

Figure 127. Current and projected levels of participation by recreation activity within the planning area from 2006 to 2016 414
Figure 128. Proportion of projected recreational demand by activity in the year 2016 414
Figure 129. Distribution of recreational demand by setting for each recreation activity 416
Figure 130. Mt. Hebo wilderness characteristics 419
Figure 131. Acres by visual resource inventory class within the planning area 421
Figure 132. Wild and scenic rivers by classification 424
Figure 133. Percentage of grazing on BLM and Forest Service lands within the planning area 428
Figure 134. Change in the number of active allotments between 1996 and 2004 429
Figure 135. Change in active animal unit months (AUMs) between 1996 and 2004 429
Figure 136. Forage production within a stand establishment forest versus a young forest..... 432
Figure 137. Wild horses in the Pokegama Herd Management Area 433
Figure 138. Distribution of functional classifications for BLM roads 449
Figure 139. Miles of road maintenance 450
Figure 140. Active mineral materials cases on BLM-administered lands by township 468
Figure 141. Active mining claim cases on BLM-administered lands by township 470
Figure 142. Structural stage abundances on the BLM-administered lands by alternative 495
Figure 143. Comparison of the BLM-administered forested lands by 2106 with the average historic conditions and current conditions by alternative 496
Figure 144. The influence of legacy retention on future stand development..... 499
Figure 145. Stand establishment forests with and without structural legacies (e.g., retained green trees) by alternative 502
Figure 146. Young forests with and without structural legacies (e.g., retained green trees) by alternative..... 503
Figure 147. Mature forest with multilayered canopies or single canopies by alternative 505
Figure 148. Structural stage abundances on the forested lands in the harvest land base by alternative 512
Figure 149. Structural stage abundances on the forested lands in the nonharvest land base by alternative ... 513
Figure 150. Comparison of the structural stage abundances on the BLM-administered forested lands by 2106 with the current conditions and the average historic conditions by alternative by province..... 514
Figure 151. Change in the mean patch size from the current condition by 2106 by forest structural stage on the BLM-administered lands 515
Figure 152. Change in the connectance from the current condition by 2106 by forest structural stage on the BLM-administered lands 516
Figure 153. Structural stage abundances on the BLM-administered forested lands in the Coast Range province by alternative 518
Figure 154. Structural stage abundances on the BLM-administered forested lands in the Western Cascades province by alternative..... 520
Figure 155. Structural stage abundances on the BLM-administered forested lands in the Klamath province by alternative..... 522
Figure 156. Structural stage abundances on the BLM-administered forested lands in the Eastern Cascades province by alternative..... 524
Figure 157. Structural stage abundances of the subalternatives and the reference analyses as a percentage of the BLM-administered forested lands by 2106 527
Figure 158. Comparison of all ownerships by 2106 with average historic conditions and current conditions by alternative 530
Figure 159. Comparison of all ownerships by 2106 with average historic conditions and current conditions by province by alternative..... 531
Figure 160. Change in the mean patch sizes from the current condition by 2106 by the forest structural stages on all ownerships 533

Figure 161. Historic and projected BLM payments to the counties for the first 10 years 539
Figure 162. Average annual stumpage revenues..... 551
Figure 163. Revenues, costs, and net revenues for the first 10 years 552
Figure 164. Total allowable sale quantity by alternative for the planning area 559
Figure 165. Allowable sale quantity by district and alternative..... 559
Figure 166. Alternative 1, Subalternative 1: Allow no regeneration harvesting until thinning opportunities are exhausted..... 560
Figure 167. Alternative 1, Subalternative 2: Allow no harvesting of stands that are 80 years of age and older 561
Figure 168. Alternative 1, Subalternative 3: Allow no harvesting of stands that are 200 years of age and older 562
Figure 169. Alternative 1, Subalternative 4: Increase the size of the late-successional management area to include all critical habitat of the northern spotted owl 563
Figure 170. Alternative 2, Subalternative 1: Change the rotation to emulate the timber industry's short rotation..... 564
Figure 171. Reference Analysis: Manage most commercial forest lands for timber production..... 565
Figure 172. Alternative 3, Subalternative 1: Apply the landscape target of 50% in late successional habitat condition to only those areas where the government land ownership is half or more of the total ownership..... 566
Figure 173. Nonharvest land base volume over time..... 567
Figure 174. Total annual volume level by alternative over the next 10 years 569
Figure 175. Total harvest volume by decade and alternative 570
Figure 176. Timber volume harvest by age class under the No Action Alternative over the next 10 years..... 571
Figure 177. Timber volume harvest by age class under Alternative 1 over the next 10 years 571
Figure 178. Timber volume harvest by age class under Alternative 2 over the next 10 years 572
Figure 179. Timber volume harvest by age class under Alternative 3 over the next 10 years 572
Figure 180. Total volume harvested for all four alternatives and subalternatives..... 573
Figure 181. Acres in the harvest land base by alternative..... 573
Figure 182. Percent volume by structural stage..... 574
Figure 183. Volume by structural stage and alternative 575
Figure 184. Percentage of number 3, peeler-grade and better Douglas fir logs by alternative 576
Figure 185. Douglas fir log volumes by peeler grade and sawlog grade by alternative 576
Figure 186. Annual stumpage value by alternative over the next 10 years..... 578
Figure 187. Harvest acres by harvest type over the next 10 years 578
Figure 188. Harvest acres by age class under the No Action Alternative..... 579
Figure 189. Harvest acres by age class under Alternative 1 580
Figure 190. Harvest acres by age class under Alternative 2 581
Figure 191. Harvest acres by age class under Alternative 3 582
Figure 192. No Action Alternative, average annual harvested acres by harvest type over the next 100 years. 583
Figure 193. Alternative 1, annual average harvested acres by harvest type over the next 100 years..... 583
Figure 194. Alternative 2, average annual harvested acres by harvest type over the next 100 years..... 584
Figure 195. Alternative 3, average annual harvested acres by harvest type over the next 100 years..... 584
Figure 196. Miles of new permanent road construction under each alternative..... 585
Figure 197. Acres of new permanent road construction under each alternative 585
Figure 198. Inventory on the harvest land base by alternative over the next 100 years 586
Figure 199. Harvest land base distribution under the No Action Alternative over the next 100 years..... 587
Figure 200. Harvest land base distribution under Alternative 1 over the next 100 years 588
Figure 201. Harvest land base distribution under Alternative 2 over the next 100 years 588

Figure 202. Harvest land base distribution under Alternative 3 over the next 100 years 589
Figure 203. Distribution of populations of BLM sensitive and assessment botany species subject to timber harvest 597
Figure 204. Number of populations and occupied habitat acres by province..... 605
Figure 205. Species in the conifer habitat group by ownership and number of currently known populations 606
Figure 206. Relative susceptibility of fifth-field watersheds to invasive plant species introduction as a result of timber harvesting activities over the next 10 years 613
Figure 207. Susceptibility comparison for the introduction of invasive plant species that are associated with timber harvesting activities over the next 10 years 614
Figure 208. Comparison of the risk by mapped watershed for the introduction of invasive plant species that are associated with timber harvesting activities over the next 10 years 616
Figure 209. Comparison of the risk by watersheds for the introduction of invasive plant species associated with timber harvesting activities over the next 10 years 617
Figure 210. Susceptibility comparison for the introduction of invasive plant species into riparian habitats associated with timber harvesting activities over the next 10 years 619
Figure 211. Relative risk of introducing invasive plant species in riparian habitats over the next 10 years *622*
Figure 212. Riparian risk category comparison for the introduction of invasive plant species over the next 10 years 623
Figure 213. Risk comparison for the introduction of invasive plant species associated with new road construction over the next 10 years 625
Figure 214. Relative risk for the introduction of invasive plant species that are associated with off-highway vehicle designations 628
Figure 215. Risk comparison for introduction of invasive plant species that are associated with off-highway vehicle use 629
Figure 216. Northern spotted owl suitable habitat on BLM-administered lands by alternative and reference analysis..... 635
Figure 217. Northern spotted owl suitable habitat on BLM-administered lands by province by alternative 638
Figure 218. Suitable Habitat within Alternative 2 large blocks of late-successional management areas by province 646
Figure 219. Acres of late-successional reserve/late-successional management area allocated by province.. 650
Figure 220. Percentage of late-successional reserve/late-successional management area acres allocated by province..... 651
Figure 221. Suitable habitat outside of late-successional reserves/late-successional management areas, as percentage of habitat-capable acres..... 657
Figure 222. Suitable habitat outside of late-successional reserves/late-successional management areas, by district/province divisions, as percentage of habitat-capable acres 658
Figure 223. Dispersal habitat conditions on BLM-administered lands across the planning area by alternative 661
Figure 224. Current condition of dispersal habitat across all land ownerships by sixth-field watershed..... 664
Figure 225. Dispersal habitat by 2106 across all land ownerships by six-field watershed for the no harvest reference analysis..... 665
Figure 226. South Willamette-North Umpqua area of concern: Total Dispersal Habitat across All Ownerships 669
Figure 227. South Willamette-North Umpqua area of concern: suitable habitat across all ownerships* 669
Figure 228. Rogue-Umpqua area of concern: total dispersal habitat across all ownerships..... 671
Figure 229. Rogue-Umpqua area of concern: suitable habitat across all ownerships.*..... 671
Figure 230. Ashland area of concern: total dispersal habitat across all ownerships..... 673
Figure 231. Ashland area of concern: suitable habitat across all ownerships* 673
Figure 232. Marbled murrelet nesting habitat by the year 2106..... 676

Figure 233. District marbled murrelet nesting habitat fluctuations in Zone 1 679
Figure 234. District marbled murrelet nesting habitat fluctuations in Zone 2 681
Figure 235. Average summer thermal habitat availability on the deer habitat management units in the Coos Bay District.* 684
Figure 236. Percent of foraging habitat availability on the deer habitat management units in the Medford District and Klamath Falls Resource Area 685
Figure 237. Percent of foraging habitat in Deer Habitat Management Areas on eastside management lands in the Klamath Falls Resource Area 686
Figure 238. Average summer thermal habitat availability on the elk habitat management units in the Coos Bay District 690
Figure 239. Average foraging habitat on the elk habitat management units in the Medford District 691
Figure 240. Bald eagle nesting and roosting habitat development under the alternatives 695
Figure 241. Summary of bald eagle nesting and roosting habitat development in the west-side of the Klamath Falls Resource Area 696
Figure 242. A histogram illustrating the abundance and development of bald eagle nesting and roosting habitat in bald eagle management areas 697
Figure 243. Fisher natal and foraging habitat summarized for BLM-administered lands within the planning area 699
Figure 244. Abundance of fisher natal habitat under Alternative 3 700
Figure 245. Response of fisher foraging habitat in the Klamath Falls Resource Area 701
Figure 246. Klamath Falls Resource Area landbird habitat trends for eastside coniferous forests, expressed as a percentage of total forested area in the plant association 703
Figure 247. Westside coniferous forest landbird habitat trends, expressed as a percentage of total forested area in the plant association 705
Figure 248. Total number of western snowy plover young fledged along the Oregon Coast from 1990-2006) 708
Figure 249. Historic range of sage grouse within the planning area of the western Oregon plan revision 709
Figure 250. Sage grouse habitat within the Klamath Falls Field Office 710
Figure 251. Forest floor habitat quality summary for each alternative 722
Figure 252. Total large wood contribution and potential coho productivity index for the five representative fifth-field watersheds on the BLM-administered lands 724
Figure 253. Riparian reserve and riparian management area widths and large wood contribution 728
Figure 254. Structural stage abundances in the harvest land base by alternative 730
Figure 255. Example of riparian management areas under all four alternatives 731
Figure 256. Percent intermittent streams with highest probability of debris flow to fish-bearing stream channels 732
Figure 257. Chinook salmon productivity index and steelhead trout productivity index for the Upper Smith River representative watershed 734
Figure 258. Maximum large wood contribution to fish-bearing streams 735
Figure 259. Wood contribution by source 736
Figure 260. Debris flow probabilities between watersheds 737
Figure 261. Differences in the number of miles of high intrinsic potential streams between watersheds on BLM-administered lands 739
Figure 262. Distribution of high intrinsic potential streams for chinook salmon, coho salmon, and steelhead trout within key watersheds of the planning area 740
Figure 263. Susceptible rain-dominated subwatershed 747
Figure 264. Susceptible rain-on-snow-dominated sixth-field subwatersheds 749
Figure 265. Riparian management areas for permanently flowing streams 751
Figure 266. Structural stage classes of the riparian reserves under the No Action Alternative 752
Figure 267. Structural stage classes of the riparian reserves under Alternative 1 754

Figure 268. Structural stage classes of the riparian reserves under Alternatives 2 and 3..... 756
Figure 269. Number of miles along streams that are maintaining 80% effective shade within the primary and secondary shade zones..... 757
Figure 270. Projected new permanent BLM road miles contributing to fine sediment delivery 759
Figure 271. Timber productivity capability classification withdrawals within the Upper Smith River representative watershed 762
Figure 272. High fire severity for northern districts by alternative 768
Figure 273. High fire severity for southern districts by alternative..... 769
Figure 274. Fire resiliency by district by alternative..... 771
Figure 275. Acres of naturalness levels for the year 2016 by alternative..... 781
Figure 276. Percent change in naturalness settings by the year 2016 under each alternative..... 782
Figure 277. Acres of BLM-administered lands with wilderness characteristics maintained by alternative..... 787
Figure 278. Visual resource inventory and management classes in acres by alternative..... 790
Figure 279. Harvest land base acres within visual resource inventory classes by alternative 791
Figure 280. Visual resource inventory class II areas maintained by alternative..... 792
Figure 281. Visual resource inventory class III areas maintained by alternative..... 792
Figure 282. Acres available for grazing..... 797
Figure 283. Change in animal unit months by alternative 799
Figure 284. Change in the number of allotments by alternative..... 799
Figure 285. Changes in structural stage abundance within lands allocated for grazing 802
Figure 286. Changes in Forage Production by Alternative 803
Figure 287. Changes in structural stage abundance within the Pokegama HMA..... 805
Figure 288. Changes in forage production by alternative 806
Figure 289. Land Use Planning, Monitoring, and Adaptive Management. 849
Figure 290. Northern spotted habitat by District and Province. 1050
Figure 291. Stand Conditions Resulting from Partial Harvests in Alternative 3 Compared to Regeneration Harvest in No Action..... 1057
Figure 292. Comparison of Classification of Mature with Multiple Canopies and Structurally Complex Forest with Classification of Suitable Habitat – No Action 1058
Figure 293. Comparison of Classification of Mature with Multiple Canopies and Structurally Complex Forest with Classification of Suitable Habitat – Alternative 3..... 1059
Figure 294. Historical independent Lower Columbia River Evolutionary Significant Unit early and late-fall-run Chinook salmon populations. Source: Myers et al. (2002). 1074
Figure 295. Historical populations of spring-run Chinook salmon in the Upper Willamette River Evolutionary Significant Unit. Source: Myers et al. (2002)..... 1075
Figure 296. Historical populations of the Southern Oregon/Northern California Coast Coho Evolutionary Significant Unit..... 1076
Figure 297. Tentative historical populations of the Lower Columbia River coho salmon Evolutionary Significant Unit. Source: based on work by Willamette/Lower Columbia Technical Recovery Team for Chinook salmon and steelhead (Myers et al. 2002).. 1077
Figure 298. Historical populations of winter-run steelhead in the Lower Columbia River steelhead ESU.Source: Myers et al. (2002). 1078
Figure 299. Map of historical Upper Willamette River steelhead Evolutionary Significant Unit populations..... 1079
Figure 300. Historical chum salmon populations in the Columbia River chum salmon ESU. 1080
Figure 301. Examples of relationship between values of the three stream attributes and the index scores used to calculate intrinsic potential. 1083

Figure 302. Using Digital Elevation Models to delineate stream. For each Digital Elevation Model point, all stream-edge segments are found within one tree height. 1085
Figure 303. Determining tree fall using DEMs. 1086
Figure 304. Probability that a falling tree at a DEM point hits a stream segment. 1086
Figure 305. Tree fall from riparian areas dependent on: forest cover, hillslope gradient, distance to stream channel, and channel planform geometry. 1088
Figure 306. Identification of valley-floor pixels: within a specified elevation of the channel; within a specified slope relative to the channel slope; all pixels flagged meeting these criteria with the identification of the reach to which they drain. 1089
Figure 307. Debris flow source areas for wood are widely distributed, but most of the wood accumulated by debris flows is scoured from low-order channels. 1090
Figure 308. Debris flow inputs to fish-bearing streams occur at these low-order channel junctions. 1091
Figure 309. Angular canopy density (ACD) and buffer widths for small streams in western Oregon (Brazier and Brown 1972). It illustrates that a buffer strip width of 60 feet will result in an angular canopy density of 65 percent. 1115
Figure 310. Angular canopy density (ACD) and stream shade (Park 1991). 1116
Figure 311. Effective Stream Shade and Change in Stream Temperature 1116
Figure 312. Solar Pathfinder (43° to 49° N Lat., Boyd 1999). 1117
Figure 313. Reservoir Standards. 1266
Figure 314. Fence Standards 1268
Figure 315. Wire Spacings 1269
Figure 316. Standards for Rangeland Health. 1285
Figure 317. Southern Tyee sedimentary basin, from Ryu *et al.* (1996) 1444
Figure 318. Coaledo Formations of the onshore portion of the Coos Basin, from Torrent Energy Inc. (2005) 1445
Figure 319. BLM Oregon Salem District, Surface. Based on Newton (1969), Ferns and Huber (1984), Olmstead ***et al.*** (1989), and BLM (2007) 1452
Figure 320. Salem District BLM, Subsurface. Based on Newton (1969), Ferns and Huber (1984), Olmstead *et al* (1989), and BLM (2007) 1454
Figure 321. Mist Gas Field, 1999 Boundary (DOGAMI 2003) 1458
Figure 322. Identified High Potential Area (this report) and Bacona Geologic Quadrangle (Houston 1997) .. 1459
Figure 323. Mist Gas Field Boundaries-1985 and 1999 1461
Figure 324. Salem District Mist gas Field Expansion Estimate, 160 acre spacing. 1466
Figure 325. Coos Basin Acreage in Area of Mutual Interest. 1470
Figure 326. Coos Basin Unleased Acreage 1471
Figure 327. Coos Basin wells based on 338 acre spacing. 1474
Figure 328. Coos Basin wells based on 160 acre spacing. 1474
Figure 329. Example of FOI Mapping for approximately a three by three mile area. 1507
Figure 330. Example of TPCC Withdrawn lands. 1510
Figure 331. CVS Plot Design 1511
Figure 332. CVS Plot overlain with Forest Operations Inventory. 1511
Figure 333. Western Oregon Age Class Distribution 2006 (Acres). 1513
Figure 334. Species Group by District – Forested Acres 1523
Figure 335. Salem District Site Class Re-Distribution Example (Species Groups NCM – Northern Conifer Mixed, NDF – Northern Douglas-Fir, NHM – Northern Hardwood Mixed). 1527
Figure 336. Organon Variants 1529
Figure 337. Example of CVS plots and FOI Units with a common existing stand condition 1531
Figure 338. Examples of subplot data imputed into FOI units 1532
Figure 339. Differences between the FOI and LLI themes. 1534

Figure 340. Graphic example how a resultant layer is created from a number of resource layers. Multiple resource layers are overlaid in a GIS process to create a single resultant layer for use in OPTIONS. 1553
Figure 341. OPTIONS trend to normality examples. 1555
Figure 342. Example of a volume growth projection curve and adjustments for thinning treatments. 1556
Figure 343. Landscape level harvest rules example. 1557
Figure 344. Green tree retention accounting within the OPTIONS model..... 1575
Figure 345. An example of adjustments utilized for a single alternative and district. 1579
Figure 346. Reserve, ASQ, and Total Volume.. 1584
Figure 347. A comparison of an initial yield curve, the regenerated (future) yield curve and the blended curve..... 1586
Figure 348. Data Flow Diagram for Owl Habitat and Structural Stage Classification. 1599

List of Maps

MAP 1. Visual resource management classes 56
MAP 2. Land use allocations under the No Action Alternative 66
MAP 3. Land use allocations under Alternative 1 74
MAP 4. Land use allocations under Alternative 2 88
MAP 5. Land use allocations under Alternative 3 100
MAP 6. Wildland urban interface 155
MAP 7. Lands available for livestock grazing 156
MAP 8. Location of proposed range improvements in the Klamath Falls Resource Area 157
MAP 9. Utility corridors 158
MAP 10. Off-highway vehicle designations 159
MAP 11. Off-highway vehicle emphasis areas 160
MAP 12. Location of Pokegama Herd Management Area 161
MAP 13. Bald eagle, deer, and elk habitat management areas 162
MAP 14. Forest vegetation series 163
MAP 15. Areas of critical environmental concern within the planning area 164
MAP 16. BLM management area adjacent to the Coquille Forest 165
MAP 17. Location of assessment areas (physiographic provinces within sustained yield units) under Alternative 3 166
MAP 18. Recreation management areas 167
MAP 19. Backcountry byways 168
MAP 20. Designated recreation sites 169
MAP 21. Designated recreation trails 170
MAP 22. Potential recreation sites 171
MAP 23. Potential recreation trails 172
MAP 24. Environmental education sites along with recreation and public purpose lease sites 173
MAP 25. National Landscape Conservation System designated lands 174
MAP 26. Proposed off-highway vehicle designations 175
MAP 27. Lands with wilderness characteristics 176
MAP 28. Location of land tenure Zone 3 177
MAP 29. Sustained yield units 178
MAP 30. BLM lands within the planning area 182
MAP 31. Fire regimes 393
MAP 32. Overlap between Alternative 2 and Alternative 1 late-successional management areas 641
MAP 33. No Action Alternative/Alternative 1 spacing of late-successional reserves/late-successional management areas 653
MAP 34. Alternative 2 spacing of late-successional management areas 654
MAP 35. Federally Listed Plant 976

Preface

Reader's Guide

This draft environmental impact statement is designed to provide a logical progression of information to the reviewer. The summary, five chapters, and appendices explain the management purpose and need being addressed, the scope of the issues involved, the alternatives designed to address the purpose and need, a description of the current biological and physical environment, and an analysis of the anticipated environmental consequences resulting from the implementation of any given alternative.

The progression of information in this document starts with a summary. The *Summary* chapter presents a digest of the document. Descriptions of the No Action Alternative and each of the three action alternatives are presented in enough detail to explain each alternative's overall management strategy for achieving the purpose and need, and to explain its associated land use allocations and management direction. The *Summary* also includes a comparison of the major land use and resource allocations and actions by alternative. For the purpose of brevity, the summery relies heavily on the use of graphics and brief descriptions of rather complex topics. Also for the sake of brevity and simplicity, the citations, references, and definitions included in the main text are omitted from the *Summary*. Therefore, the details provided in the five chapters of the document are needed to fully understand the alternatives and their effects.

Chapter 1 presents the purpose and need for the revision of the western Oregon resource management plans. Central to these plan revisions is the interplay between the laws directing or influencing the management of the BLM's O&C lands in western Oregon and the various legal precedents and opinions that guide the implementation of various laws. This chapter contains a more detailed discussion of these laws and legal precedents than is normally found in an environmental impact statement in order to help the reader clearly understand the purpose and need and the five major issues identified for analysis. This chapter also describes the planning area, the past management of the O&C lands, the planning process, and the involvement of local, state, and other federal agencies that are collaborating in the preparation of the plan revisions. Finally, this chapter identifies the seven recognized tribes within the planning area that are engaged in government-to-government relationships with the BLM.

Useful comments regarding Chapter 1 include whether the purpose and need require clarification or further explanation.

Chapter 2 presents the three action alternatives. The No Action Alternative would continue management under the current resource management plans (refer to the 1995 resource management plans for the districts of Salem, Eugene, Roseburg, Coos Bay, and Medford, and the Klamath Falls Resource Area of the Lakeview District). The action alternatives consist of a range of management approaches or strategies that are designed to meet the purpose and need and to resolve the planning issues. The alternatives consist

of management objectives, management actions, and land use allocations. Two of the action alternatives are based on a network of managed reserves that allow intensive timber management outside of the reserves. The other action alternative minimizes land use allocations and manages timber across the landscape on a long rotation to provide older forest habitats. Certain management objectives and management actions vary by alternative, while others are common to all three action alternatives. This chapter also describes the six subalternatives (variations of the three action alternatives) that were set forth to examine certain questions raised by the public and BLM managers. Finally, this chapter describes the alternatives that would not meet the purpose and need and, as a result, were not analyzed in detail.

Useful comments regarding Chapter 2 include:

- *Are the alternatives adequately and clearly described?*
- *Is it clear why some alternatives were eliminated from detailed study?*
- *Are there alternatives that appear to meet the purpose and need that are not included in the detailed study?*

Chapter 3 presents the existing condition and trends of the resources and programs within the planning area that would be affected by implementing the alternatives. Understanding the affected environment serves as a baseline against which to measure the potential effects, including the cumulative effects, of implementing an alternative. The description of the affected environment also provides the information necessary to understand the analysis of the environmental consequences in *Chapter 4*.

Chapter 4 presents the potential direct, indirect, and cumulative effects that would result from the implementation of individual action alternatives and subalternatives. The effects of the alternatives on the various resources are compared and contrasted against each other and against the No Action Alternative. This chapter also includes brief discussions of the use of models and the assumptions used in analyzing the alternatives. Adverse affects that cannot be avoided if the alternatives were to be implemented are disclosed, and mitigation is identified. A brief summary of the environmental consequences are located in the *Summary* and in *Chapter 2*. However, as in any overview or summary, detail is sacrificed for brevity; therefore, the information in *Chapter 4* needs to be read in order to fully understand the effects.

Useful comments regarding Chapter 4 include:

- *Are the conclusions clearly stated?*
- *Are the conclusions supported by evidence, analysis, and logic?*
- *Is there information included that appears to be unnecessary and gets in the way of understanding?*

Chapter 5 presents information on the consultation and coordination that occurred in the preparation of this draft environmental impact statement. The public involvement, cooperators, and preparers are identified. Reference information and a glossary of

words and terms that are not in common usage are included. In addition, future actions, such as the consultation on species listed under the Endangered Species Act, adaptive management, and plans for monitoring, are discussed.

Commenting

Well-written comments can be the most important contribution from citizens. It is the goal of citizen involvement to help the agency make better-informed decisions. Comments should be clear, concise, and on point. Comments that are solution-oriented and provide specific examples will be more helpful than those that simply oppose or support a particular alternative or position.

Numerous comments that repeat the same basic message of support or opposition will typically be responded to collectively. General comments that simply state that an action will have significant environmental consequences may not help the agency make a better decision unless the relevant causes and environmental consequences of concern are explained.

When providing comments, it is most helpful if you:

- Reference your comments to a chapter, subheading, or page.
- Locate errors in the analysis that had been performed.
- Provide new or missing information that would have a bearing on the analysis.
- Locate misinformation that may have been used and could affect the outcome of the analysis.
- Suggest a different way to combine the features from the analyzed alternatives.
- Suggest a new alternative that meets the purpose and need.

Comments received in response to this draft environmental impact statement, including names and addresses, become part of the public record and are available for public inspection. Comments, including names and addresses, may be published as part of the final environmental impact statement. Before including your address, phone number, e-mail address, or other personal identifying information in your comment, you should be aware that your entire comment (including your personal identifying information) may be made publicly available at any time. While you can ask us in your comment to withhold your personal identifying information from public review, we cannot guarantee that we will be able to do so due to limitations under the Freedom of Information Act.

If you wish to withhold your name or address from public review, or from disclosure under the Freedom of Information Act (FOIA), you must state this prominently at the beginning of your written comments. Persons requesting such

confidentiality should be aware that, under FOIA, confidentiality may be granted in only very limited circumstances, such as to protect trade secrets.

Comments can be mailed to:

Western Oregon Plan Revisions
P.O. BOX 2965
Portland, OR 97208

You can also make comments online at the following website:

http://www.blm.gov/or/plans/wopr/index.php

Your comments must be postmarked before November 9, 2007.

Abstract

Draft Environmental Impact Statement for the Revision of the Resource Management Plans of the Western Oregon Bureau of Land Management Districts

1. Responsible Agency: United States Department of the Interior, Bureau of Land Management

2. Draft (X) Final ( )

3. Administrative Action (X) Legislative Action ( )

4. Abstract: This draft environmental impact statement has identified three action alternatives for managing approximately 2.6 million acres of federal land, which is mostly revested California Railroad and Coos Bay Wagon Road Grant Lands Act lands (i.e., the O&C lands), within the approximately 22 million acre western Oregon planning area. The BLM intends to revise six resource management plans with this single draft environmental impact statement.

   Public comment played an important role in shaping the alternatives, which are described and analyzed in this document.

   - The No Action Alternative maintains the decisions in the current resource management plans.
   - Alternative 1 creates late-successional management areas that are similar to the large late-successional reserves in the No Action Alternative, applies new criteria for designating the width of riparian management areas, and provides for intensive timber management in other areas.
   - Alternative 2 designates late-successional management areas based on the habitat requirements for the northern spotted owl and the marbled murrelet, applies new criteria for designating the width of riparian management areas, and provides for intensive timber management in other areas.
   - Alternative 3 manages most of the land base for timber production under long rotations, or uneven-aged management in fire-prone ecosystems, in order to provide late-successional habitat across the landscape and also to provide for timber production.

   Six subalternatives, which are variations of the three action alternatives, are also analyzed in this document.

The major resource management plan issues include:

- Providing a sustainable supply of wood and other forest products as mandated by the O&C Act, while also meeting the requirements of other applicable laws.
- Providing for the conservation of species that are listed under the Endangered Species Act.
- Contributing toward meeting the goals of the Clean Water Act and the Safe Drinking Water Act.
- Reducing the risk of wildfires and integrating fire back into the ecosystem.
- Providing for off-highway vehicle management to meet that demand while protecting other resources.

This document acknowledges the primacy of O&C Act in regards to the management of timber resources. Therefore, specific changes to the current management direction for areas of critical environmental concern and research natural areas, scenic values as identified through a visual resource management inventory, and sensitive species protection are proposed across the alternatives.

5. Date comments must be received: November 9, 2007

6. For further information contact:

Alan Hoffmeister
Bureau of Land Management
Western Oregon Planning Revision Public Outreach Coordinator
P.O. Box 2965
Portland, OR 97208

Telephone: (503) 808–6629
E-mail: orwopr@or.blm.gov

Summary

This *Summary* provides a synopsis of the information presented in this draft environmental impact statement for the proposed revision of the resource management plans of the six western Oregon BLM districts that are within the planning area.

In this chapter:

Introduction XLIII

What is the purpose and need for the action being proposed? XLIV

What alternatives are being proposed? XLV

What are the environmental consequences of the alternatives? L

Introduction

Key Points

This draft environmental impact statement has been written because (1) the BLM plan evaluations found that the BLM has not been achieving the timber harvest levels directed by the existing plans, (2) there is an opportunity to coordinate the BLM management plans with new recovery plans and re-designations of critical habitat currently under development and (3) the BLM has re-focused the goal for management to the objectives of its statutory mandate to utilize the principles of sustained yield management on the timber lands covered under the O&C Act. There are four alternatives—the No Action Alternative and three action alternatives (Alternative 1, Alternative 2, and Alternative 3).

This draft environmental impact statement is broken up into the following sections:

- Chapter 1, which provides the purpose and need for revising the resource management plans.
- Chapter 2, which details the alternatives found to be reasonable solutions for the purpose and need presented in Chapter 1.
- Chapter 3, which details the current condition of the affected environment.
- Chapter 4, which provides the effects on the environment that result from each of the alternatives.
- Chapter 5, which lists those that participated in the development of this draft environmental impact statement.
- And an appendix volume and a map packet that each provides details regarding the analyses of the alternatives.

For details about the process up to this point (e.g., the published notice of intent, the scoping effort, and the planning criteria) and beyond the public commenting period, go to *http://www.blm.gov/or/plans/wopr*.

The Bureau of Land Management (BLM) administers the use of a variety of natural resources on approximately 2.6 million acres within an area of approximately 22 million acres, which is the western Oregon planning area. Resource management plans (RMPs) define the management direction for specified areas of BLM-administered lands (typically, for individual BLM districts or BLM resource areas). Resource management plans are typically designed to continue a defined management direction for a specified period of time that includes periodic evaluation. Resource management plans are formally evaluated periodically to determine whether there is a significant cause for amending or revising them.

The primary direction for administrating the approximately 2.2 million acres of what are called the O&C lands that lie within the approximately 2.6 million acres of BLM-administered lands in western Oregon is derived from the statutory authority of the Oregon and California Railroad and Coos Bay Wagon Road Grant Lands Act (O&C Act). The remaining BLM-administered lands within the western Oregon planning area are public domain lands, and other statutory authorities direct the administration of those lands.

The BLM is proposing to revise existing plans to replace the Northwest Forest Plan land use allocations and management direction because (1) the BLM plan evaluations found that the BLM has not been achieving the timber harvest levels directed by the existing plans, and the BLM now has more detailed and accurate information than was available in 1995 on the effects of sustained yield management on other resources, (2) there is an opportunity to coordinate the BLM management plans with new recovery plans and re-designations of critical habitat currently under development and (3) the BLM has re-focused the goal for management of the BLM-administered lands to the objectives of its statutory mandate to utilize the principles of sustained yield management on the timber lands covered under the O&C Act of contributing to the economic stability of local communities and industries, and other benefits from such management to watersheds, stream flows, and recreation.

What is the purpose and need for the action being proposed?

The goals for the Northwest Forest Plan were broader than the specific requirements of the Endangered Species Act and Clean Water Act and sought to provide consistent management of the Forest Service and the BLM-administered lands, by applying National Forest Management Act requirements to the BLM-administered lands. The selected alternative for the Northwest Forest Plan was selected because it would "maintain the late-successional and old-growth forest ecosystem and provide a predictable and sustainable supply of timber, recreational opportunities and other resources at the highest level possible." The purpose and need for this plan revision is focused on specific legal requirements and intended benefits of the BLM's unique mandate under the O&C Act, distinct from the mandate to the Forest Service under National Forest Management Act.

The purpose and need for this proposed action is to manage the BLM-administered lands for permanent forest production in conformity with the principles of sustained yield, consistent with the O&C Act.[1] The plans will also comply with all other applicable federal laws including, but not limited to, the Endangered Species Act, the Clean Water Act, and, to the extent that it is not in conflict with the O&C Act, the Federal Land Policy and Management Act. In accord with the Endangered Species Act, the plans will use the BLM's authorities for managing the lands it administers in the planning area to conserve habitat needed from these lands for the survival and recovery of species listed as threatened or endangered under the Endangered Species Act.[2]

In selecting among the alternatives in this plan revision, BLM will evaluate which alternative or combination of alternatives best meets the Purpose and Need. In addition, BLM will consider the environmental consequences related to the issues identified during scoping and the cost of implementation.

[1] The Ninth Circuit in *Headwaters v. BLM*, 914 F.2d 1174 (9th Cir. 1990) confirmed that in the O&C Act Congress mandated timber production as the dominant use of these BLM-administered lands.

[2] This revision process will satisfy a settlement agreement resolving long-standing litigation of the Northwest Forest Plan (*AFRC v. Clarke*, Civil No. 94-1031-TPJ (D.D.C.)) that alleged the current RMPs violate the O&C Act. The settlement agreement requires BLM to consider revisions to the RMPs by the end of the year 2008, and include at least one alternative that "will provide permanent forest production across the O&C lands without reserves except as required to avoid jeopardy under the Endangered Species Act." See *Appendix A* for a discussion of the Settlement Agreement.

What alternatives are being proposed?

There are three action alternatives, along with the No Action Alternative, being proposed. The No Action Alternative would continue the management of the current resource management plans, which were approved in 1995 and subsequently amended. The three action alternatives consist of a range of management strategies that are designed to meet the purpose and need discussed in *Chapter 1*. These management strategies encompass management objectives, management actions, and land use allocations. Some management objectives, management actions, and land use allocations are common to all three action alternatives. Examples of management objectives, management actions, and land use allocations that are common to the three action alternatives are:

- Congressionally reserved areas would be retained and managed for the purposes for which they were established.
- A diversity of developed and dispersed outdoor recreational experiences would be maintained. District recreation sites, management areas, facilities, trails, and visitor service programs would be carried forward.
- The BLM would take actions to reduce fire hazards to communities that are at risk from uncharacteristic wildfires.
- The BLM would provide for the harvest and collection of special forest products.

Some management objectives, management actions, and land use allocations vary by action alternative. These differences would result in a variance in the degree or rate in which each action alternative achieves the identified purpose and need for the proposed action. See *Table 1 (Limited comparison of the key features of the four alternatives)*. It highlights specific examples of these differences between the alternatives. For a complete comparison of the key features of the four alternatives, see *Table 39 (Comparison of the key features of the four alternatives)*in *Chapter 2*.

The key differences between the four alternatives include:

- the width and management of riparian areas;
- the retention of green trees, snags, and down wood;
- the salvaging after disturbances; and
- the management of habitat for the northern spotted owl and the marbled murrelet.

Following are the key land use allocations that vary by action alternative.

Alternative 1

The key land use allocations for this alternative are:

- **Late-successional management areas.** These areas are designated to provide structurally complex forests. They are similar to the existing late-successional reserves under the No Action Alternative. There would be no salvaging after disturbances in these areas, except for safety or operational reasons.
- **Riparian management areas.** These areas would maintain or promote the development of mature or structurally complex forests, and provide for the riparian and aquatic conditions that supply streams with shade, sediment filtering, leaf litter and large wood, and root masses that stabilize stream banks. They are half the width of the current riparian reserves under the No Action Alternative (with the exception of non-fish-bearing perennial streams which remain the same).
- **Timber management areas.** In these areas, forests would be managed to achieve a high level of continuous timber production that could be sustained through a balance of growth and harvesting and an allowable sale quantity of timber. The rotation age would be approximately 80 to 100 years and there would be no green tree retention after regeneration harvesting.

Alternative 2

The key land use allocations for this alternative are:

- **Late-successional management areas.** These areas would provide habitat for the northern spotted owl (large, connected blocks of suitable habitat) and the marbled murrelet. Salvaging would be allowed to recover economic value from the timber harvested after stand-replacement disturbances. These areas are based on new recovery planning efforts for the northern spotted owl.
- **Riparian management areas.** These areas would maintain or promote the development of mature or structurally complex forests and provide for the riparian and aquatic conditions that supply streams with shade, sediment filtering, leaf litter and large wood, and root masses that stabilize stream banks.

  All streams, except for intermittent non-fish-bearing streams, would have a 100 foot nonharvesting and shade retention area on each side of the stream. Intermittent non-fish-bearing streams that have a high risk of debris flows (a source of large wood) would also have a 100 foot nonharvesting and shade retention area on each side of the stream. Other intermittent non-fish-bearing streams would retain a 25 foot area with noncommercial vegetation on each side of the stream and 12 conifer trees per acre.
- **Timber management areas.** These areas would be managed to achieve a high level of continuous timber production that could be sustained through a balance

of growth and harvesting and an allowable sale quantity of timber. The rotation age would be approximately 80 to 100 years and there would be no green tree retention after regeneration harvesting.

Alternative 3

The key land use allocations for this alternative are:

- **General landscape areas.** These areas would provide for the habitat conditions that are required for late-successional species, would maintain and promote the development of mature or structurally complex forests, would provide continuous timber production that could be sustained through a balance of growth and harvesting, and would offer an allowable sale quantity of timber. The rotation age would approximate natural stand-replacement disturbances (generally, 360 years north of Grants Pass and 240 years south of Grants Pass).

  There would be a deferral of regeneration harvests until 50% of an assessment area is older than the threshold stand age of 90 years north of Grants Pass and 140 years south of Grants Pass. In the meantime, partial harvesting and commercial thinning would be applied to stands that are at or beyond the partial harvest interval age (60 to 120 years, depending on the vegetation series).

  There would be 6 to 9 green trees retained after harvesting depending on the vegetation series, and salvaging for economic purposes would be allowed after a disturbance (with legacy retention requirements).

- **Riparian management areas.** These areas would maintain or promote the development of mature or structurally complex forests and provide for the riparian and aquatic conditions that supply streams with shade, sediment filtering, leaf litter and large wood, and root masses that stabilize stream banks.

  All streams, except for intermittent non-fish-bearing streams, would have a 100 foot nonharvesting and shade retention area on each side of the stream. Intermittent non-fish-bearing streams would allow no harvesting within 25 feet of the stream.

Comparing the Alternatives

The areas included within the land use allocations vary significantly under the alternatives. See *Figure 1 (Land use allocations under the alternatives)*. Note that Alternative 3 contains a land use allocation called general landscape area that covers much of the landscape and provides habitat for late-successional species as well as timber production.

Figure 1. Land use allocations under the alternatives

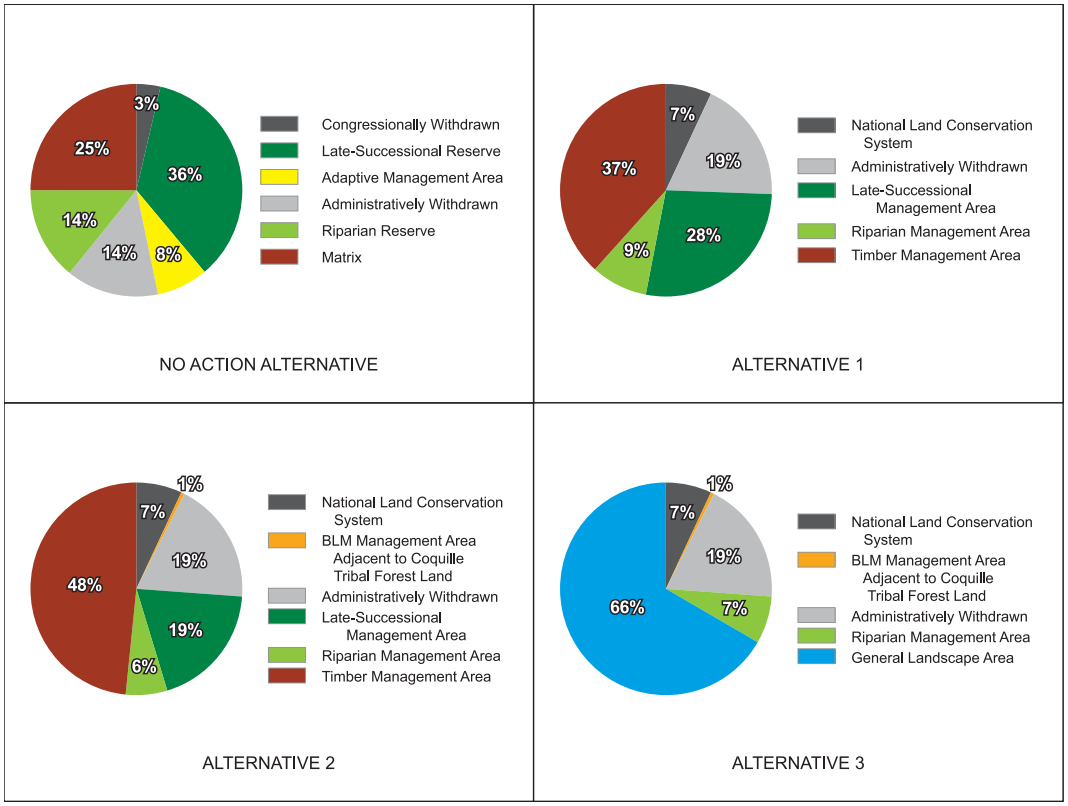


Table 1. Limited comparison of the key features of the four alternatives (for a complete comparison of the key features of the four alternatives, see the comparison table in *Chapter 2*)

Features	No Action Alternative	Alternative 1	Alternative 2	Alternative 3
Late-Successional Vegetation	• Maintains the Northwest Forest Plan's late-successional reserves (LSRs) • Allows no treatment of stands that are older than 80 years	• Establishes late-successional management areas (LSMAs) • Treats LSMAs to promote the development of structurally complex forests	• Establishes late-successional management areas (LSMAs) • Treats LSMAs to promote the development of suitable habitat	Creates a landscape target for regeneration harvesting that requires 50% or more of the acres in an assessment area be of the required age for harvesting, which is 90 years north of Grants Pass and 140 years south of Grants Pass
Critical Habitat Units (CHUs) for the Northern Spotted Owl and the Marbled Murrelet	• CHUs for the marbled murrelet completely match with the LSRs • CHUs for the northern spotted owl partially match the LSRs	• CHUs for the marbled murrelet completely match with the LSMAs • CHUs for the northern spotted owl partially match the LSMAs	• CHUs for the marbled murrelet partially match with the LSMAs • CHUs for the northern spotted owl partially match the LSMAs	No special management
Northern Spotted Owl Activity Centers	Retains the owl activity centers that were known as of January 1994	Retains no owl activity centers in the timber management areas (TMAs)	Retains no owl activity centers in the timber management areas (TMAs)	• Retains 215 acre owl activity centers in the general landscape areas • Manages the owl activity centers until the landscape target is reached
Green Tree Retention	• North of Grants Pass: 6 to 8 trees per acre • South of Grants Pass: 18 to 25 trees per acre • In connectivity diversity blocks: 12 to 18 trees per acre	None	None	6 to 9 trees per acre depending on the vegetation series
Snag Retention	1.1 snags per acre	• In the LSMAs: 2 to 6 snags per acre depending on the vegetation series • In the TMAs: Noncommercial only	• In the LSMAs: 2 to 6 snags per acre depending on the vegetation series • In the TMAs: Noncommercial only	2 to 4 snags per acre depending on the vegetation series

Down Wood	120 to 240 ft./ac.	• In the LSMAs:
		  • 120 to 240 ft./ac. for stands with QMD > 14 in.
		  • 60 to 120 ft./ac. for stands with QMD ≤ 14 in.
		• In the TMAs: Noncommercial only
			• In the LSMAs:
			  • 40 to 240 ft./ac. for stands with QMD > 14 in.
			  • 20 to 120 ft./ac. for stands with QMD ≤ 14 in.
			• In the TMAs: Noncommercial only
				• In the western hemlock zone: 240 ft./ac.
				• In the Douglas fir/true fire and tanoak zones: 120 ft./ac.

Salvaging	• Allows salvaging in the LSR reserves when a disturbance is greater then 10 acres • Allows salvaging in the matrix land use allocations for economic purposes	• Allows no salvaging in the LSMAs, except to reduce hazards in the wildland urban interface areas • Allows salvaging in the wildland urban interface areas to reduce hazards • Allows salvaging in the TMAs for economic purposes	• Allows salvaging in the LSMAs for economic purposes with retention of legacy • Allows salvaging in the wildland urban interface areas to reduce hazards • Allows salvaging in the TMAs for economic purposes	Allows salvaging for economic purposes with retention of legacy

Features	No Action Alternative	Alternative 1	Alternative 2	Alternative 3
Zones for Riparian Management Areas	For all fish-bearing streams: 2 site potential tree ht. For all non-fish-bearing streams: 1 site potential tree ht.	For all but intermittent non-fish-bearing streams: 1 site potential tree ht. For intermittent non-fish-bearing streams: 1/2 site potential tree ht.	For all but intermittent non-fish-bearing streams: • 0 to 25 ft. no harvest • 25 to 60 ft. 80% shade retention • 60 to 100 ft. 50% canopy retention For non-debris-flow prone intermittent non-fish-bearing streams: 0 to 25 ft. noncommercial vegetation +12 tpa For debris-flow prone intermittent streams: • 0 to 25 ft. no harvest • 25 to 100 ft. managing for mature or structurally complex forests	For all but intermittent non-fish-bearing streams: • 0 to 25 ft. no harvest • 25 to 60 ft. 80% shade retention • 60 to 100 ft. 50% canopy retention For all intermittent non-fish-bearing streams: 0 to 25 ft. no harvest

LSMA (late-successional management area) LSR (late-successional reserve) QMD (quadratic mean diameter) TMA (timber management area)

What are the environmental consequences of the alternatives?

The following sections summarize the environmental consequences that are described in detail in *Chapter 4*. The consequences vary between the alternatives for the different resources and programs. See *Table 40 (Comparison of the key impacts by alternative)* in *Chapter 2* for which resources and programs do and do not vary, and the amount of variance for those that do vary.

Note that the preciseness of the analyses for this draft environmental impact statement has improved due to the increased quality and quantity of the data and the increased sophistication of the forest vegetation and habitat modeling that is now available as opposed to when the current resource management plans were first analyzed in 1995.

Ecology

Forests are classified in the analysis of this draft environmental impact statement by the following four-stage structural classification system:

- **Stand establishment.** Forests that approximate the early-successional conditions that follow disturbances, such as timber harvesting or wildfires. This classification is subdivided based on whether or not the stand establishment forest includes trees (structural legacies) from the previous forest.
- **Young.** Forests that approximate the small conifer forests that are described in the FEMAT Report and Northwest Forest Plan. This classification is subdivided, like stand establishment, based on whether or not the young forest includes trees (structural legacies) from the previous forest.
- **Mature.** Forests that are defined similarly to the mature forests that are described in the FEMAT Report and Northwest Forest Plan. This classification is subdivided based on whether the forest has a single canopy layer or multiple canopy layers.
- **Structurally complex.** Forests that approximate the old-growth forests that are described in many analyses (e.g., the medium/large conifer multi-story forests of the FEMAT Report and the large, multi-storied older forests of the *Late-Successional Forest Monitoring Report*).

Together, the mature and structurally complex forests approximate the late-successional forests that are described in the FEMAT Report, the Northwest Forest Plan, and the resource management plans of the six western Oregon BLM districts that are within the planning area.

The abundance and spatial patterns of the forest structural stages (stand establishment, young, mature, and structurally complex) that would exist under the alternatives for the BLM-administered lands, as well as across all ownerships compared to average historic conditions, would be as follows:

- Across all ownerships, the abundance of the structural stages would not return to the average historic conditions within 100 years, even if there was no timber harvesting on the BLM-administered lands.
- The differences in the alternatives would result in only a 1% shift in the structural stage abundances across all ownerships within 100 years.
- On BLM-administered lands, only the No Action Alternative would result in a structural stage abundance that would be consistent with the average historic conditions. However, all four alternatives would decrease the abundance of young forests and increase the abundance of mature&structurally complex forests from current amounts.
- The retention of structural legacies in regeneration harvested areas, which would occur in the No Action Alternative and Alternative 3, would result in

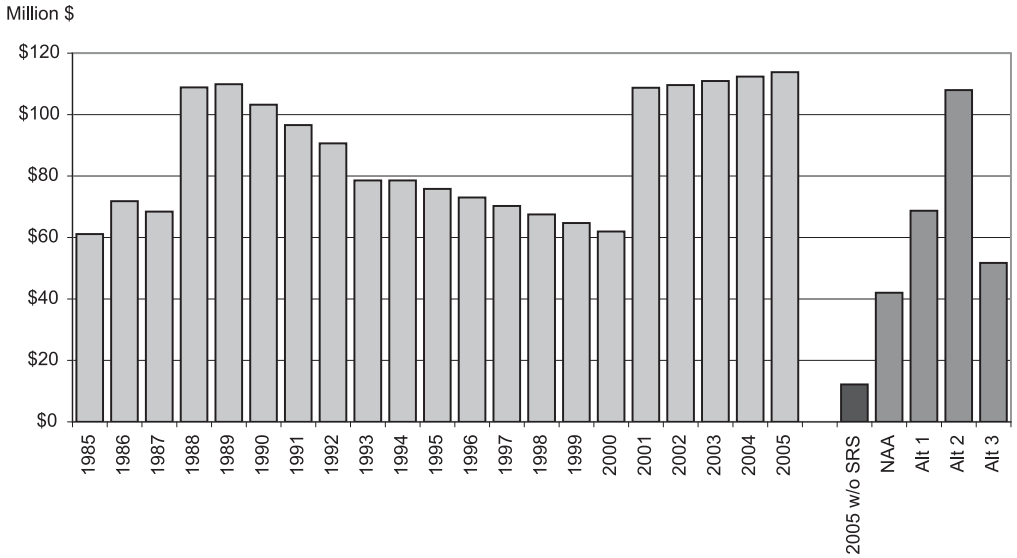
structurally complex forests that develop almost twice as fast after harvesting as in Alternatives 1 and 2.

- The No Action Alternative would reduce fragmentation in most physiographic provinces. Alternatives 1 and 2 would increase fragmentation in most provinces. Alternative 3 would increase fragmentation in all provinces.

Socioeconomics

As shown in *Figure 2 (BLM projected county payments compared to historic payments)*, none of the alternatives would produce timber receipts sufficient to bring payments to the O&C counties to the level provided by the BLM portion of the Secure Rural Schools payments. Alternative 2 would produce the highest payments to the counties at 94% of the O&C portion of the 2005 Secure Rural Schools payments, while the No Action Alternative would produce the lowest payments at 37% of the O&C portion of the 2005 payment.

Figure 2. BLM projected county payments compared to historic payments



Effects vary widely by county. The BLM plays the greatest role in the Douglas County budget, where it accounts for 20% of the total budget and 70% of the discretionary budget.

Alternative 2 would have the most favorable impact on local economies and would result in a net increase of 3,442 jobs and $136.5 million of earnings (wages). The No Action Alternative would have the least favorable impact on local economies and would result in a net decrease of 3,770 jobs and $125.5 million of earnings. Under all four alternatives, economic losses would be greatest in southwestern Oregon where the O&C lands are concentrated. *Table 2 (Total economic impacts by alternative)* shows that under all, but Alternative 2, the loss of Secure Rural Schools funding, coupled with the reduction in

the plywood industry, would be greater than the increased employment and earnings that would be linked to increased BLM harvest levels.

Table 2. Total economic impacts by alternative

Totals	Current Condition	O&C County Totals by Alternative (change compared to current)			
		No Action Alternative	Alternative 1	Alternative 2	Alternative 3
Jobs (number of)	8,948	**-3,770**	**-516**	3,442	**-1,275**
Earnings ($millions)	319.4	**-125.5**	**-7.3**	136.5	**-34.7**

Present net value is a measure of economic return. Future revenues and costs over a 50-year period are discounted back to the present using a 5% discount rate. As shown in *Table 3 (First decade revenues and costs and the present net value over 50 years)*, the present net value of the BLM timber harvest would range from $46.1 million under Alternative 3 to $962.3 million under Alternative 2.

Table 3. First decade revenues and costs and the present net value over 50 years

Alternative	Decade 1			Present Net Value (over 50 years) ($ million)
	Total Revenues ($ million)	Total Costs ($ million)	Net Revenues ($ million)	
No Action	83.9	**-78.7**	5.2	107.5
Alternative 1	137.5	**-117.7**	19.8	342.8
Alternative 2	215.8	**-166.9**	48.9	962.3
Alternative 3	103.3	**-103.8**	**-0.4**	46.1

Environmental Justice

No high or adverse human health or environmental consequences have been identified for any of the alternatives. The consequences of the alternatives are not expected to fall disproportionately on minority or low-income populations.

Timber

As shown in *Figure 3 (Percentage of BLM-administered lands in the harvest land base by alternative)*, the harvest land base varies between the alternatives from a high of 1.4 million acres, which is 65% of the forested acres, under Alternative 3 to a low of 607,000 acres, which is 27% of the forested acres, under the No Action Alternative.

Figure 3. Percentage of BLM-administered lands in the harvest land base by alternative

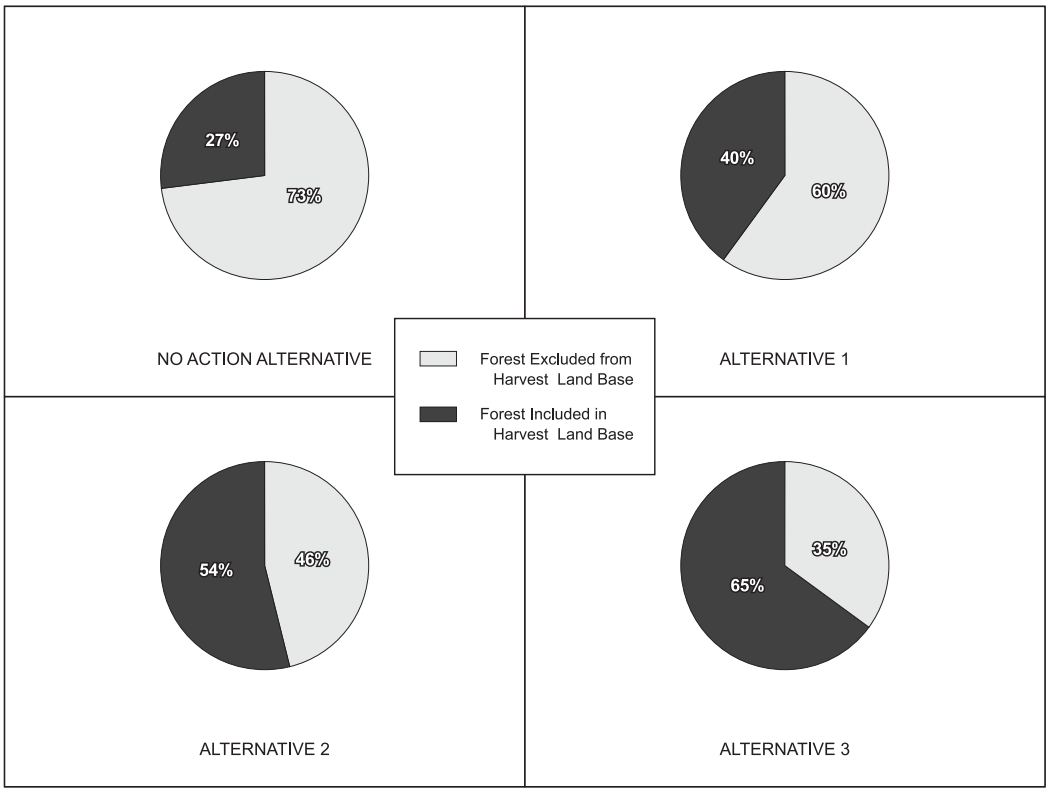


Figure 4 (Total allowable sale quantity by alternative for the planning area) shows that the annual allowable sale quantity would range from a high of 727 mmbf under Alternative 2 to a low of 268 mmbf under the No Action Alternative.

Figure 4. Total allowable sale quantity by alternative for the planning area

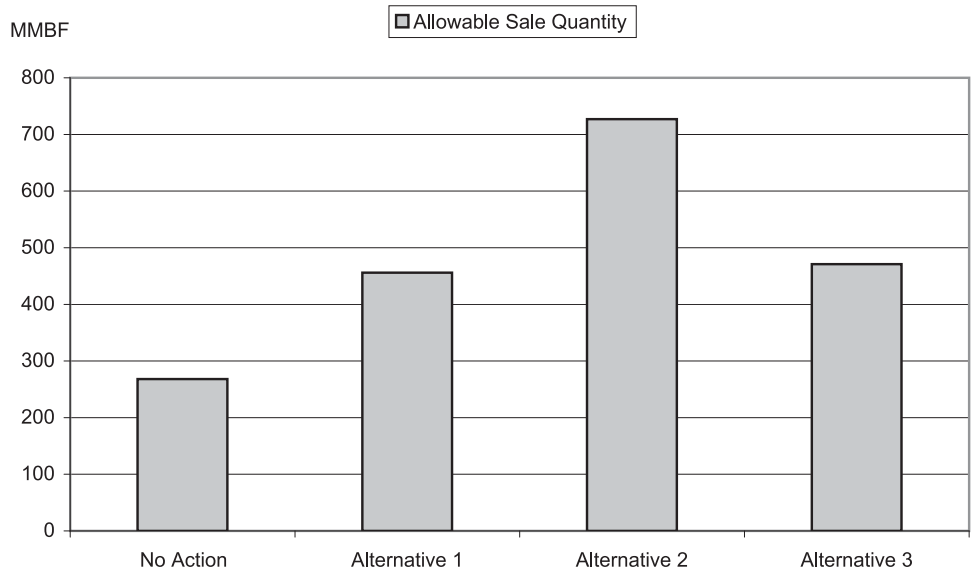
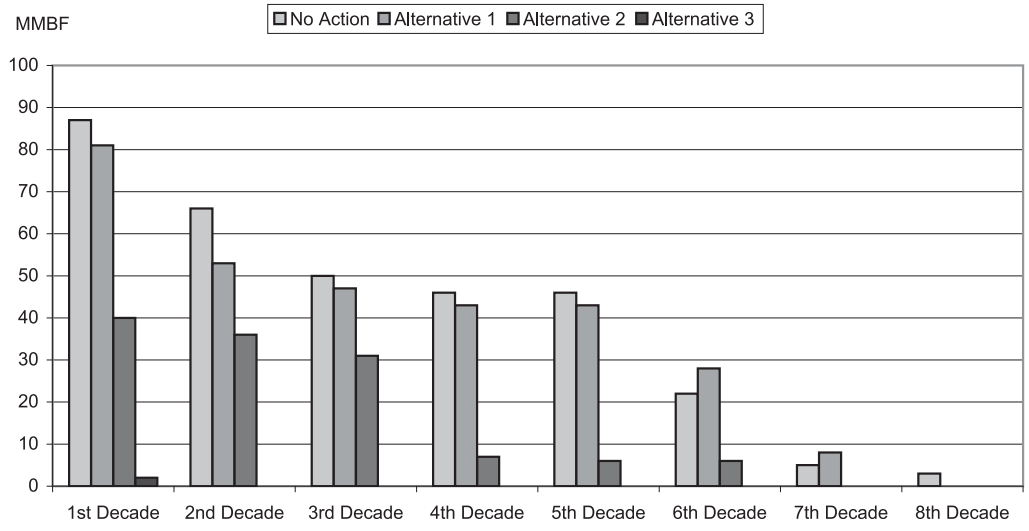


Figure 5 (Nonharvest land base volume over time) shows that over the next 10 years the volume from thinnings in the nonharvest land base would range from a high of 87 mmbf under the No Action Alternative to virtually no volume under Alternative 3. *Figure 5* also shows that the volume from thinnings would gradually decrease over time and would cease by the eighth decade.

Figure 5. Nonharvest land base volume over time



The different types of harvesting that occur under the alternatives include thinning, partial harvesting, uneven-aged management, and regeneration harvesting. Thinning can occur in both the harvest land base and the nonharvest land base. On an annual basis, the timber harvest acres of all harvest types would range from approximately 16,000 acres for the No Action Alternative to 29,000 acres for Alternative 3.

Special Forest Products

The location of specific special forest products moves with the location of management activities. As in the past, special forest products would be harvested from common and abundant plant and fungi species.

All four alternatives would maintain similar levels of availability and quantity of special forest products. Special forest products would generally be abundant relative to demand over the long term for all four alternatives.

Botany

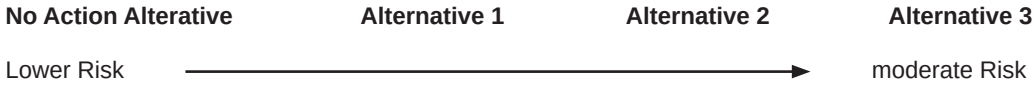
There are 134 (nonfederally listed) special status plant and fungi species that occur on BLM-administered lands within the planning area. These species are not evenly distributed or predictable across the landscape, even when good potential habitat exists.

The risk of population loss varies with the number of populations, the patch size (density of known populations) of populations, and the location of management activities. The risk of population loss is higher where the patch size per population is smaller, where management activity includes regeneration or partial harvesting, and where there would be multiple treatments over 10 to 15 years (timber harvest, fuels, and silviculture).

Under the No Action Alternative and on the public domain lands under the three action alternatives, there would be little risk of loss of populations and extirpation or extinction of bureau sensitive species or bureau assessment species.

Under the three action alternatives, some populations on O&C lands would be lost and the risk of local extirpation or extinction to bureau sensitive species and bureau assessment species would increase compared to the No Action Alternative.

The ranking of the alternatives for the risk of loss is as follows:



The three action alternatives would cause a low-moderate risk of local extirpation or extinction for the conifer-related species that are known from 20 or fewer sites on BLM-administered lands.

There are 13 federally listed species that are found within the planning area. Only five of the thirteen federally listed species occur on BLM-administered lands. Under all four alternatives, populations of species listed under the Endangered Species Act would be maintained and all four alternatives would contribute to the recovery of these species.

Invasive Plants

The greatest risk for the introduction of invasive plants would be in areas where they are abundant and when management activity results in increased light and soil disturbance, and when activities are proximate to riparian areas.

Alternative 2 would have the greatest risk of introduction based on levels of timber harvesting and associated roads. Alternative 2 also has the greatest risk of introduction into riparian areas based on riparian management widths, prescriptions, and levels of timber harvesting activities. The No Action Alternative would have the lowest risk of invasive plant introduction.

The greatest risk for the spread of invasive plants would be when management activities are dispersed and proximate to riparian areas.

Alternative 3 would have the highest risk of spread, since harvesting under Alternative 3 would be the most dispersed and occur on a larger proportion of lands. The No Action Alternative would have the lowest risk of spread.

Wildlife

For special status wildlife species, the habitat needs of aquatic- and riparian-associated species would be met for perennial and fish-bearing streams under all four alternatives. The habitat needs of aquatic- and riparian-associated species along intermittent streams would be met under the No Action Alternative and Alternative 1, but would not be met under Alternatives 2 and 3.

The habitat needs of forest-floor-associated species that are highly endemic to one or several locations would be at risk of decline in abundance and distribution under the three action alternatives.

Marbled Murrelet

The nesting habitat for the marbled murrelet on BLM-administered lands would increase under all four alternatives within 100 years. There are 891,000 acres of BLM-administered lands capable of growing nesting habitat for the marbled murrelet. Marbled murrelet habitat exists in stands that are classified as mature with multilayered canopies forest or structurally complex forest. By the year 2106, the habitat would increase from the current condition of 373,000 acres to:

- 715,000 acres under the No Action Alternative
- 620,000 acres under Alternative 1
- 439,000 acres under Alternative 2
- 493,000 acres under Alternative 3

In the short term (50 years), there would be a 16% decrease from the current condition in the quantity of marbled murrelet nesting habitat under Alternative 2 and a 14% decrease under Alternative 3.

Under the No Action Alternative and Alternative 1 in the Coast Range province, and the No Action Alternative in the Klamath province, there would be an increase in the mean patch and core area size and an increase in the edge density from the current condition. Under Alternatives 2 and 3, there would be a decrease in the mean patch and core area size and an increase in the edge density.

Northern Spotted Owl

For the northern spotted owl, the No Action Alternative and Alternative 1 would steadily increase the total amount of suitable habitat. Alternative 2 would maintain approximately the current amount of suitable habitat over time. Alternative 3 would maintain approximately the current amount of suitable habitat for the first 20 years, and then increase the amount of habitat to more than it would under Alternative 1 by 2106.

As shown in *Table 4 (Suitable habitat within the late-successional reserves and the late-successional management areas)* and *Figure 6 (Northern spotted owl suitable habitat on BLM-administered lands by alternative and reference analysis)*, the No Action Alternative, Alternative 1, and Alternative 2 would contribute to large blocks of suitable habitat to support clusters of reproducing owls. However, the BLM contribution to large blocks would require 50 to 100 years to develop into almost all suitable habitat. Alternative 3 would not contribute to large blocks of suitable habitat to support clusters of reproducing owls, because it would fragment suitable habitat from the current condition.

Figure 6. Northern spotted owl suitable habitat on BLM-administered lands by alternative and reference analysis

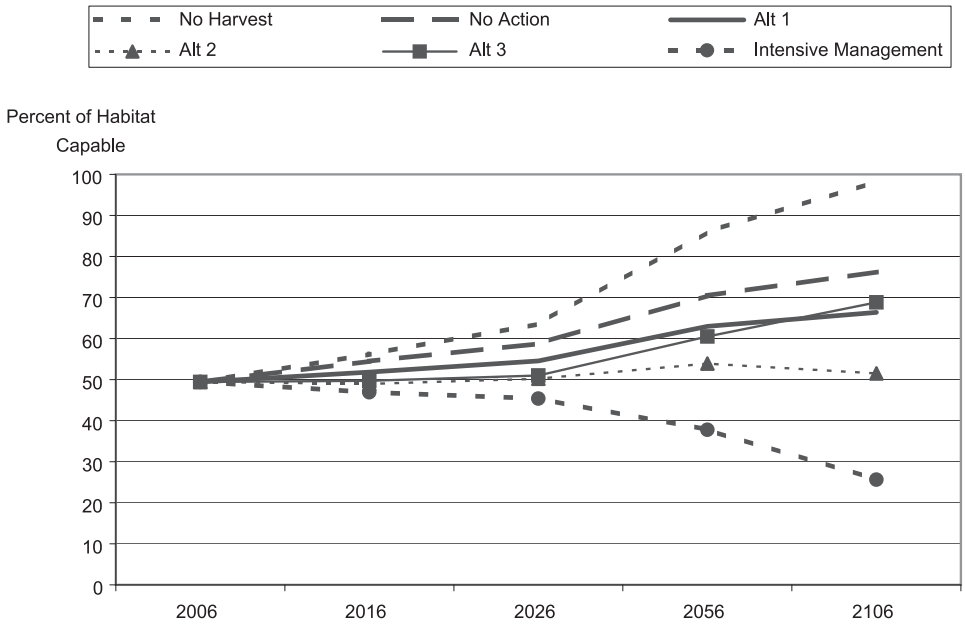


Table 4. Suitable habitat within the late-successional reserves and the late-successional management areas

Alternatives	Total Habitat-Capable Acres	% of Habitat-Capable Acres									
		2006		2016		2026		2056		2106	
		acres	%	acres	%	acres	%	acres	%	acres	%
No Action Alternative	809,400	458,900	57	490,400	61	535,300	66	693,100	86	797,300	99
Alternative 1	807,400	456,800	57	485,600	60	528,000	65	682,000	84	796,500	99
Alternative 2	521,500	281,300	54	300,400	58	334,800	64	452,400	87	515,000	99

Note: Alternative 3 is not included, because it would not allocate late-successional management areas.

The development of suitable habitat outside of large blocks is important because owl populations would need to rely on it until habitat within the blocks is capable of supporting clusters of reproducing owls. The development of suitable habitat outside of the large blocks would differ widely among the alternatives as a result of differing amounts of riparian management area acres and the differing management direction within the harvest land base.

As shown in *Table 5 (Acres of suitable habitat outside of the late-successional reserves and the late-successional management areas)*, during the first 50 years after implementation, while large blocks would be developing into suitable habitat, the No Action Alternative would increase the amount of suitable habitat outside of the large blocks. Alternative 1 would maintain and Alternative 2 would decrease the current amount of suitable habitat.

Table 5. Acres of suitable habitat outside of the late-successional reserves and the late-successional management areas

Alternatives	Total Habitat-Capable Acres	% of Habitat-Capable Acres									
		2006		2016		2026		2056		2106	
		acres	%	acres	%	acres	%	acres	%	acres	%
No Action Alternative	1,404,000	661,300	47	706,100	50	755,000	54	854,700	61	877,500	62
Alternative 1	1,406,000	637,900	45	653,200	46	670,400	48	701,700	50	661,400	47
Alternative 2	1,675,000	808,100	48	774,900	46	767,900	46	731,800	44	615,900	37
Alternative 3	2,196,700	1,085,800	49	1,092,000	50	1,119,200	51	1,329,000	60	1,512,000	69

Note: For Alternative 3, this table presents the amount of suitable habitat on all BLM-administered lands, because Alternative 3 does not allocate late-successional management areas.

Dispersal habitat conditions within and between the large blocks of suitable habitat would facilitate owl movement between the blocks. The No Action Alternative and Alternative 1 would maintain the current total quantity of dispersal habitat and would increase the quality of the dispersal habitat from the current condition. Alternative 2 would decrease the total quantity of dispersal habitat and would not increase the quality of dispersal habitat. Alternative 3 would decrease the total quantity of dispersal habitat, but would increase the quality of the dispersal habitat over time.

Fish

The abundance and survival of salmonids is closely linked to the abundance of large woody debris in streams.

The No Action Alternative would have almost twice the acreage in riparian management areas as Alternative 1, four times the acreage as Alternative 2, and more than three times the acreage as Alternative 3. Despite this difference in the size of the riparian management areas, large wood contributions would increase and nearly reach the maximum potential under every alternative; though slightly less under Alternatives 2 and 3.

This is because:

- all areas in the watershed (not just the riparian management areas) serve as source areas that can deliver large wood to streams; and
- the riparian management areas under all four alternatives incorporate some portion of large wood source areas.

There would be slight differences in the contribution of large wood in three of the five representative watersheds that were modeled. The differences are greater in the watersheds where a greater amount of debris-flow prone channels and fish-bearing streams is coupled with higher land ownership. The No Action Alternative and Alternative 1 would have similar levels of large wood contribution and Alternatives 2 and 3 would have slightly lower contributions.

The differences among the alternatives, in terms of fish productivity, would be less than 3%.

Increases in fine sediment delivery under all four alternatives would be less than 1% of the baseline sediment rates, and therefore would not degrade fish habitat under any of the alternatives.

None of the alternatives would result in increases in peak flows in fifth-field watersheds to a level that would affect fish habitat.

None of the alternatives would result in increases in stream temperature that would affect fish habitat or populations, except that under Alternatives 2 and 3 there would be some localized increases in stream temperature in the management area adjacent to the Coquille Forest land use allocation.

Water

Timber harvesting influences peak flows where a large proportion of the timber has been harvested in a watershed. The magnitude of the effect is affected by the type of harvesting (thinning or regeneration harvesting), amount, and distribution of harvesting within watersheds. For all four alternatives, there would be four sixth-field subwatersheds (out of 1,071) susceptible to increased peak flows from timber management.

Subwatersheds are more sensitive to extremes in environmental conditions than alternative variations of harvest levels. Regeneration harvesting under the alternatives is not great enough to increase susceptibility to increased peak flows.

Effective shade is the total solar radiation blocked from reaching a stream over a 24-hour period. All four alternatives would maintain effective stream shade that would limit the increase of stream temperature within the range of natural variability.

Roads near streams are primary sites where mobilization of chronic fine sediment would take place. Most new roads would be located outside of a stream influence zone where possible, and therefore these miles would mostly likely not deliver fine sediment to streams channels. Between 8 and 37 miles of permanent new roads with a natural or aggregate surface would be constructed within a distance that could deliver sediment to streams over the next 10 years under the all four alternatives.

Under all four alternatives over the next 10 years, the increase in the amount of fine sediment delivered to streams from new permanent roads would be less than three-tenths of 1% of the amount delivered from the existing road network. Road improvements and the decommissioning of roads near streams would be of greater importance to decreasing fine sediment delivery than the effect of new roads.

Under all four alternatives, best management practices would be applied and are assumed to maintain or improve water quality. Best management practices include methods that limit the delivery of sediment to streams.

Fire and Fuels

The analysis of fire and fuels divides the planning area into two areas:

- the Salem, Eugene, Roseburg, and Coos Bay districts (north of Grants Pass), which generally have a low-frequency and high-severity fire regime; and
- the Medford District and Klamath Falls Resource Area of the Lakeview District (south of Grants Pass), which generally have a high-frequency and low-severity fire regime.

Fire severity, hazard, and resiliency can generally be equated to broad descriptions of vegetation conditions. Under moderate and extreme conditions, the primary source of high-severity fire would be in stand establishment and young forests that consist of even-aged stands.

All four alternatives would reduce fire severity and hazards north of Grants Pass, because all four alternatives would reduce the combined abundance of stand establishment and young forests. The No Action Alternative and Alternative 1 would result in the largest decrease and Alternative 2 would result in the smallest decrease.

All four alternatives would reduce fire severity and hazard in the Medford District, but the amount of decrease would vary widely among the alternatives. The amount of decrease is relative to the reduction in acreage of stand establishment and young forests compared to the current condition. The No Action Alternative would result in the most decrease and Alternative 2 would have the least decrease.

Alternatives 1 and 2 would increase fire severity and hazards in the Klamath Fall Resource Area of the Lakeview District while the No Action Alternative and Alternative 3 would decrease fire severity and hazards at approximately the current levels.

Alternatives 1 and 2 would decrease the acreage of fire-resilient forests from current conditions, because they would create forests without green tree structural legacies, which have a lower fire resiliency compared to forests with such structural legacies.

In both the Medford District and Klamath Falls Resource Area, the No Action Alternative and Alternative 3 would increase the acreage of fire-resilient forests from current conditions, because they would create forests with structural legacies.

Air

Under all four alternatives, emissions from prescribed burning would occur at the local level, but all burning would follow the Oregon Smoke Management Plan. This would result in the protection of all air quality, Class 1 visibility areas, and air quality maintenance areas.

Recreation

All four alternatives meet recreational demand and improve the quality of visitor experiences.

The off-highway vehicle designations would be the same under the three action alternatives. See *Table 6 (Off-highway vehicle designations under the alternatives)*. Additionally, in the Medford District, the number of off-highway vehicle emphasis areas would vary from 0 to 10 under all four alternatives.

Table 6. Off-highway vehicle designations under the alternatives

Off-highway Vehicle Designation	No Action Alternative (acres)	All Action Alternatives (acres)
Open	330,000	77
Closed	84,600	98,800
Limited to Existing Roads and Trails	950,000	0
Limited to Designated Roads and Trails	1,100,000	2,400,000

Under the three action alternatives, the redesignation of off-highway vehicle areas, and the designation of 10 new emphasis areas in the Medford District (under Alternative 2), would reduce visitor conflicts and increase off-highway vehicle opportunities. This would improve public safety and visitor experiences compared to the No Action Alternative.

Harvesting and associated roads can change the remoteness and naturalness of an area, which in turn can cause changes in the recreational settings used by the public. Remoteness would be little changed under all four alternatives since there are relatively few new permanent roads. The naturalness of BLM areas would also be little changed overall. The alternatives would maintain a mix of naturalness settings that provide a variety of opportunities and experiences for visitors.

Wilderness Characteristics

The BLM evaluated 146 public wilderness proposals that were received during scoping. It was determined that nine of these areas (26,123 acres) contained wilderness characteristics. Under the three action alternatives, there would be special management (no harvesting) to maintain the wilderness characteristics on five of these areas.

It was assumed that timber harvesting would not maintain wilderness characteristics. *Table 7 (Acres of wilderness characteristics maintained under the alternatives)* shows that each of the four alternatives would maintain 52 to 63% of the 26,123 acres that have wilderness characteristics.

Table 7. Acres of wilderness characteristics maintained under the alternatives

Wilderness Characteristics Maintained	No Action Alternative	Alternative 1	Alternative 2	Alternative 3
Acres	16,485	15,610	13,637	13,918
Percentage	63	60	52	53

Visual Resources

Visual resource quality is determined through the visual resource inventory process, which is based on a combination of scenic quality, sensitivity levels, and distance zones. The results of this inventory process classified all BLM lands within the planning area as Class I, II, III, or IV. Class I areas are determined to have the highest level of visual resource quality, while Class IV areas have the lowest level (see *Chapter 3*).

The BLM also designates visual resource management classes through the land use planning process. These classes also range from Class I through IV. Class I areas are managed to preserve visual resource quality, while Class IV areas allow for major modifications. Management classes can vary from the original inventory classes to be consistent with the goals and objectives of resource management plans.

Areas inventoried as Class I and IV would be maintained under all four alternatives. Regeneration harvests would diminish existing visual resource quality within Class II and III areas. Alternative 1 would maintain existing visual resource quality on the greatest portion of BLM lands within the planning area compared to the other two action alternatives.

National Landscape Conservation System

The three action alternatives would continue to protect all National Landscape Conservation System designated lands.

Soils

The same or improved practices would be used to minimize the loss of soil productivity under the three action alternatives as under the No Action Alternative.

Despite some residual detrimental soil disturbance, overall soil productivity would be maintained or improved under all four alternatives.

Grazing

Under the three action alternatives, the acres of livestock grazing authorizations would decrease from 560,000 acres to 418,500 acres. This decrease is largely in the Medford District and Klamath Falls Resource Area of the Lakeview District, where the acres are vacant and not currently grazed.

Under all four alternatives, there would be an increase in forage production in the Medford District and the western portion of the Klamath Falls Resource Area of the Lakeview District. The highest increase under the three action alternatives would occur under Alternative 3. None of the alternatives would substantially change the quantity of forage production in the eastern portion of the Klamath Falls Resource Area, since little regeneration or partial harvesting would occur there.

Wild Horses

The Pokegama Herd Management Area is located partially (84%) within the planning area. Forage production in support of the herd would be affected by changes to vegetation due to management activity. Stand establishment forests, where regeneration or partial harvesting would occur, provides the best forage.

All four alternatives would increase forage production with the highest increase being under Alternative 3. All four alternatives would maintain the current appropriate herd management level of 30 to 50 head.

Areas of Critical Environmental Concern and Research Natural Areas

During the planning process, the status of 94 existing and 38 proposed areas of critical environmental concern were reviewed. There were 124 that met the designation criteria and that were carried forward under the three action alternatives.

Relevant and important values are the unique values for which an area of critical environmental concern is managed. Some land use allocations may provide for these values, so there would be no need for designation. Under the three action alternatives, areas of critical environmental concern were analyzed for designation, and if areas were not viable without O&C lands they were not designated.

See *Table 8 (Total existing and potential ACECs designated by alternative)* for the number of areas of critical environmental concern under the alternatives.

Table 8. Total existing and potential ACECs designated by alternative

Designated	No Action Alternative	Alternative 1	Alternative 2	Alternative 3
Number of ACECs	94	92	93	82

It was assumed that if an area of critical environmental concern was not designated due to the loss of O&C lands, the relevant and important values would be degraded or lost. See *Table 9 (Relevant and important value categories that would receive no special management attention)* for the action alternatives that would not maintain 25 to 35% of the relevant and important values. Note that an area of critical environmental concern can have more than one relevant and important value.

Table 9. Relevant and important value categories that would receive no special management attention

Value Category	Alternatives							
	No Action		Alternative 1		Alternative 2		Alternative 3	
	number	%	number	%	number	%	number	%
Cultural, historic, and scenic	0	0	5	16	4	13	7	22
Fish and wildlife	0	0	19	34	15	27	24	43
Natural process or system			34	28	33	28	43	36
Natural hazard	0	0	0	0	0	0	0	0
Totals	**0**	**0**	**58**	**27**	**52**	**25**	**74**	**35**

Note: See *Appendix M. Areas of Critical Environmental Concern and Research Natural Areas* for information about the specific important and relevant values for each area of critical environmental concern.

Cultural Resources

Impacts to sites would be largely reduced or eliminated due to predisturbance site discovery and avoidance or protection measures. However, there would be some residual incidental or inadvertent loss of sites. Damage to cultural, paleontological, and traditional use sites would vary little between the alternatives. For all four alternatives, 2% or less of the number of sites would be damaged per decade.

Energy and Minerals

All four alternatives would maintain similar levels of availability and quantity of energy and mineral resources. Opportunities to explore for energy and mineral resources on public land within the planning area would generally be abundant relative to the demand under all four alternatives.

Under all four alternatives, those portions of the Coos Bay District that are in the Coos geologic basin would be of special interest for exploration and development of coal bed natural gas, as an extension of development already under way. As many as 77 wells may be drilled on federal land, which would result in approximately 525 acres of disturbance.

Chapter 1 – Purpose and Need

Chapter 1 describes the purpose and need for the action that is proposed, and identifies the factors that will be used when choosing among the alternatives at the time of the decision. This chapter also describes the boundaries of the planning area, the planning process – including scoping, the collaborative efforts the BLM has made with the many agencies and organizations that have an interest in BLM-administered lands in western Oregon, and the relationship these revised resource management plans have to other plans and programs.

In this chapter:

Introduction 3

Purpose and Need for the Plan Revisions 3

Reasons for Revising the RMPs Now 4

Selecting a Preferred Alternative 7

Background 8

Planning Area 16

Planning Process 18

Collaboration 19

Relationship of the RMPs to Other Plans, and Programs 22

Introduction

The Bureau of Land Management (BLM) is revising the resource management plans (RMPs) for the Coos Bay District, Eugene District, Medford District, Roseburg District, Salem District, and the Klamath Falls Resource Area of the Lakeview District. The Oregon and California Railroad and Coos Bay Wagon Road Grant Lands Act (O&C Act) is the statutory authority that provides primary direction to the BLM for managing most of the lands it administers in western Oregon.

O&C Act

The lands that are managed by the O&C Act include the Oregon and California Railroad grant lands that were revested in 1916 and the Coos Bay Wagon Road lands that were reconveyed in 1919.

The existing RMPs are consistent with the 1994 Northwest Forest Plan, adopted by the Department of the Interior and the Department of Agriculture for federal forests within the range of the northern spotted owl as an "ecosystem management plan for managing habitat for late-successional and old-growth forest related species." The proposed action is to revise the RMPs with land use allocations and management direction that best meet the purpose and need.

The BLM is proposing to revise existing plans to replace the Northwest Forest Plan land use allocations and management direction because (1) the BLM's plan evaluations found harvest levels have not been achieving the timber harvest levels directed by existing plans, and the BLM now has more detailed and accurate information than was available in 1995 on the effects of sustained yield management on other resources, (2) there is an opportunity to coordinate the BLM management plans with new recovery plans and re-designations of critical habitat currently under development and (3) the BLM has re-focused the goal for management of the BLM-administered lands to the objectives of its statutory mandate to utilize the principles of sustained yield management on the timber lands covered under the O&C Act of contributing to the economic stability of local communities and industries, and other benefits from such management to watersheds, stream flows, and recreation.

Purpose and Need for the Plan Revisions

The goals for the Northwest Forest Plan were broader than the specific requirements of the Endangered Species Act and Clean Water Act and sought to provide more consistent management of federally-managed lands by applying National Forest Management Act requirements to BLM-administered lands. The selected alternative for the Northwest Forest Plan was selected because it would "maintain the late-successional and old-growth forest ecosystem and provide a predictable and sustainable supply of timber, recreational opportunities and other resources at the highest level possible." The purpose and need for this plan revision is focused on specific legal requirements and intended benefits of the BLM's unique mandate under the O&C Act, distinct from the mandate to the U.S. Forest Service under National Forest Management Act.

The purpose and need for this proposed action is to manage the BLM-administered lands for permanent forest production in conformity with the principles of sustained yield, consistent with the O&C Act.[1] The plans will also comply with all other applicable laws including, but

[1] The Ninth Circuit in *Headwaters v. BLM*, 914 F.2d 1174 (9th Cir. 1990) confirmed that in the O&C Act Congress mandated timber production as the dominant use of these BLM-administered lands.

not limited to, the Endangered Species Act, the Clean Water Act, and, to the extent that it is not in conflict with the O&C Act, the Federal Land Policy and Management Act. In accord with the Endangered Species Act, the plans will use the BLM's authorities for managing the lands it administers in the planning area to conserve habitat needed from these lands for the survival and recovery of species listed as threatened or endangered under the Endangered Species Act.[2]

Reasons for Revising the RMPs Now

Plan evaluations showed the BLM's timber harvest levels as directed by existing plans were not being achieved, and the BLM now has more detailed and accurate information on the effects of sustained yield timber management on other resources.

RMP revisions are necessary where monitoring and evaluation findings, new data, new or revised policy, or changes in circumstances indicate decisions in a plan (an entire plan or a major portion of a plan) no longer serve as a useful guide for resource management (43 CFR 1610.5-6). Failure to meet some plan objectives and new information that increases opportunities to improve the performance of other plan objectives necessitates revisions to resource management plans.

The BLM completed evaluations for the six western Oregon RMPs in 2004 and found departures from objectives, management actions, and assumptions in the timber resources program. The BLM determined the annual productive capacity and declared an allowable sale quantity of 211 million board feet (mmbf) in the 1995 records of decision for the RMPs for western Oregon.[3] Except for the Klamath Falls Resource Area of the Lakeview District, evaluations for the other districts documented that regeneration harvest was 30 to 60 percent of the levels anticipated. Even when thinning volume was added, except for the Klamath Falls Resource Area of the Lakeview District, plan evaluations showed that the timber offered from the harvest land base was still only 40 to 70 percent of the anticipated allowable sale quantity. This failure to meet the harvest levels is largely due to unanticipated legal and practical implementation issues involved in managing designated critical habitat for the northern spotted owl that was different then the land use allocations in the Northwest Forest Plan, and court decisions regarding the survey and manage mitigation measure and Aquatic Conservation Strategy.

[2] This revision process will satisfy a settlement agreement resolving long-standing litigation of the Northwest Forest Plan (*AFRC v. Clarke*, Civil No. 94-1031-TPJ (D.D.C.)) that alleged the current RMPs violate the O&C Act. The settlement agreement requires BLM to consider revisions to the RMPs by the end of the year 2008, and include at least one alternative that "will provide permanent forest production across the O&C lands without reserves except as required to avoid jeopardy under the Endangered Species Act." See *Appendix A* for more discussion.

[3] Currently, due to subsequent adjustments through plan amendments and maintenance, the declared allowable sale quantity for the BLM lands in western Oregon is 203 million board feet (mmbf).

The departures from the expectations and assumptions of the RMPs regarding the ability of the BLM to supply timber at a predictable and sustained level under the Northwest Forest Plan have created substantial uncertainty as to whether the objective under the O&C Act (managing O&C lands for permanent forest production and contributing to the stability of the local economy and industry) can be met in the short or long term. Even though the purpose of the O&C Act in providing a stable source of revenue to the county governments has been supplanted in recent years through temporary Congressional funding, the source of this revenue in the long term is uncertain. To the extent the BLM can provide a substantial stream of revenue to the counties through the revenue sharing provisions of the O&C Act, the ability of county governments dependent on these revenues to provide services will be improved. Furthermore, the revenue sharing provision is primarily in support of the local governments, whereas the intended benefits of sustained yield timber management under the O&C Act also include contribution to the local economies and industries, not just to governments.

These plan evaluations generally found that other resource programs were functioning as anticipated in achieving most goals, but identified potential for improvements. For example, the evaluations indicated opportunities to adjust the off highway vehicle designations for some districts, to add a new policy (the National Fire Plan) for some districts, to address the latest science and more recent listings on threatened and endangered species for all of the districts. These items in themselves may not have justified a revision of the current RMPs, but will be considered in this revision of the RMPs.

In 1995, the Northwest Forest Plan analysis used a geographical information database that was limited to a resolution of units of 40 acres in size. The current database has a resolution many times finer than this: i.e., 10 square meters in resolution rather than 40 acres. Additionally the hydrological map data, among others, was incomplete at that time and has now been completed and updated. As a consequence, the BLM is now able to perform analysis on such resources as aquatic habitat in much finer detail with more precision using analytical models that were unavailable in 1993. In part due to the limitations of the available information database, the 1995 RMPs erred on the side of caution regarding resources used by species considered rare, threatened, or endangered. That margin of error is no longer justified. Making this adjustment in light of advances in the analytical ability, data, and knowledge of the resources is consistent with the principles of adaptive management articulated in the Northwest Forest Plan in 1994.

There is an opportunity to coordinate the BLM's management plans with new recovery plans and redesignations of critical habitat currently under development.

The National Marine Fisheries Service and Fish and Wildlife Service are currently reviewing, revising or drafting recovery plans and critical habitat for some listed species in the planning area. These revisions will also allow the BLM to coordinate its RMPs with decisions on the recovery plans and any re-designation of critical habitats.

The late-successional reserves in the Northwest Forest Plan do not coincide completely with the critical habitat that was designated for the northern spotted owl by the Fish and Wildlife Service in 1992. This resulted in an uncertainty for those matrix lands that are overlain with the critical habitat designation, because the matrix land use allocation was where the majority of timber harvesting to meet the declared allowable sale quantity was expected to occur.

Some Fish and Wildlife Service biological opinions on timber sales within critical habitat have been litigated and found invalid. In the *Gifford Pinchot Task Force*[4] decision, the Ninth Circuit made it clear that effects to critical habitat must be considered regardless of whether the Northwest Forest Plan would be expected to recover the species. As a result, the ability of the BLM to implement timber sales in the portions of the matrix and adaptive management area that are within designated critical habitat is more limited than anticipated in the current RMPs.

The existing management uncertainty resulting from the differences between the designated critical habitat and the reserves established in the Northwest Forest Plan could be reduced by harmonizing the BLM RMPs with designated critical habitat. The Fish and Wildlife Service is concurrently writing a recovery plan and reexamining the designation of critical habitat for the northern spotted owl. Thus, the BLM, at this time, has an opportunity to integrate the recovery plans of the Fish and Wildlife Service and National Marine Fisheries Service, and any redesignation of critical habitat, into the revision of the BLM's resource management plans.

The BLM has re-focused the goal for management of the BLM-administered lands to the statutory mandates specifically applicable to these lands.

The statutory requirements of the O&C Act, which governs most BLM-administered lands in western Oregon, include, but are not limited to, managing the O&C lands for permanent forest production by selling, cutting, and removing timber in conformance with the principles of sustained yield; determining the annual productive capacity of the lands managed under the O&C Act; and offering that determined capacity annually under normal market conditions. The statute states that the purpose of sustained yield management of these lands is to provide a permanent source of timber, contribute to the economic stability of local communities and industries, as well as benefit watersheds, regulate stream flows, and provide recreational use.[5] The statutory requirements of the O&C Act are limited by other statutes providing for the need to conserve listed species and the habitat they depend on, not jeopardizing listed species and not adversely modifying critical habitat, and the protection of the chemical, biological and physical properties of the water of the United States. As long as the requirements of these other statutes are met, increasing the level of timber production consistent with the principles of sustained yield would further the objectives set by Congress for managing these lands under the O&C Act.

Land use allocations

For details about the Northwest Forest Plan and its land use allocation designations, search for the phrase Northwest Forest Plan at htpp://www.blm.gov/search.

[4] *Gifford Pinchot Task Force v. U.S. Fish and Wildlife Service*, 378 F.3d 1059 (9th Cir. 2004)

[5] The BLM interprets this language of the O&C Act as explaining the rationale for sustained yield forest management, rather than enumerating additional objectives for management.

Selecting a Preferred Alternative

In selecting among the alternatives in this plan revision, the BLM will evaluate which alternative or combination of alternatives best meets the Purpose and Need. In addition, the BLM will consider the environmental consequences related to the issues identified below and the cost of implementation.

Background

The following background summarizes the major resource plans, and laws that affect the BLM's management of the O&C lands of western Oregon.

Northwest Forest Plan

The management direction contained in the 1994 Northwest Forest Plan (NWFP) was designed to respond to the need for both forest habitat and forest products (NWFP ROD, p. 25). In selecting Alternative 9 (which became the NWFP), the secretaries of the Interior and Agriculture stated that "[t]o balance these sometimes conflicting purposes and plan for management of ecosystems that cross the administrative boundaries … we adopt the alternative that will both maintain the late-successional and old-growth forest ecosystem and provide a predictable and sustainable supply of timber" (NWFP ROD, p. 26).

Northwest Forest Plan

For documents relating to the Northwest Forest Plan, including the record of decision (ROD), visit http://www.blm.gov/or/plans/nwfpnepa/index.htm or http://www.reo.gov/library.

The decision to select Alternative 9 was an attempt to balance the two purposes of forest habitat and forest products. The balancing was primarily accomplished through land allocations between lands designated as reserved lands (congressionally reserved areas, administratively withdrawn, late-successional reserves, and riparian reserves) that were declared "incompatible with programmed, sustained timber harvest" (NWFP SEIS, p. 3&4-263) and the lands not reserved for conservation purposes were left as "matrix" or "adaptive management areas" land allocations on which programmed timber harvest could take place. These remaining unreserved lands constituted 23 percent of the BLM-administered lands. Timber harvesting on the matrix lands and in the adaptive management areas was restricted by the standards and guidelines that were designed to achieve conservation objectives on these lands (NWFP ROD, p. 1-2).

The conservation strategy of the Northwest Forest Plan addressed not only the Endangered Species Act, but also the National Forest Management Act of 1976 (NFMA) and its requirement that the United States Forest Service "provide for diversity of plant and animal communities … to meet overall multiple-use objectives" (16 U.S.C. §1604). The Northwest Forest Plan applied the same criteria for the management of habitat on both United States Forest Service and BLM-administered lands. The discussion regarding the legal and regulatory compliance of Alternative 9 (as it relates to the National Forest Management Act) in the 1994 record of decision for the Northwest Forest Plan states that:

NFMA

The National Forest Management Act of 1976 was an amendment to the Forest and Rangeland Renewable Resources Planning Act of 1974 that reorganized and expanded the 1974 act. For the complete act and its regulations, search for Title 16 and all sections starting with Section 1600 at http://uscode.house.gov.

Although NFMA regulations apply to lands administered by the Forest Service, the fish and wildlife regulation was used as a criterion in the development of the alternative we select today, which includes direction for management of BLM lands. Use of the regulation's goals in developing alternatives applicable to BLM lands serves the important policy goal of protecting the long-term health and sustainability of all of the federal forests within the range of the owl and the species that inhabit them." (NWFP ROD, p. 44)

Major Laws Affecting Management of O&C Lands

How the various laws affect the management of the O&C lands is discussed in this section. In addition to the laws presented here, there are a multitude of other legal authorities that affect the management of the O&C lands. For those, see *Appendix A*.

The O&C Act has been the statutory authority for the management of the O&C lands since 1937. Subsequent laws affect the management of the O&C lands to varying degrees. Laws, such as the Endangered Species Act and Clean Water Act, are directly applicable to how the BLM exercises its statutory authorities in managing the O&C lands, but none of these laws repealed the underlying primary direction and authority for the O&C lands. Thus, the BLM has a duty to find a way to concurrently implement all these laws, in a manner that harmonizes any seeming conflict between them, unless Congress has provided that one law would override another law. This is the situation in the Federal Land Policy and Management Act where Congress provided that in any conflict between that law and the O&C Act, the O&C Act would prevail. Thus, the O&C Act takes precedence over FLPMA with regard to timber management and receipts distribution.

O&C Act

The 1937 act that administers the O&C lands is untitled, but, through the title given to the codified regulations that administers the act, it is now known as the Oregon and California Railroad and Coos Bay Wagon Road Grant Lands Act (O&C Act).

Oregon and California Railroad and Coos Bay Wagon Road Grant Lands Act (43 U.S.C. §1181a et seq.)

The 1937 Oregon and California Railroad and Coos Bay Wagon Road Grant Lands Act (O&C Act) provides the legal authority to the Secretary of the Interior for the management of the O&C lands. The O&C Act was intended to provide forest management that would generate revenue to the local counties and halt previous practices of clearcutting without reforestation and the "boom and bust" cycles caused by logging in excess of the forest's sustained yield capacity. The O&C Act limited timber harvest to a level that could be continued without

O&C Act

For the complete act and its regulations, search for Title 43 and all sections starting with Section 1181a at http://uscode.house.gov.

exceeding the amount of forest growth to avoid depletion of timber resources and provide other benefits.[6]

The O&C Act requires that the O&C lands be managed "for permanent forest production, and the timber thereon shall be sold, cut, and removed in conformity with the principal of sustained yield for the purpose of providing a permanent source of timber supply, protecting watersheds, regulating stream flow, and contributing to the economic stability of local communities and industries, and providing recreational facilities" (43 U.S.C. §1181a).

The O&C Act goes on to state that "[t]he annual productive capacity for such lands shall be determined and declared … [p]rovided, [t]hat timber from said lands … not less than the annual sustained yield capacity … shall be sold annually, or so much thereof as can be sold at reasonable prices on a normal market" (43 U.S.C. §1181a).

When monetary receipts from the sale of timber from the O&C lands are distributed, 50% is distributed to the counties in which the revested lands are located. That 50% is distributed to the counties according to their proportion of the total assessed value of the revested lands that existed in each of the counties in 1915. Those percentages range from 0.36% to 25.05% for the 18 O&C counties. It does not matter in which counties the timber is harvested. All counties get their assigned percentage of whatever receipts are available each year.

In meeting the various requirements for managing the O&C lands, the Secretary of the Interior has discretion under the O&C Act to determine how to manage the forest to provide for permanent forest production on a sustained yield basis. While the O&C Act does state that "the timber thereon shall be sold, cut, and removed in conformity with the principal [sic] of sustained yield," it does not specify the harvest methods, rotation length, or silviculture regimes under which these forests would be managed. Nor does it establish a minimum level of harvest or a minimum level of receipts.

Federal Land Policy and Management Act (43 U.S.C. §1701 et seq.)

FLPMA

For the complete act and its regulations, search for Title 43 and all sections starting with Section 1701 at http://uscode.house.gov.

The Federal Land Policy and Management Act of 1976 (FLPMA) provides the legal authority to the Secretary of the Interior for the management of public domain lands. The act requires, in part, that "the public lands be managed in a manner that will protect the quality of scientific, scenic, historical, ecological, environmental, air and atmospheric, water resource, and archeological values; that, where appropriate, will preserve and protect certain public lands in their natural condition; that will provide food and habitat for fish and wildlife and domestic animals; and that will provide for outdoor recreation and human occupancy and

[6] H.R. Report, No. 1119, 75th Cong., 1st Sess. 2 (1937).

use" (43 U.S.C. §1701 [Sec. 102.a.8]). In addition, the act requires that "the public lands be managed in a manner which recognizes the Nation's need for domestic sources of minerals, food, timber, and fiber from the public lands" (43 U.S.C. §1701 [Sec. 102.a.12]).

However, the Federal Land Policy and Management Act specifically provides that if there is any conflict between its provisions and the O&C Act related to the management of timber resources or the disposition of revenues from the O&C lands and resources, the O&C Act prevails (i.e., takes precedence) (43 U.S.C. §1701). Thus, the multiple-use management direction of this act does not apply to the O&C lands that are suitable for timber production. On the other hand, the planning process established by this act is applicable to the O&C lands, since it is not in conflict with the O&C Act's management direction for those lands.

Note that the multiple-use management direction of this act does apply to other public lands (e.g., the public domain lands) that are managed by the BLM in western Oregon.

Endangered Species Act (as amended) (16 U.S.C. §1531 et seq.)

Endangered Species Act

For the complete act and its regulations, search for Title 16 and all sections starting with Section 1531 at http://uscode.house.gov.

Section 7 of the Endangered Species Act (ESA) requires federal agencies to use their legal authorities to promote the conservation purposes of the act. This section also requires federal agencies to consult with the United States Fish and Wildlife Service or the National Marine Fisheries Service to ensure that actions they authorize, fund, or carry out will not jeopardize species listed as threatened or endangered under the ESA or cause destruction or adverse modification to designated critical habitat for such species. Critical habitat is defined, in part, as geographic areas occupied by the species that contain the physical or biological features essential to the conservation of a species listed under the act and that may need special management or protection. (U.S. Fish and Wildlife Service, Endangered Species Program. *ESA Basics - 30 Years of Protecting Endangered Species*. May 2006. URL: http://www.fws.gov/Endangered/pubs/ESA%20BASICS_050806.pdf (accessed October 2006))

Clean Water Act (as amended) (33 U.S.C. §1251 et seq.)

The objective of the Clean Water Act is to restore and maintain the chemical, physical, and biological integrity of the nation's waters. To accomplish this objective, the statute requires that: water quality standards consistent with the statutory goals of the Clean Water Act be established; water bodies be monitored to determine whether the water quality standards are being met; and, if all of the water quality standards are being met, then antidegradation policies and programs, including ambient monitoring, be employed to keep the water quality

at acceptable levels.

If a water body is not meeting the applicable water quality standards for a beneficial use, a strategy for meeting the required standards must be developed by the administrating agency, typically the state water quality agency. For example, section 303(d) of the Clean Water Act directs states and tribes to develop a list of waters that fail to meet water quality standards and develop total maximum daily loads (TMDLs) for the individual pollutants (e.g., sediment, bacteria, elevated instream temperature) causing the water quality standards violations. TMDLs determine what level of pollutant load would be consistent with meeting the water quality standards and allocate acceptable loads among sources of the relevant pollutants. Necessary reductions in pollutant loading are achieved by implementing strategies that are authorized by the Clean Water Act, along with other tools that are available from federal, state, and local governments and nongovernmental organizations. (U.S. Environmental Protection Agency, Watershed Academy Web. *Introduction to the Clean Water Act*. March 13, 2003. URL: *http://www.epa.gov/watertrain/cwa/rightindex.htm* (accessed October 2006))

Clean Water Act

For the complete act and its regulations, search for Title 33 and all sections starting with Section 1251 at http://uscode.house.gov.

Sections 303(d) and 319 of the Clean Water Act most directly apply to the BLM. Section 303(d) (codified as 33 U.S.C. §1313(d)) directs states and tribes to develop a list of waters that fail to meet water quality standards for various constituents including, among others, sediment, temperature, and bacteria. Section 303(d) requires states and tribes to develop total maximum daily loads that apportion a load of pollutants that can be discharged into the waters of a state. Section 319 (codified as 33 U.S.C. §1329) established management programs to control water pollution from nonpoint sources, such as sediment.

The BLM's Application of the O&C Act

Based on the language of the O&C Act, the O&C Act's legislative history, and the decision by the Ninth Circuit in *Headwaters v. BLM,(914 F.2d 1174 (9th Cir. 1990)*, it is clear that the management of timber (including harvesting) is the dominant use of the O&C lands in western Oregon. That dominant use, however, must be implemented in full compliance with a number of subsequent laws that direct how the BLM accomplishes that statutory direction. See *Appendix A* for a discussion of court rulings most relevant to the decisions which must be made in revising the RMPs for the BLM lands in western Oregon.

The following sections discuss the laws that affect the management of areas of critical environmental concern, wilderness study areas, scenic values, and listed species.

Areas of Critical Environmental Concern

The Federal Land Policy and Management Act provides the authority for the designation of areas of critical environmental concern (43 U.S.C. §1712 [Sec. 202.c.3]). However, the O&C Act prevails over the Federal Land Policy and Management Act with regard to the management of timber resources on O&C lands. With these two laws, the BLM:

- Would manage areas of critical environmental concern to protect their relevant and important features on O&C lands where management of the area of critical environmental concern would not conflict with sustained yield forest management in areas dedicated to timber production .
- Would manage areas of critical environmental concern to protect their relevant and important features on public domain lands.
- Would designate research natural areas, a type of area of critical environmental concern, on O&C lands when the scientific value of the research is relevant to sustained yield forest management.
- Would not designate other areas of critical environmental concern on O&C lands where management of the area of critical environmental concern would conflict with sustained yield forest management in areas dedicated to timber production.

Wilderness Study Areas

The Federal Land Policy and Management Act provided the authority for the designation of wilderness study areas (43 U.S.C. §1782 [Sec. 603]), but that authority expired in 1993. Moreover, the O&C Act prevails over the Federal Land Policy and Management Act with regard to the management of timber resources on O&C lands. With these two laws, the BLM:

- Cannot designate additional wilderness study areas due to the expiration of that designation authority under the Federal Land Policy and Management Act.
- Can manage lands outside of the existing wilderness study areas for wilderness characteristics on O&C lands where management for wilderness characteristics would not conflict with sustained yield forest management in areas dedicated to timber production.
- Can manage lands outside of the existing wilderness study areas for wilderness characteristics on public domain lands.

Visual Resources

The Federal Land Policy and Management Act provides the authority for the protection of scenic values (43 U.S.C. §1701 [Sec. 102.a.8]). However, the O&C Act prevails over the Federal Land Policy and Management Act with regard to the management of timber resources on O&C lands. With these two laws, the BLM:

- Would protect scenic values as identified through a visual resource management inventory where the protection is required as part of the management specified by Congress in subsequent legislation, such as the Wild and Scenic Rivers Act.
- Can protect scenic values as identified through a visual resource management inventory on O&C lands where protection would not conflict with sustained yield forest management in areas dedicated to timber production.
- Can protect scenic values as identified through a visual resource management inventory on public domain lands.

Special Status Species

Special status species includes those species that are listed by the Endangered Species Act as threatened or endangered (including proposed and candidate species), listed by a state as being of special concern, and listed by the BLM as sensitive or needing assessment. The *BLM Manual 6840 – Special Status Species Management* provides the direction for the management of species that are listed as having special status. The Endangered Species Act provides the authority for the management of species that are listed as threatened or endangered. The Sikes Act provides the authority for the management of species that are listed by a state as being of special concern. The Federal Land Policy and Management Act provides the authority for the management of species that are listed by the BLM as sensitive or assessment species. The O&C Act, however, prevails over the Federal Land Policy and Management Act with regard to the management of timber resources on O&C lands. With these four laws and BLM policy, the BLM:

BLM Manual 6840

For this policy manual, search for 6840 at http://www.blm.gov/search/.

- Must, as a federal agency, follow certain procedures to assure that the exercise of its authorities would not likely jeopardize a listed species or adversely modify the critical habitat of a listed species on all BLM-administered lands.
- Must utilize its authorities to further the purposes of the Endangered Species Act by managing BLM-administered lands in a manner that aids the recovery of threatened and endangered species.

- Would accord specific protection to a state listed species under the O&C Act where the state and the BLM have entered into a cooperative management agreement for a species.
- Would accord specific protection to BLM sensitive or assessment species on O&C lands where protection would not conflict with sustained yield forest management in areas dedicated to timber production, or where such protection is necessary to prevent extinction of a species, even if it is not yet listed under the Endangered Species Act.
- Would accord specific protection to BLM sensitive or assessment species on public domain lands.

Management of the Public Domain Lands in Relation to the O&C Lands

Out of the 2,557,800 acres of the BLM lands that are in the planning area, approximately 394,600 acres are public domain lands. About half of those public domain lands are small parcels that are widely scattered and intermingled with the O&C lands. While the Federal Land Policy and Management Act requires that the public domain lands be managed for a multitude of values, the act does not require that every parcel be managed for every value. As in previous resource management plans, these public domain parcels will be managed in accordance with the 1975 Public Land Order (PLO) No. 5490, which reserves these intermingled public domain lands for multiple-use management, including the sustained yield of forest resources in connection with the intermingled revested Oregon and California Railroad Grant lands and reconveyed Coos Bay Wagon Road Grant lands.

PLO No. 5490

For the complete subject heading and FR citation, search for PLO 5490 at http://blm.gov/nhp/what/plo.

Planning Area

The entire planning area includes all lands (private, local, state, and federal) in western Oregon (*Figure 7*). The resource management plan revisions will affect the lands that are administered by the BLM in the BLM districts and counties of western Oregon that are listed in *Table 10*.

Figure 7. Entire planning area of the resource management plan revisions

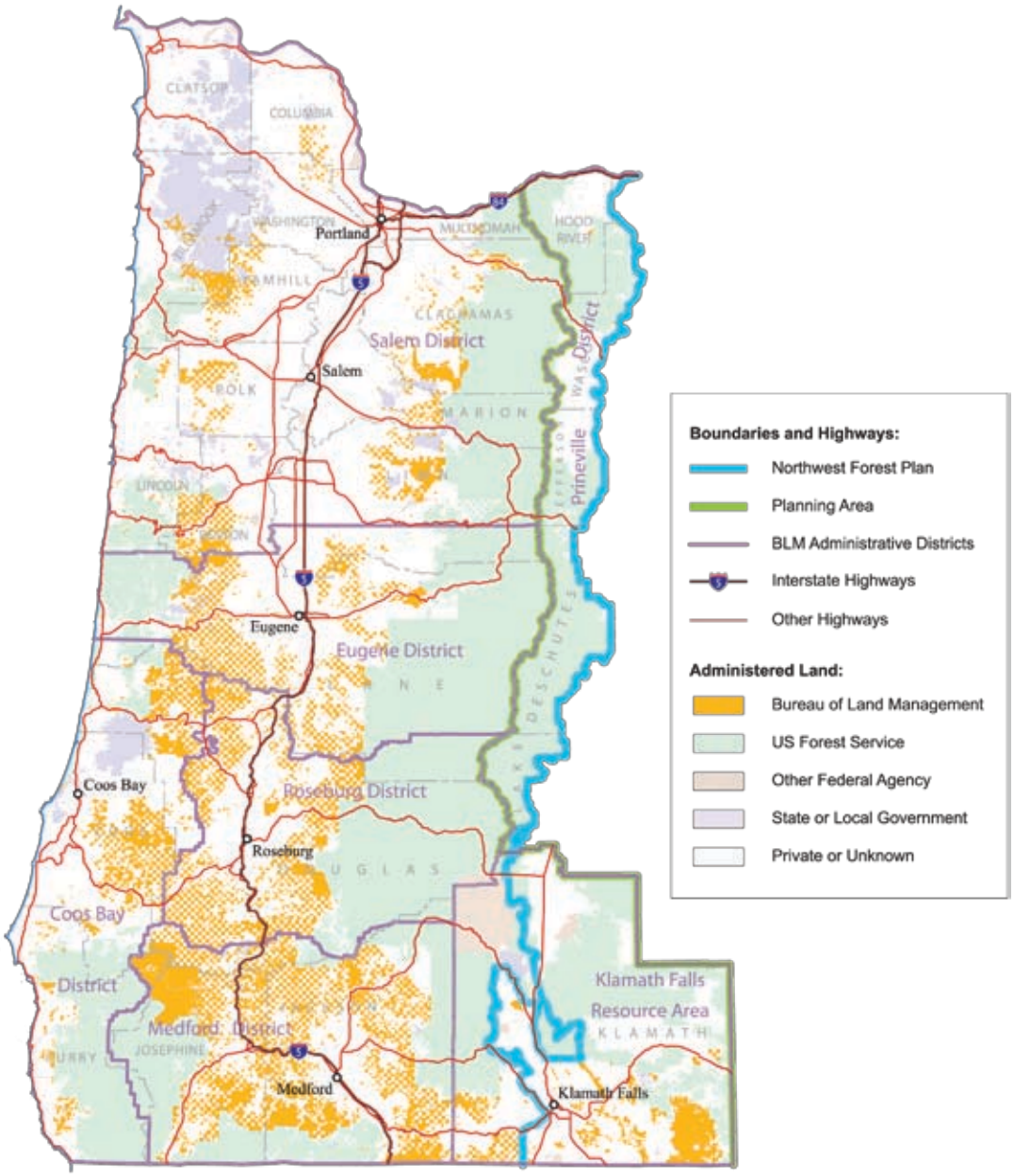


Table 10. The BLM districts and Oregon counties included in the planning area of the resource management plan revisions

BLM Districts	Oregon Counties	
Coos Bay	Benton	Lane
Eugene	Clackamas	Lincoln
Lakeview (Klamath Falls Resource Area only)	Columbia	Linn
Medford	Coos	Marion
Roseburg	Curry	Multnomah
Salem	Douglas	Polk
	Jackson	Tillamook
	Josephine	Washington
	Klamath	Yamhill

The BLM's current resource management plans provide the procedures and requirements for the management of approximately 2,557,800 acres of federal land within the planning area. These acres are the orange blocks in *Figure 7*. These BLM-managed lands are widely scattered and represent only about 11% of the planning area. Of the approximately 2,557,800 acres that are managed by the BLM, approximately 2,151,200 acres are managed primarily under the O&C Act and are commonly referred to as the O&C lands. The remaining 406,600 acres are public domain (394,600 acres) and other (12,000 acres) lands that are managed primarily under the Federal Land Policy and Management Act. See *Table 11* for the status of all federal lands in the planning area per district.

Note: The BLM's resource management plans also apply to an additional 69,000 acres that are split-estate lands for which the BLM manages only the subsurface mineral estate.

Table 11. Legal status of lands managed by the BLM in western Oregon

BLM Districts	O&C and Coos Bay Wagon Road Lands (acres)	Public Domain (acres)	Other (acres)	Total (acres)
Salem	349,300	51,600	2,100	403,000
Eugene	304,200	10,500	400	315,100
Roseburg	406,500	19,800	0	426,300
Coos Bay	279,400	41,800	1,500	322,700
Medford	764,900	96,100	4,800	865,800
Klamath Falls Resource Area (Lakeview District)	46,900	174,800	3,200	224,900
Total	**2,151,200**	**394,600**	**12,000**	**2,557,800**

Much of the O&C lands have retained the checkerboard character of the original railroad land grants of the 1800s with the BLM managing the odd-numbered sections. Because of this ownership pattern, activities on adjacent private lands have implications for the management of the federal lands. The BLM typically manages less than half, and often only a small percentage, of the land in any particular fifth-field watershed.

Checkerboard

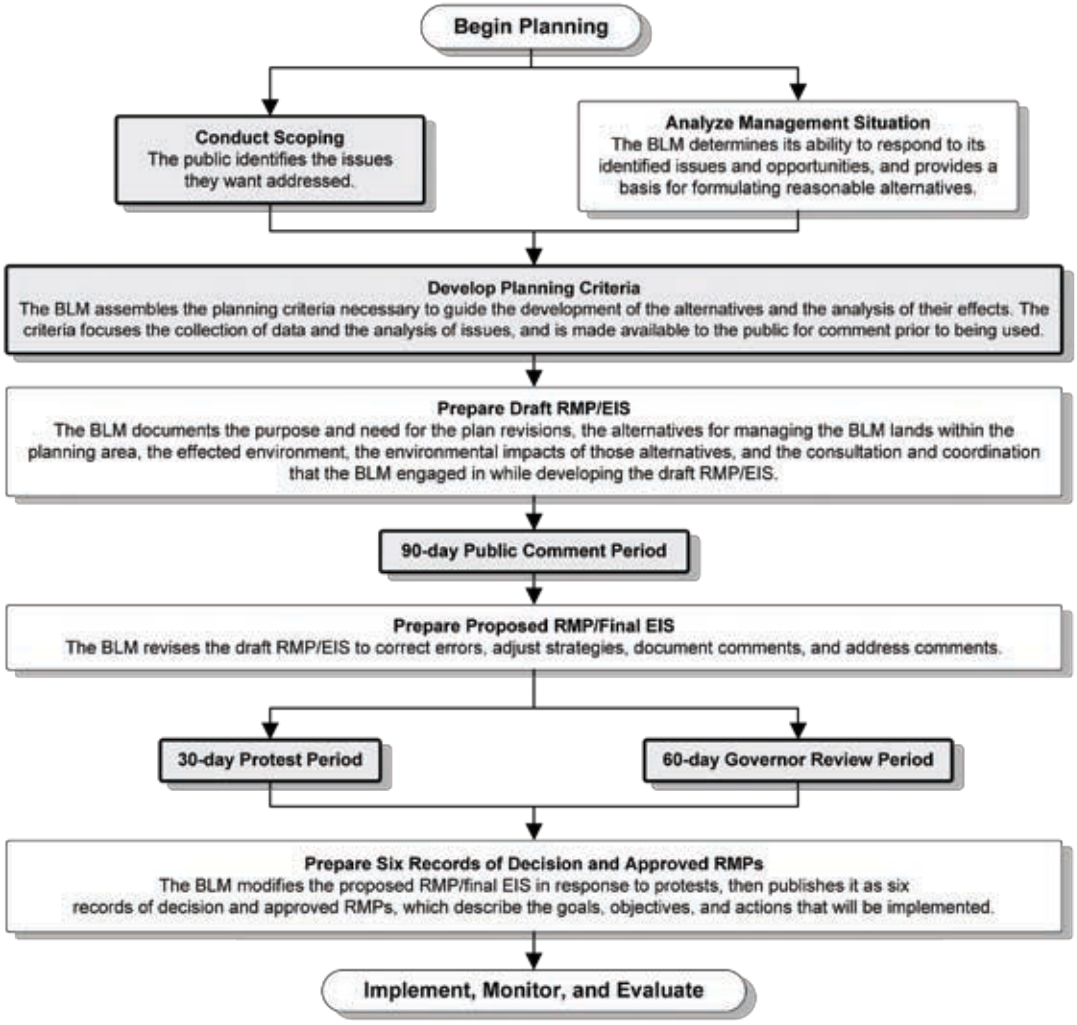
A land ownership pattern in which square-mile sections of federal lands are intermixed with and surrounded by private lands.

Planning Process

Preparing a resource management plan involves a series of explicit steps. See *Figure 8*. The following tasks have been completed as of the release of this draft environmental impact statement:

- Scoping was conducted from September through October 2005. The BLM attended or hosted about 75 meetings with community groups, special interest groups, elected officials, and others. About 3,000 communications were received with public comments and suggestions.
- Analysis of the management situation was released in October 2005.
- The planning criteria and the scoping report were released in February 2006.

Figure 8. Steps in the planning process (highlighted boxes indicate public involvement)



Collaboration

NEPA

For the complete act and its regulations, search for Title 42 and all sections starting with Section 4321 at http://uscode.house.gov.

The Federal Land Policy and Management Act and the National Environmental Policy Act (NEPA) provide direction regarding the coordination and cooperation of federal agencies with other agencies and also local and state governments. The Federal Land Policy and Management Act specifically emphasizes the need to ensure the coordination and consistency of a federal agency's proposed actions with the plans and policies of other relevant jurisdictions. The National Environmental Policy Act specifically requires cooperative relationships between lead and cooperating agencies.

Formal Cooperators

Cooperating agency status provides a formal framework for governmental units—local, state, or federal—to engage in active collaboration with a lead federal agency to implement the requirements of the National Environmental Policy Act. Within the constraints of time and resources, cooperating agency staff members are encouraged to participate fully with the BLM as members of the planning and environmental impact statement team.

For these resource management plan revisions, the BLM has worked with cooperators from a multitude of agencies. Cooperators have provided expertise in much of the subject matter being analyzed and have provided advice based on experiences with similar planning efforts. See *Table 12* for a list of the formal cooperators for the western Oregon resource management plan revisions.

Table 12. Formal cooperators

Federal Agencies	State Agencies	Oregon Counties	
	Office of the Governor		
	Department of Forestry		
	Department of Fish and Wildlife	Benton*	Lane
United States Forest Service	Department of Environmental Quality	Clackamas	Lincoln
United States Fish and Wildlife Service	Department of Transportation	Columbia	Linn
	Department of Geology and Mineral Industries	Coos	Marion
National Marine Fisheries Service		Curry	Polk
	Department of Agriculture	Douglas	Tillamook
Environmental Protection Agency	Department of Parks and Recreation	Jackson	Washington
	Department of State Lands	Josephine	Yamhill
	State Marine Board	Klamath	
	Water Resources Department		

*Not represented by the Association of O&C Counties.

Government-to-Government Relationships

There are seven recognized tribes within the planning area. *Table 13* lists these tribes. All of the tribes have stated that they want government-to-government relationships rather than cooperator relationships. The Coquille Tribe is directly engaged in the planning process because, by law (25 U.S.C. §715c), the management of their tribal lands must be consistent with the management of the surrounding federal lands.

Coquille Restoration Act

For the complete act and its regulations, search for Title 25 and all sections starting with Section 715 at http://uscode.house.gov.

Table 13. Recognized tribes within the planning area

Tribes
Confederated Tribes of the Coos, Lower Umpqua, and Siuslaw Indians
Coquille Indian Tribe
Cow Creek Band of Umpqua Tribe of Indians
Confederated Tribes of Grand Ronde
Confederated Tribes of Siletz
Confederated Tribes of the Warm Springs Reservation
The Klamath Tribes

Title V of the Oregon Resource Conservation Act of 1996 (Public Law 104-333) created the Coquille Forest. The act states that the Coquille Forest shall be managed "under applicable State and Federal forestry and environmental protection laws, and subject to critical habitat designations under the Endangered Species Act, and subject to the standards and guidelines of Federal forest plans on adjacent or nearby Federal lands, now and in the future." The Coquille Indian Tribe and the BLM are considering entering into an agreement to collaborate and coordinate management on the BLM lands that are adjacent to the Coquille Forest to further the management described in the act.

Formal Scoping

Scoping is a public involvement process. Its purpose is to identify issues early in the planning process that the planning process needs to address and to provide opportunities for the public to provide comments. These public comments determine the scope of the issues to be addressed and help identify the significant issues related to the proposed actions.

Summary of the Scoping Process

The formal scoping period started with the printing of a notice of intent in the Federal Register on September 7, 2005 and concluded on October 21, 2005. The first edition of the BLM planning newsletter (*Western Oregon Plan Revisions News, Scoping for Issues, Issue No. 1, August 2005*) was mailed in early September to approximately 11,000 postal addresses. The addresses

were collected from interested parties who had contacted the six BLM districts regarding the resource management plan revisions or the 2004 survey and manage environmental impact statement. Approximately 75 meetings were conducted with interested parties in western Oregon. These public meetings included one-on-one meetings with key stakeholders, presentations to organized groups and agencies, tours, and advertised public meetings. Several newspaper articles reported on the scoping process and advertised the public meetings.

The BLM also requested that an outside organization conduct an independent assessment of the interests and concerns of the stakeholders. The Public Policy Research Institute at the University of Montana was retained to solicit ideas on how to involve the public throughout the planning process. The Institute conducted this assessment with the assistance of RESOLVE and the Consensus Building Institute, which are two nationally recognized public involvement organizations. Their report and recommendations were considered in designing the public involvement activities.

About 3,000 communications were received during the scoping period. Comments included e-mail messages, written correspondence, face-to-face discussions, and meeting notes. The results of the scoping are available in the *Western Oregon Plan Revisions, Scoping Report, February 2006*. This public input greatly assisted the BLM in formulating this draft environmental impact statement.

Issues Identified

An issue, in the context of an environmental impact statement, is a matter of concern about resource management activities or land use that is well-defined or topically discrete. Identification of issues contributes to the development of the objectives which any reasonable alternative must achieve and/or factors that will be considered in choosing among the reasonable alternatives. The issues identified during scoping for these resource management plan revisions were:

- **Vegetation.** How should the BLM provide a sustainable supply of wood and other forest products, as mandated by the O&C Act, while also meeting all of the applicable laws and regulations?
- **Habitat for species listed under the Endangered Species Act.** How should the BLM manage federal lands in a manner that is consistent with the Endangered Species Act in order to contribute to the conservation of species?
- **Watershed management and water quality.** How should the BLM manage federal lands to contribute to the goals of the Clean Water Act and the Safe Drinking Water Act?
- **Wildland fire and fuels.** How should the BLM manage federal lands to reduce the risk of wildfires and integrate fire back into the ecosystem?

- **Off-highway vehicle management (particularly in the Medford District).** How should the BLM administer federal lands to meet the demand for off-highway vehicle use while protecting other resources?

Relationship of the RMPs to Other Plans, and Programs

The April 1994 record of decision for the Northwest Forest Plan, signed jointly by the Secretary of the Interior and the Secretary of Agriculture, required the BLM to incorporate the Northwest Forest Plan's land use allocations and its standards and guidelines into the resource management plans for western Oregon. The resource management plans were subsequently amended by the following interagency plan amendments:

- *January 2001, Record of Decision and Standards and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and other Mitigation Measures Standards and Guidelines in Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl*

  Note: The survey and manage categorizations for the red tree vole were established in this record of decision. The Ninth Circuit Court decision in *Klamath-Siskiyou Wildlands Center v. Boody*, 468 F.3d 549 (9th Cir., 2006), found that the changes to those survey and manage categorizations for the red tree vole would constitute plan amendments that need to be analyzed with National Environmental Policy Act (NEPA) procedures. The court then invalidated the re-categorizations regarding the red tree vole, because the BLM had not prepared a NEPA document to "amend" the plans. Whether other re-categorizations made through the annual species review process would constitute plan amendments has not been addressed in litigation.

- *March 2004, Record of Decision to Remove or Modify the Survey and Manage Mitigation Measure Standards and Guidelines in Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl*

  Note: The United States District Court for the Western District of Washington found this record of decision invalid since it relied on a supplemental environmental impact statement that the Court found deficient in certain respects. (See *Northwest Ecosystem Alliance v. Rey*, 380 F. Supp. 2d 1175 (W.D. Wash. 2005). The Court issued an order of relief on January 9, 2006. That order was later modified by another order dated October 11, 2006, which allowed the decision to eliminate the survey and manage requirement to take effect for four specified activities. Another supplemental environmental impact statement has been prepared to address the deficiencies in the 2004 environmental impact statement found by the Court.

- *March 2004, Record of Decision, Amending Resource Management Plans for Seven Bureau of Land Management Districts and Land and Resource Management Plans for Nineteen National Forests Within the Range of the Northern Spotted Owl, Decision to Clarify Provisions Relating to the Aquatic Conservation Strategy*

  Note: The United States District Court for the Western District of Washington found this record of decision invalid since it relied on a supplemental environmental impact statement and a biological opinion that the Court found deficient in certain respects. (See *Pacific Coast Federation of Fishermens' Associations v. NMFS*, No. 04-1299-RSM (W.D. Wash. March 30, 2007). The Court, as of this writing, has not yet issued an order of relief.

The Northwest Forest Plan is not a statute or regulation. It was a coordinated, multi-agency amendment to then current resource management plans of the BLM and forest plans of the Forest Service. The Secretaries and the agencies retained authority provided by statutes and regulations to revise these plans in the future. The only provision the Northwest Forest Plan made concerning future amendments to these plans was that they would be "coordinated" through the "Regional Interagency Executive Committee and the Regional Ecosystem Office." (See NW Forest Plan ROD, p. 58). This plan revision does not seek to amend the Northwest Forest Plan, but to replace the Northwest Forest Plan land use allocation and management direction through plan revision. Nevertheless, the BLM has briefed the Regional Interagency Executive Committee on this plan revision. Furthermore, many of the agencies that were signatories to the Memorandum of Understanding that created the Regional Interagency Executive Committee and the Regional Ecosystem Office are cooperating agencies in this revision.

Endangered Species Act, Section 7, Consultation

Pursuant to the Endangered Species Act, the BLM, as a federal agency, consults with NOAA's National Marine Fisheries Service and the United States Fish and Wildlife Service on all actions that it proposes that may affect listed species. Federal land management plans are considered to be equivalent to conservation plans wherever habitat is being managed for endangered species and as such, require consultation under Section 7 of the Endangered Species Act. (See *Lane County Audubon Society v. Jamison*, 958 F.2d 290 (9th Cir., 1992))

Consultation under the Endangered Species Act for the resource management plans will look broadly at the total landscape management approach. Since no specific on-the-ground activity is actually proposed in the resource management plans, no specific level of incidental take can be identified or exempted in biological opinions for the plans. As subsequent actions are proposed to implement approved resource management plans, those actions will undergo project-level consultation, either formally or informally (as appropriate).

Additionally, species recovery plans and consideration of revisions to critical habitat are currently in progress for several threatened and endangered species. The BLM anticipates that these recovery plans will be completed within the current planning period for the western Oregon resource management plan revisions. If the recovery plans become available before the revisions are completed, they will be incorporated into the revisions.

Recovery planning

For details about the recovery planning for the northern spotted owl and other species that is being led by the U.S. Fish and Wildlife Service, visit http://www.fws.gov/pacific/ecoservices/endangered/recovery/NSORecoveryPlanning.htm

Water and Air Quality Management

As part of the revisions for the western Oregon resource management plans, the BLM will concurrently coordinate with various agencies on water and air quality management. The BLM will coordinate with the Environmental Protection Agency and the Oregon Department of Environmental Quality (the federally designated management agency) on water quality standards and other requirements of the federally designated management agency as authorized by the Clean Water Act. Similarly, the BLM will coordinate with the Environmental Protection Agency, the Oregon Department of Environmental Quality, and the United States Forest Service to minimize the impacts of the emissions from prescribed burns.

Other Plans

The BLM collaborates with many other agencies in the development and coordination of their plans for areas that are within and surrounding the BLM's planning area. *Table 14* identifies the various plans of these other agencies and their resources that are in common, dependent, or interdependent with the BLM's resource management plans.

Table 14. Other plan and resource coordination opportunities

Entity	Plan/Program	Common Resources or Dependencies
County/City		
Counties	• Land use plans • Wildfire plans	Timber, fuels management, and payments in lieu of taxes
Cities	• Land use plans • Community wildfire protection plans	Fuels management and communities at risk
State		
Office of the Governor	Statewide planning goals	Soil, timber, water, fish, wildlife, and habitat
Department of Environmental Quality	• BLM water quality restoration plans • Water quality management plans • Total maximum daily loads (TMDLs) • Smoke management plans	Streams, watersheds, air and water quality standards, beneficial uses, and BLM water quality restoration plans
Department of Forestry	• State forest management plans • Fire plans • Rules of the Oregon Forest Practices Act	Watersheds and timber
Department of Fish and Wildlife	• Comprehensive Wildlife Conservation Strategy (Oregon Conservation Strategy) • Oregon Plan for Salmon and Watersheds	Wildlife, habitat, and fisheries
Division of State Lands, Natural Heritage Program	• Rare and Endangered Invertebrate Program (Oregon) • Oregon Natural Heritage Program	Special status species and natural areas
Department of Human Resources	Public water system standards	Surface water
Department of Agriculture	State listed endangered species Noxious Weed	Botanical species Noxious weed list and control
Department of Parks and Recreation	Off-highway vehicle (OHV) plans	Off-highway vehicle (OHV) trails
Federal		
United Sates Forest Service	Land and resource management plans	Wildlife, fisheries, habitat, streams, watersheds, timber, fuels management, and communities at risk
National Marine Fisheries Service	• Recovery plans for threatened and endangered species • ESA, Section 7 (Consultation)	Threatened and endangered fish species and habitat
United States Fish and Wildlife Service	• Recovery plans for threatened and endangered species • ESA, Section 7 (Consultation)	Threatened and endangered wildlife species and habitat
Environmental Protection Agency	Clean Water Act	Streams, watersheds, total maximum daily loads (TMDLs)
National Resources Conservation Service	Watershed plans	Streams and watersheds
Tribes		
Coquille Indian Tribe	Coquille Forest	Soil, timber, water, fish, wildlife, and habitat

Chapter 2 – Alternatives

Chapter 2 of this draft environmental impact statement defines the alternatives that were developed for the six resource management plans of the planning area that are being revised.

In this chapter:

Introduction **29**

Management Common to All Action Alternatives **29**

The Alternatives **64**

Tables for Areas of Critical Environmental Concern **114**

Tables for District-Specific Recreation Management Actions **119**

Maps **154**

28

Introduction

This chapter describes the No Action Alternative and three action alternatives. The No Action Alternative would continue the management of the current resource management plans, which were approved in 1995 and subsequently amended. The three action alternatives consist of a range of management strategies that are designed to meet the purpose and need discussed in *Chapter 1*. These management strategies encompass management objectives, management actions, and land use allocations.

- **Management objectives.** Descriptions that specifically describe the desired outcomes from the management of particular resources, which are usually expressed in terms that are quantifiable and measurable.
- **Management actions.** Proactive measures that will be applied to activities to achieve the management objectives for resources.
- **Land use allocations.** Identifiers that designate which activities are allowed, restricted, or excluded in all or part of a planning area.

Some management objectives, management actions, and land use allocations are common to all three action alternatives and some vary by action alternative. These differences would result in a variance in the degree or rate in which they achieve the identified purpose and needs for the proposed action.

Management Common to All Action Alternatives

This section identifies the management objectives and management actions that would apply under the three action alternatives. The next section identifies what is unique between the individual alternatives.

Management actions would be used only where and when necessary and practical to achieve management objectives. For example, the BLM may decide not to take a management action when:

- Site-specific circumstances would make the application of the management action unnecessary to achieve resource management plan objectives.
- Site-specific circumstances would make the application of the management action impractical.
- The application of the management action would be inconsistent with other resource management plan decisions.

Activities that are not specifically mentioned in the management actions would be permitted if they are consistent with management objectives.

Air

Management Objective

Prevent impacts to air quality in areas designated as Class I for air quality and nonattainment areas.

Management Actions

- Prescribed burns would be implemented in accordance with the Oregon Smoke Management Plan to reduce emissions, to avoid smoke intrusions into designated areas, and to avoid degrading the visibility in Class I areas.
- Dust palliatives would be used, as necessary, during timber hauling operations to reduce dust.

Cultural and Paleontological Resources including Native American Traditional Uses

Management Objective

Conserve scientific, traditional use, heritage, educational, public, and recreational values of cultural and paleontological resource sites.

Management Actions

- Ground-disturbing actions would avoid sites that are listed (or eligible for listing) on the National Register of Historic Places. If avoidance would not be practical, prior to disturbance the sites with scientific value would be salvaged through practices such as data recovery, which include excavation, relocation, or documentation.
- Cultural properties that are determined to be available for consideration as the subject of scientific or historical study would be classified as scientific use sites or experimental use sites.
- Unusual cultural properties that are not currently available for scientific or historical study, because of scarcity, a research potential that surpasses the current state of the art, singular historic importance, cultural importance, tribal importance, architectural interest, or comparable reasons, would be classified as *conservation for future use sites*. Sites would be selected for the purpose of retaining a representative sample of site types from those available in areas where conflicts with other resource management activities are not anticipated. These sites would be preserved.

- Cultural properties that are found to be appropriate for use as interpretive exhibits at their original location (i.e., in place) or found to be appropriate for related educational and recreational uses would be classified as *public use sites*. Priority locations for these interpretive exhibits would include developed recreation sites, recreation corridors, and locations where recreation is being promoted. These sites would be preserved.
- Cultural properties that are only important for their scientific values and whose research potential is effectively exhausted (ones where the salient information has been collected and preserved or has been destroyed by natural or human activity) would receive no special management.
- Significant cultural resource properties would be acquired for public, cultural heritage, and scientific purposes when such properties are adjacent to or inholdings of BLM-administered land.

Use sites

For complete descriptions of the use site classifications, search for 8110 (BLM Manual H-8110) at http://www.blm.gov.

- Cultural and paleontological resources that are threatened by natural processes or human activity would be excavated and the data would be recovered where warranted by the scientific importance of the site.

Energy and Minerals

Management Objective

Maintain existing opportunities and develop new opportunities for the exploration and development of locatable, leasable, and saleable energy and mineral resources, and for casual mineral prospecting.

Management Actions

- Areas would be available for energy and mineral resource exploration and development.
- Biomass would be recovered from harvesting actions, silvicultural treatments, and forest health and fuels treatments.
- New and existing quarry and pit sites would be used to provide economical sources of rock and aggregate. Existing quarry and pit sites, along with the areas involved in their incremental expansion, would be managed as existing facilities and would not be available for other management uses.

  See *Table 15 (Areas open or closed to energy and mineral developments)* for the areas that would be open or closed to energy and mineral developments. See *Appendix P. Energy and Minerals* for a reasonably

foreseeable development scenario for the BLM units within the planning area and the stipulation that would be applied to the developments.

Table 15. Areas open or closed to energy and mineral developments

Categories	Subcategories	Acres by BLM District					
		Salem	Eugene	Roseburg	Coos Bay	Medford	Klamath Falls
Federal Surface and Mineral Estate		398,100	318,000	425,600	329,600	866,300	212,000
Federal Minerals/Private Surface		27,800	1,300	1,700	12,200	4,700	21,000
Locatable (e.g., metallics and gemstones)							
Closed	Nondiscretionary	5,900	400	300	1,000	16,800	4,700
Closed	Discretionary	16,200	15,300	4,800	11,500	20,800	700
Open	Standard Restrictions/ Stipulations	49,200	290,600	366,200	99,500	536,500	191,600
Open	Additional Restrictions	326,800	10,000	20,800	217,600	293,400	37,900
Salable (e.g., sand, gravel, stone, clays, pumice)							
Closed	Nondiscretionary	5,900	100	30	600	--	300
Closed	Discretionary	220,400	9,100	8,400	14,700	--	14,500
Open	Standard Restrictions/ Stipulations	49,200	200	381,700	84,600	864,800	--
Open	Additional Restrictions	122,600	307,000	29,200	229,700	--	222,500
Leasable (e.g., oil, gas, geothermal, coal, chemical minerals)							
Closed	Nondiscretionary	5,900	100,000	30	1,600	22,000	300
Open	Standard Restrictions/ Stipulations	49,200	--	356,300	101,400	232,500	--
Open	Additional Restrictions	122,000	138,000	53,300	56,300	539,700	197,600
Open	No Surface Occupancy	221,000	177,000	9,700	170,300	73,300	40,800

Fire and Fuels Management

Management Objectives

- Promote ecosystem function and resiliency.
- Reduce the fire hazards to communities that are at risk from uncharacteristic wildfires.
- Decrease the risk of large wildfires, and reduce the cost and associated hazard of fire suppression.
- Reduce the risk of resource damage due to uncharacteristic wildfires.

Management Actions

- Prescribed burns would be used to emulate natural fire occurrences and processes.
- Ecosystems with the highest risk of uncharacteristic wildfires and the greatest potential for risk reduction would receive priority for fuels treatments.
- Silvicultural treatments would be applied in oak woodlands to create open conditions with large fire-resistant oaks.
- Silvicultural treatments would treat hazardous fuels, particularly in wildland urban interface areas. See *Map 6 (Wildland urban interface)*.
- Immediate action to control and suppress all wildfires would be taken in all areas, except in the large contiguous blocks of BLM lands, which are Galice, Wild Rogue Wilderness, Rogue River Wild and Scenic River in the Medford District, and the Gerber Block in the Klamath Falls Field Office, where aggressive initial attack and direct control procedures would be employed.
- Fire-suppression activities in the large contiguous blocks of BLM lands, which are Galice, Wild Rogue Wilderness, Rogue River Wild and Scenic River in the Medford District, and the Gerber Block in the Klamath Falls Field Office, would include direct control, perimeter control, and prescription control. See *Map 6 (Wildland urban interface)*.
- Fuels treatment would be applied to stands of any age in order to reduce the fuel hazards. Fuel treatments would include tree cutting, brush cutting, pruning, reducing crown bulk density, treating activity fuels, and prescribed burning.
- Vegetation removal would occur around ponds that are constructed for fire management for safety or operational reasons.

Fish

Management Objectives

- Restore stream complexity.
- Restore access to stream channels for all life stages of fish species.
- Prevent livestock from causing trampling disturbances to spawning beds where federally listed salmonid fish species occur.

Management Actions

- Priority for restoration activities would be given to projects in streams with a high intrinsic potential for fish and to high-priority fish populations that have been defined in recovery plans.
- Stream complexity would be restored through the placement of large wood and boulders.
- New and replacement stream-crossing structures on fish-bearing streams would be designed to provide access within stream channels for fish.
- For streams with salmonid species listed under the Endangered Species Act, livestock would not be released into riparian areas until 30 days following the emergence of salmonids from spawning beds.

Grazing

Management Objective Pertinent Only to the Coos Bay District, Medford District, and the Klamath Falls Resource Area of the Lakeview District

Provide livestock grazing permits and leases while maintaining or improving public rangelands.

Management Actions Pertinent Only to the Medford District and the Klamath Falls Resource Area of the Lakeview District

- Livestock grazing would be managed in accordance with the *Standards for Rangeland Health and Guidelines for Livestock Grazing Management for Public Lands Administered by the Bureau of Land Management in the States of Oregon and Washington*. See:
  - *Map 7 (Lands available for livestock grazing)*
  - *Appendix L. Grazing (Grazing Allotments in the Klamath Falls Resource Area and the Medford District)*

– *Appendix L. Grazing (Standards for Rangeland Health and Guidelines for Livestock Grazing Management for Oregon and Washington)*

- Grazing levels and management practices would be maintained for the allotments. Adjustments would be made to meet or make progress toward meeting the standards for rangeland health for Oregon and Washington. See *Appendix L. Grazing (Grazing Allotments in the Klamath Falls Resource Area and the Medford District)*
- Areas disturbed by natural and human-induced events, including wildland fire, prescribed burns, timber-management treatments, and juniper cuts, would be rested from livestock grazing, except where grazing would either not impede site recovery or where grazing could be used as a tool to aid in achieving recovery objectives. Livestock grazing would be resumed after soil and vegetation had sufficiently recovered to support livestock grazing.
- Livestock grazing would be authorized through management agreements, temporary nonrenewable grazing permits or leases, or special-use permits on lands that are not available through the issuance of a grazing lease or permit.
- Prescribed livestock grazing would be used to control invasive plants, reduce fire danger, or accomplish other management objectives.

Management Action Pertinent Only to the Coos Bay District

The authorization of livestock grazing through the issuance of grazing leases would be discontinued. However, grazing would be authorized through management agreements, temporary nonrenewable grazing permits or leases, or special-use permits in a manner that is consistent with the grazing regulations.

Management Actions Pertinent Only to the Klamath Falls Resource Area of the Lakeview District

- The authorization of livestock grazing through the issuance of grazing leases would be discontinued, in whole or in part, for the grazing allotments identified in *Table 16 (Allotments not available for livestock grazing in the Klamath Falls Resource Area)*.
- Grazing would not continue to be authorized under Section 15 of the Taylor Grazing Act (43 U.S.C. §315 et seq.) for the allotments listed in *Table 16*. However, grazing would be authorized through management agreements, temporary nonrenewable

Rangeland standards

For the rangeland health standards and livestock grazing guidelines document, search for the document by its complete title at http://www.blm.gov.

grazing permits or leases, or special-use permits in a manner that is consistent with the grazing regulations.

Table 16. Allotments not available for livestock grazing in the Klamath Falls Resource Area

Allotment Name	Allotment Number	Acres	Forage Allocation (AUMs)
Edge Creek*	00102	5,950	---
Plum Hills	00813	160	20
	Totals	6,110	20

*The portion of the Upper Klamath Scenic River within the Edge Creek Allotment would be closed to grazing. This portion of the allotment was not allocated any AUMs (animal unit months). The remainder of the allotment would be available for grazing as described in Appendix L. Grazing (Grazing Allotments in the Klamath Falls Resource Area and the Medford District).

- Exclosures or other areas, as identified on *Table 17 (Exclosures or other areas closed to grazing in the Klamath Falls Resource Area)*, would be closed to grazing, except as scheduled.
- Range improvements would be developed in the Klamath Falls Resource Area as described in *Appendix L. Grazing* and *Map 8 (Location of proposed range improvements in the Klamath Falls Resource Area)*.

Table 17. Exclosures or other areas closed to grazing in the Klamath Falls Resource Area

Allotment Name	Allotment Number	Areas Closed within Allotments
Edge Creek	00102	Hayden Creek Exclosures (2) Fox Lake Exclosure
Buck Lake	00104	Tunnel Creek Exclosure Surveyor Campground Exclosure
Dixie	00107	Dixie (Long Prairie Creek) Exclosure
Stukel-O'Neil	00822	Aspen Exclosure
Rodgers	00852	Van Meter Flat Reservoir Exclosure
Yainax	00861	Bull Spring Exclosure Timothy Spring Exclosure
Bear Valley	00876	Holbrook Spring Exclosure
Bumpheads	00877	Bumpheads Reservoir Outlet Exclosure Antelope Creek Exclosure
Horsefly	00882	Long Branch Exclosure Caseview Spring Exclosure Norcross Spring Exclosure (area within the spring exclosure fence) Boundary Spring Exclosure Barnes Valley Riparian Pasture (except as scheduled)
Pankey Basin	00884	Pankey Creek Riparian Exclosure
Dry Prairie	00885	Ben Hall Creek Riparian Pasture (except as scheduled)
Horse Camp Rim	00886	21 Reservoir Exclosure
Pitchlog	00887	Pitchlog Creek Exclosure Willow Spring Exclosure CCC Spring Exclosure
Willow Valley	00890	East Fork Lost River Exclosure Duncan Spring/Antelope Creek Exclosures (2) Antelope Riparian Pasture (except as scheduled)
Wood River	30855	Entire area excluded from regular grazing use, except as a tool to support wetland restoration

Management Actions Pertinent Only to the Medford District

- The authorization of livestock grazing through the issuance of grazing leases would be discontinued, in whole or in part, for the grazing allotments identified in *Table 18 (Allotments not available for livestock grazing in the Medford District)*.
- Grazing would not be authorized under Section 15 of the Taylor Grazing Act (43 U.S.C. §315 et seq.) for the allotments listed in *Table 18*. However, grazing could be authorized through management agreements, temporary nonrenewable grazing permits or leases, or special-use permits in a manner that is consistent with the grazing regulations.
- Range improvements would be implemented to achieve the Oregon standards for rangeland health or other allotment-specific objectives.

Taylor Grazing Act

For the complete act and its regulations, search for Title 43 and all sections starting with Section 315 at http://uscode.house.gov.

Table 18. Allotments not available for livestock grazing in the Medford District

Allotment Name	Allotment Number	Acres	Forage Allocation (AUMs)
Trail Creek	10003	12,868	113
Longbranch*	10004	10,844	71
Antioch Road	10005	40	4
Roundtop Evans	10006	27,086	110
West Perry Road	10010	75	10
East Perry Road	10011	40	7
Obenchain Mountain	10014	120	12
Nichols Gap	10018	280	18
Eagle Point Canal	10020	465	55
Shady Branch	10025	320	32
Derby Station	10030	540	36
West Derby	10034	1,120	89
Emigrant Creek	10111	40	7
Baldy	10120	798	87
Lost Creek	10123	80	6
Cartwright	10127	40	4

Table continues on the next page.

Allotment Name	Allotment Number	Acres	Forage Allocation (AUMs)
Bybee Peak	10144	321	36
Stiehl	10210	175	18
Fielder Creek	10211	40	5
Del Rio	10216	40	5
Sugarloaf/Greensprings	20158	2,926	210
Applegate	20201	25,518	294
Tunnel Ridge	20202	2,183	14
Timber Mountain	20204	1,720	70
Sardine and Galls Creek	20205	3,765	158
Sterling Creek	20207	29,209	190
Spencer Gulch	20208	1,935	150
Quartz Gulch	20209	680	9
Burton Butte	20212	5	2
Chapman Creek	20213	3,309	81
Ecker	20217	40	6
Stage Road	20218	40	4
Lomas Road	20222	635	50
Star	20223	118	24
Pickett Mountain	20302	820	30
Jump Off Joe	20303	80	8
Deer Creek*	20308	278	0
Reeves Creek	20309	1,672	95
Q Bar X	20310	15	3
Esterly Lake	20312	4,457	152
Glade Creek	20315	560	17
Cherry Gulch	20316	40	6
	Totals	**135,337**	**2,298**

*These portions of the Longbranch and Deer Creek Allotments would be closed to grazing. The remainder of the allotments would be available for grazing as described in *Appendix L. Grazing*.

Hazardous Materials

Management Objectives

- Limit the use of hazardous materials.
- Eliminate hazardous wastes.

Management Actions

- Response to hazardous material incidents would include cleanup, proper notifications, criminal investigations, and site assessments.
- Hazardous materials would be stored, treated, and disposed of in accordance with applicable laws and regulations.
- Employees and the public would be protected from known hazardous materials on BLM-administered lands.

Lands, Realty, Access, and Transportation

Management Objectives

- Make land tenure adjustments to facilitate the management of resources.
- Provide legal access to BLM-administered lands and facilities adequate to support resource management programs.
- Provide needed right-of-ways for access to nonfederal lands in a manner that is consistent with federal, state, and local planning goals and rules.
- Provide a road transportation system that serves resource management needs.
- Protect lands that have important resource values or substantial levels of investment by withdrawing them, where necessary, from the implementation of nondiscretionary public land and mineral laws.

Management Actions

- Lands in Zone 1 would be retained under BLM administration. Lands in Zone 1 include:
  - National Landscape Conservation System designated lands
  - areas of critical environmental concern
  - research natural areas
  - outstanding natural areas
  - recreation sites
  - critical habitat for threatened or endangered species

Land Zones

Zone 1: Retain for continuing resource development.

Zone 2: Available for exchange to facilitate management.

Zone 3: Available for sale or exchange to facilitate management.

See *Table 137 (Acres of land tenure zones by district)* in *Chapter 3* and *Appendix O. Lands*.

- Lands in Zone 2 would be available for exchange to enhance public resource values, improve management capabilities, and reduce the potential for land use conflict. Zone 2 lands are not specifically listed. They consist of all lands not listed in the description of Zone 1 lands and the lands listed in *Appendix O. Lands*.
- Lands in Zone 3 would be available for disposal. These lands would include:
  - lands that are not practical or are uneconomical to manage (because of their intermingled location and unsuitability for management by another federal agency)
  - survey hiatuses
  - encroachments

  Survey hiatuses and encroachments that are discovered in the future would be assigned to Zone 3. See *Map 28 (Location of land tenure Zone 3)*.
- The acres of O&C lands of all classifications, and the acres of O&C and public domain lands that are available for harvesting, would not be reduced through disposal, exchange, or purchase. This standard would be met by evaluating the total net change in land tenure in the planning area at 10-year intervals.
- Lands would be acquired or disposed of to facilitate resource management objectives as opportunities occur. See *Appendix O. Lands*.
- Public domain lands that have been under Section 7 of the Taylor Grazing Act would be available for disposal.

- Newly acquired lands would be managed for the purpose for which they were acquired or in a manner that is consistent with the management objectives for adjacent BLM-administered lands.
- Temporary-use permits, as identified under the Federal Land Policy and Management Act (Section 302), would be issued for a variety of uses, such as, but not limited to, stockpile and storage sites and as tools to authorize unintentional trespass situations pending final resolution.
- No leases or permits would be issued for landfills or other disposal facilities.
- Land-use authorizations would be used to resolve agricultural or occupancy trespasses, where appropriate.
- Existing leases and permits would be recognized as valid uses.
- Lands would be withdrawn from the operation of public land and mineral laws, where appropriate, to avoid the damage that would be caused by nondiscretionary activities. See *Appendix O. Lands*.
- Withdrawals would be limited to the area needed and would restrict only those activities needed to accomplish the purposes of the withdrawal.
- Lands would be available for right-of-ways.
- Class I visual resource management areas, such as wild and scenic rivers that are classified as wild, wilderness areas, and wilderness study areas, would be *right-of-way exclusion areas* (i.e., right-of-ways would not be granted).
- Recreation sites, areas of critical environmental concern, research natural areas, wild and scenic rivers that are classified as scenic and recreational rivers, and Class II visual resource management areas would be *right-of-way avoidance areas* (i.e., right-of-ways would be granted where no practicable alternative was available).
- Existing right-of-ways would be recognized as valid uses.
- Access across BLM lands to nonfederal lands would be granted, except within the National Landscape Conservation System designated lands.
- Utility corridors would be the preferred location for energy transmission or distribution facilities. Corridors would generally be 1,000 feet on each side of the centerline unless otherwise designated. No development or management activities would be permitted that would conflict with construction, operation, or maintenance of facilities corresponding to the purpose of the utility corridor. See *Map 9 (Utility corridors)*.
- Communication facilities would be allowed on existing communication sites. See *Map 9 (Utility corridors)* and *Appendix O. Lands*.

- Reasonable expansion of existing communication sites and the development of new sites would be allowed. The priority for accommodating the need for additional capacity would be the use of existing sites.
- Existing roads would be managed to protect resource values, to provide for safety, to protect facility investment, and to provide access for management activities. Trees would be removed along roads for safety or operational reasons.
- New permanent or temporary roads, and stream-crossing structures, would be constructed for the implementation of management actions.
- Roads that are not needed for long-term management would be decommissioned. Roads would be temporarily closed or travel would be restricted for administrative and resource purposes.

National Landscape Conservation System

The National Landscape Conservation System designations on BLM lands in western Oregon include:

- wild and scenic rivers
- wilderness, wilderness study, and wilderness instant study areas
- a national monument
- a national scenic trail
- an outstanding natural area
- a scenic corridor
- a watershed management unit

Management Objective

Conserve, protect, and restore the identified outstanding cultural, ecological, and scientific values of the National Landscape Conservation System designated lands.

Management Actions

Wild and scenic rivers

- Designated wild and scenic river corridors (including those classified as wild, scenic, or recreational) would be managed to protect their outstandingly remarkable values and to enhance the natural integrity of river-related values.

See *Table 58 (District-specific designated wild and scenic rivers and river segments)*.

- Interim protection would be provided to wild and scenic river corridors (including those classified as wild, scenic, or recreational) that are suitable for inclusion as components of the National Wild and Scenic Rivers System.

  See *Table 59 (District-specific suitable wild and scenic rivers and river segments)*.

- Interim protection would be provided to wild and scenic river corridors (including those classified as wild, scenic, or recreational) that are eligible but have not yet been studied for suitability as components of the National Wild and Scenic Rivers System.

  See *Table 60 (District-specific eligible wild and scenic rivers and river segments)*.

Wilderness Areas

Wilderness areas would be managed to preserve the undisturbed natural integrity of these areas.

See *Table 61 (District-specific wilderness areas)*.

Wilderness Study Areas and Wilderness Instant Study Areas

Wilderness study areas and wilderness instant study areas would be managed to maintain wilderness suitability.

See *Table 48 (District-specific wilderness study areas and wilderness instant study areas)*.

Cascade-Siskiyou National Monument

The Cascade-Siskiyou National Monument (located in the Medford District) would be managed to protect the geophysical, botanical, and other biological features for which the area was designated.

See *Table 63 (District-specific miscellaneous National Landscape Conservation System designated lands)*.

Pacific Crest National Scenic Trail

The portion of the Pacific Crest National Scenic Trail that is located in the Medford District and the Klamath Falls Resource Area of the Lakeview District would be managed for outdoor recreational opportunities while conserving its scenic, historic, natural, and cultural values.

See *Table 63 (District-specific miscellaneous National Landscape Conservation System designated lands)*.

Yaquina Head Outstanding Natural Area

The Yaquina Head Outstanding Natural Area (located in the Salem District) would be managed to promote the conservation of scenic, historic, natural, and cultural values, and for educational, scientific, and recreational opportunities.

See *Table 63 (District-specific miscellaneous National Landscape Conservation System designated lands)*.

Mt. Hood Corridor

BLM lands within the Mt. Hood Corridor (located in the Salem District) would be managed to protect and enhance scenic quality. Timber harvesting would be excluded, except to maintain safe conditions for the visiting public, to control the continued spread of wildfires, and for activities related to the administration of the corridor.

See *Table 63 (District-specific miscellaneous National Landscape Conservation System designated lands)*.

Note: The Oregon Parks and Recreation Department (Oregon State parks), Oregon Department of State Lands, Portland General Electric (PGE), and a mixture of county, local, and private owners administer the remaining lands in this corridor.

Bull Run Watershed Management Unit

BLM lands within the Bull Run Watershed Management Unit (located in the Salem District) would be managed to protect and enhance water quality. Timber harvesting would be excluded, except, as necessary, to protect or enhance water quality, or except, as necessary, for the construction, expansion, protection, or maintenance of facilities for either a municipal water supply or the transmission of energy.

See *Table 63 (District-specific miscellaneous National Landscape Conservation System designated lands)*.

Note: This watershed is the source of the Portland metropolitan area's domestic water supply and is congressionally designated and separate from other watersheds that are administratively designated. Also note that the United States Forest Service and the Portland Water Bureau administer the greater portion of the lands in this unit.

Plants, Fungi, and Invasive Species

Management Objective

Provide for the conservation of species that are listed or are candidates for listing under the Endangered Species Act or state listed species where the BLM have entered into a cooperative management agreement for a species.

Management Action

- Management would be consistent with recovery plans and designated critical habitat, including: the protection and restoration of habitat; altering the type, timing, and intensity of actions; and other strategies designed to recover populations of species.
- Species listed under the state of Oregon Endangered Species Act would be managed in accordance with cooperative management agreements.

Plants with recovery plans are listed in *Table 19 (Federally listed plants with recovery plans)*. Also see *Appendix E. Botany (Digest of Actions Contained in Individual Recovery Plans for Plant Species)*.

Table 19. Federally listed plants with recovery plans

Common Name	Scientific Name
Nelson's checker-mallow	*Sidalcea nelsonia*
Rough popcorn flower	*Plagiobothrys hirtus*
Gentener's fritillary	*Fritillary gentneri*
Kincaid's lupine	*Lupinus sulphureus spp. kincaidii*
Western lily	*Lilium occidentale*
Bradshaw's lomatium	*Lomatium bradshawii*
McDonald's rock-cress	*Arabis mcdonaldiana*
Golden paintbrush	*Castelleja levisecta*
Applegate's milk-vetch	*Astaragalus applegatei*
Water howellia	*Howellia aquatilis*

Management Objective

State listed species where the BLM has not entered into a conservation agreement and species listed by the BLM as sensitive or assessment species will be managed on public domain lands and on O&C lands where protection does not conflict with sustained yield forest management in areas dedicated to timber production. This is so that special status designation would no longer be warranted and so that actions will not contribute to the need to list the species under the Endangered Species Act. Where conflicts with sustained yield management occur, protections on O&C lands will only be applied to prevent extinction of a species even if it is not yet listed under the Endangered Species Act.

Management Actions

- Conservation plans for the following plants would be implemented and are incorporated by reference. Management would be consistent with conservation plans. Plants with conservation plans are listed in *Table 20 (Special status species plants with conservation plans)*. Also see *Appendix E. Botany (Digest of Conservation Plans for Special Status Species Plants)*.

Table 20. Special status species plants with conservation plans

Common Name	Scientific Name
Large-flowered rush-lily	*Hastingsia bracteosa*
Purple-flowered rush-lily	*Hastingsia atropurpurea*
Mendocino gentian	*Gentiana setigera*
Oregon willow-herb	*Epilobium oreganum*
Kincaid's lupine	*Lupinus sulphureus spp. kincaidii*
Western bog violet	*Viola Primulifolia ssp. occidentalis*
Umpqua mariposa lily	*Calochortus umpquaensis*
Green gentian or Umpqua swertia	*Frasera umpquaensis*
Tall bugbane	*Cimicifuga elata*
Gormans's aster	*Aster gormanii*
Crinite mariposa lily	*Calochortus coxii*
Silvery phacelia	*Phacelia argentea*
Columbia cress	*Rorippa columbiae*

- Special status species plants without conservation plans would be managed to maintain or restore populations and habitat.
- Protections measures include altering the type, timing, and intensity of actions; and other strategies designed to maintain populations of species.

Management Objective

Support natural species composition and vegetation on noncommercial areas, including, noncommercial forests, oak woodlands, shrublands, grasslands, cliffs, rock outcrops, talus slopes, meadows, wetlands, springs, fens, ponds, and vernal pools.

Management Actions

- Natural processes, native species composition, and vegetation structure would be maintained or restored. Management would include the use of prescribed burns, the retention of legacy components (e.g., large trees, snags, and down logs), and the removal of encroaching vegetation in meadows, grasslands, or oak woodlands in a manner that is consistent with natural or historic processes and conditions.

- Degraded or disturbed areas would be revegetated with species appropriate to the native or historic plant communities.
- Road construction, road maintenance, and culvert replacement would be designed to retain or reconnect the hydrologic flows to wetlands, springs, fens, ponds, and vernal pools.

Management Objective

Avoid the introduction of invasive plants or the spread of invasive plant infestations that are preventable.

Management Actions

- Cost-effective measures would be implemented to prevent, detect, and rapidly control new invasive plant infestations.
- Manual, mechanical, cultural, chemical, and biological treatments would be used to manage invasive plant infestations.
- Invasive plants would be controlled in accordance with the final environmental impact statement and record of decisions for the Northwest Area Noxious Weed Control Program. These documents are incorporated by reference.

Special Forest Products

Management Objective

Provide for the harvest and collection of special forest products.

Management Actions

- Special forest product collection would be implemented in a manner that limits adverse impacts to other resources. This would be accomplished by restricting collection amounts and restricting collection activities.
- Stipulations would be included in permits issued for the collection of special forest products to limit adverse impacts to the plant community, individual plants, soil, and water.
- Areas for the collection of individual special forest products would be rotated to maintain the availability of special forest products.

Recreation

Management Objective

Provide a diversity of developed and dispersed outdoor recreational opportunities that contribute to meeting recreational demand and quality visitor experiences.

See the tables and maps at the end of this chapter for district-specific recreation information.

Management Actions

- Legal public access would be obtained to BLM lands that have high recreational potential.
- Special recreation management areas would be managed in accordance with their planning frameworks (see *Appendix J. Recreation* and *Map 18 (Recreation management areas)*). These frameworks describe implementation-level actions that would achieve recreational management objectives for those areas.
- Lands not designated as special recreation management areas would be managed as extensive recreation management areas for dispersed recreational opportunities.
- Recreational developments, including sites, trails, and backcountry byways, would be maintained.
- Potential recreational developments, including sites, trails, and backcountry byways, would be developed in the future depending on recreational demand and feasibility.
- Locatable mineral withdrawals would be obtained for recreational developments that contain mineral development potential.
- Closed or abandoned logging roads would be developed to provide additional trail opportunities.
- Service-oriented and outreach programs, including interpretation and education, would be provided to visitors.
- Environmental education areas would be managed to provide educational opportunities for the public.
- Recreation sites authorized under the Recreation and Public Purposes Act would be managed according to their lease agreements.
- A 77-acre portion of Heceta Dunes on the Eugene District would be designated as open to off-highway vehicle use.
- Areas listed in *Table 54 (District-specific areas closed to off-highway vehicle use)* would be designated as closed to off-highway vehicle use.

See *Map 10 (Off-highway vehicle designations) and Map 26 (Proposed Off Highway Vehical designations).*

- Areas not designated as open or closed would be designated as *limited to existing roads and trails* or *limited to designated roads and trails*. See *Table 53 (District-specific off-highway vehicle area designations)* and *Map 10 (Off-highway vehicle designations) and Map 26 (Proposed Off Highway Vehical designations).*
- Areas listed in *Table 55 (District-specific off-highway vehicle emphasis areas)* would be designated as off-highway vehicle emphasis areas. These designations would be located within areas that are limited to designated roads and trails where off-highway vehicle use is more concentrated and intensively managed. See *Map 11 (Off-highway vehicle emphasis areas).*
- Potential off-highway vehicle emphasis areas listed in *Table 56 (District-specific potential off-highway vehicle emphasis areas)* would be developed in the future depending recreational demand and feasibility.
- Off-highway vehicle areas and off-highway vehicle emphasis areas would be managed according to interim management guidelines until subsequent comprehensive travel management plans are completed. See *Appendix J. Recreation*. Detailed maps are available to the public at each district office that show proposed off-highway vehicle area designations with a preliminary road and trail network.
- Lands within state scenic waterway corridors (see *Table 57 (District-specific Oregon State scenic waterways)*), excluding portions that occur on O&C lands that are suitable for permanent timber production, would be managed to protect and enhance identified scenic, aesthetic, recreation, scientific, research, fish, and wildlife qualities.

Research

Management Objective

Provide for research to support the management of lands and resources administered by the BLM in western Oregon.

Management Action

Ongoing research projects would be continued according to current or updated study plans. New research projects would require study plans. Management actions on study sites that conflict with research objectives would be deferred until the research is complete.

Soils

Management Objective

Improve or maintain soil productivity.

Management Action

Management activities associated with prescribed burns, wildfire suppression, silviculture, timber harvesting, and grazing would be consistent with maintaining or improving soil productivity.

Timber

Management Objective

Assure the survival of planted trees and enhance the growth of desirable trees in harvested or disturbed areas.

Management Actions

- Newly harvested and inadequately stocked areas would be prepared for the regeneration of desirable tree species.
- Site preparation methods would include mechanical or manual procedures, and prescribed burns.
- Adequate reforestation would be achieved as promptly as practical following timber harvests, as follows:
  - Harvested areas would be planted with indigenous commercial tree species.
  - Identified root disease centers would be planted with indigenous disease-resistant tree species.
  - Genetically selected stock would be used to the extent available.
- The establishment and survival of coniferous seedlings would be promoted through maintenance and protective treatments.

Management Objective

Enhance the health, stability, growth, vigor, and economic value of forest stands in the harvest land base.

Management Actions

- Lands currently growing primarily brush or hardwoods would be converted to the appropriate conifer species, unless the hardwoods would produce a higher net monetary return.
- Precommercial thinning would be applied to forest stands that exceed healthy density levels.
- Fertilizer would be applied to forest stands that are at suitable density levels and where treatment is expected to provide a positive economic return.
- Pruning would be applied to enhance timber value in a manner that is consistent with fuels and disease management.
- Yarding corridors or new roads would be permitted within riparian management areas if no practical alternative exists to access adjacent uplands.
- Uneven-aged management would be applied in the eastern portion of the Klamath Falls Resource Area.
- Incidental harvest of trees associated with implementing management actions would occur from lands that are not in the harvest land base for safety or operational reasons.

Visual Resource Management

See *Map 1 (Visual resource management classes)* and *Table 21 (Acres of visual resource management classes by district)* after the fourth management objective.

Management Objective

Preserve the existing character of the landscape in Class I visual resource management areas.

Management Action

Designated, suitable, and eligible wild and scenic rivers that are classified as wild, wilderness areas, wilderness study areas, and wilderness instant study areas would be designated as Class I visual resource management areas.

These areas would be managed in accordance with natural ecological changes. Some very limited management activities would occur in these areas. The level of change to the characteristic landscape would be very low and would not attract attention. Changes would repeat the basic

elements of form, line, color, texture, and scale found in the predominant natural features of the characteristic landscape.

Management Objective

Retain the existing character of the landscape in Class II visual resource management areas.

Management Action

Designated, suitable, and eligible wild and scenic rivers that are classified as scenic, the Cascade-Siskiyou National Monument, the Pacific Crest National Scenic Trail, the Mt. Hood Corridor, the Bull Run Watershed Management Unit, and the Yaquina Outstanding Natural Area would be designated as Class II visual resource management areas. See *Table 63 (District Specific Miscellaneous National Landscape Conservation System designated lands*).

These areas would be managed for low levels of change to the characteristic landscape. Management activities would be seen but would not attract the attention of the casual observer. Changes would repeat the basic elements of form, line, color, texture, and scale found in the predominant natural features of the characteristic landscape.

Management Objective

Partially retain the existing character of the landscape in Class III visual resource management areas.

Management Action

Designated, suitable, and eligible wild and scenic rivers that are classified as recreational would be designated as Class III visual resource management areas.

These areas would be managed for moderate levels of change to the characteristic landscape. Management activities would attract attention but would not dominate the view of the casual observer. Changes would repeat the basic elements of form, line, color, texture, and scale found in the predominant natural features of the characteristic landscape.

Management Objective

Allow for major modification of the existing character of the landscape in Class IV visual resource management areas.

Management Action

All lands that are not designated as Class I, Class II, or Class III would be designated as Class IV visual resource management areas.

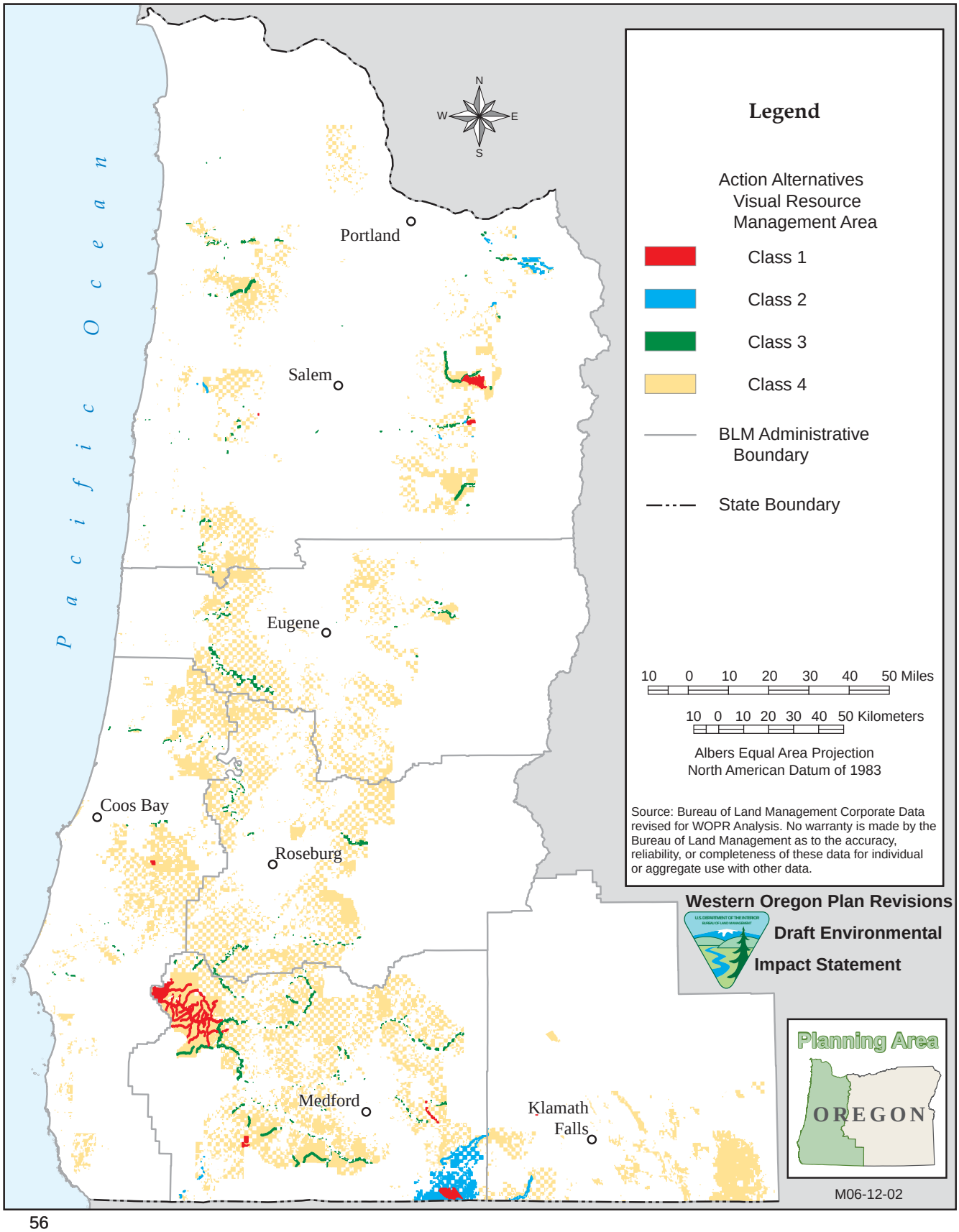
These lands would be managed for high levels of change to the characteristic landscape. Management activities would dominate the view and would be the major focus of viewer attention.

Table and Map for the Visual Resource Management Classes

Table 21. Acres of visual resource management (VRM) classes by district

Visual Resource Management (VRM) Classes	No Action Alternative (acres)	All Action Alternatives (acres)
Salem District		
VRM Class I	14,100	7,550
VRM Class II	22,800	7,627
VRM Class III	59,600	16,313
VRM Class IV	301,600	371,705
Eugene District		
VRM Class I	0	0
VRM Class II	4,471	0
VRM Class III	33,130	8,183
VRM Class IV	277,499	307,062
Roseburg District		
VRM Class I	28	0
VRM Class II	18,045	0
VRM Class III	4,385	6,409
VRM Class IV	396,546	419,952
Coos Bay District		
VRM Class I	600	592
VRM Class II	6,600	0
VRM Class III	14,700	1,958
VRM Class IV	307,700	319,700
Medford District		
VRM Class I	14,330	51,427
VRM Class II	113,880	51,564
VRM Class III	393,100	27,797
VRM Class IV	337,220	737,370
Klamath Falls Resource Area		
VRM Class I	0	340
VRM Class II	33,500	2,961
VRM Class III	81,800	0
VRM Class IV	96,700	221,600
Totals for all western Oregon BLM lands		
VRM Class I	**29,058**	**59,909**
VRM Class II	**199,296**	**62,152**
VRM Class III	**586,715**	**60,660**
VRM Class IV	**1,717,265**	**2,377,389**

Map 1. Visual resource management classes



Water

Management Objectives

- Maintain and restore water quality.
- Maintain and restore the proper functioning condition of riparian and wetland areas to provide shade, sediment filtering, and surface and stream bank stabilization.

Management Actions

- Priority for restoration, road maintenance, or road decommissioning would be given to projects that reduce chronic sediment inputs along stream channels and floodplains in source water areas.
- Prescribed burns would be applied in riparian management areas to reduce the potential for uncharacteristic wildfires.
- Best management practices (see *Appendix I. Water*) would be implemented to meet water quality standards.

Riparian Management Area Land Use Allocation for the Nonforest Areas of the Medford District and the Klamath Falls Resource Area of the Lakeview District

The following management actions are common to all of the alternatives but are specific to the nonforest areas of the riparian management areas.

Riparian management areas would be delineated by the water influence zone as indicated by hydrophilic vegetation.

Management Objective

Maintain and restore the proper functioning condition of riparian and wetland areas.

Management Actions

- Livestock grazing in riparian management areas would be managed at a level that allows the maintenance or development of the proper functioning condition of riparian and wetland plant communities. Methods would include installing and maintaining livestock exclosures, managing season of use and intensity, and implementing other appropriate techniques.
- Perennial and intermittent streams, wetlands, lakes, and natural ponds would be managed to maintain, improve, or restore floodplain connectivity.
- Conifer encroachment would be removed in riparian management areas unless conifers are an appropriate component of the riparian community type.

Wild Horses

Management Objective

Maintain a healthy population of wild and free-roaming horses in the Pokegama Herd Management Area of the Klamath Falls Resource Area of the Lakeview District. See *Map 12 (Location of Pokegama Herd Management Area)*.

Management Actions

- Horses would be gathered to maintain the established appropriate management level of 30 to 50 head, as follows:
  - During gathers, the number of horses would normally be reduced to the low end of the appropriate management level, and then allowed to increase to the top end of the appropriate management level before another gather occurred.
  - Horses would be removed from private land at private landowner request.
  - Horses straying outside the herd management area would be removed or returned to the herd management area.
- Horses from other herd areas would be periodically introduced to the Pokegama herd to maintain the viable genetic diversity of the herd.
- Water developments would be maintained or established to provide season-long water for wild horses within the herd management area. See *Appendix L. Grazing* and *Map 8 (Location of proposed range improvements in the Klamath Falls Resource Area)*.
- The appropriate management level would be adjusted when:
  - Monitoring data identified a change in long-term forage availability.
  - Health assessments and evaluations determined that wild horse numbers, or patterns of grazing use, were a contributing factor toward not meeting one or more of the Oregon standards for rangeland health.

Rangeland Standards

For the rangeland health standards and livestock grazing guidelines document, search for the document by its complete title at http://www.blm.gov.

Wilderness Characteristics

Management Objective

Maintain wilderness characteristics on designated BLM lands.

Management Action

Wilderness characteristics would be maintained on the BLM lands that are listed in *Table 22* (*Lands with wilderness characteristics maintained under special management)* and shown in *Map 27 (Lands with wilderness characteristics)*, excluding the portions of those areas that occur on O&C lands that are suitable for permanent timber production.

Table 22. Lands with wilderness characteristics maintained under special management

BLM Lands	Total (acres)	Identified Wilderness Characteristics		
		Naturalness	Outstanding Opportunities for Solitude	Outstanding Opportunities for Primitive, Unconfined Recreation
Salem District				
Bull of the Woods/Opal Creek Additions	3,203	X	X	X
South Fork Clackamas River	919	X	X	
Salmon Huckleberry Additions	637	X	X	X
Mount Hebo	81	X	X	X
Eugene District				
No lands were identified with wilderness characteristics				
Roseburg District				
Special management would not apply to lands with wilderness characteristics				
Coos Bay District				
Wasson Creek	3,408	X	X	X
Medford District				
Special management would not apply to lands with wilderness characteristics				
Klamath Falls Resource Area				
No lands were identified with wilderness characteristics				
Total	**8,248**			

Wildlife

Management Objective

Provide for the conservation of species that are listed or are candidates for listing under the Endangered Species Act or state listed species where the BLM have entered into a cooperative management agreement for a species.

Management Actions

- Management would be consistent with approved recovery plans and designated critical habitat, including the protection and restoration of habitat and other actions designed to recover populations of species.
- Species listed under the state of Oregon Endangered Species Act would be managed in accordance with cooperative management agreements.
- Wildlife species with approved recovery plans include the marbled murrelet, bald eagle, and the Columbia River population of the Columbia white-tailed deer. Management would be consistent with these recovery plans. See *Appendix G. Wildlife*.
- For the western snowy plover, the BLM's contribution to recovery would consist of the following actions:
  - Public use of nesting areas would be managed during the nesting season to reduce activities that would substantially reduce nesting success.
  - Predator controls would be employed when data demonstrates that loss of nests due to predators substantially reduces overall nesting success.
  - Control measures would be implemented if invasive plant species are creating a loss of suitable nesting habitat.
  - Measures would be implemented to support coastal dune processes to sustain suitable western snowy plover nesting habitat.
- Activities would be restricted within threshold distances of active northern spotted owl nest sites identified through consultation from March 1 through September 30. Restrictions on activities would usually not be required for nest sites located near roads or in other areas of permanent human activity.
- Bald eagle management areas would be managed to protect current suitable nesting and winter roosting habitat and to develop replacement habitat for nesting and roosting. Management activities would include prescribed burns and other treatments to reduce fuel loading and to accelerate growth, such as commercial thinning and density management. See *Map 13 (Bald eagle, deer, and elk habitat management areas)*.

Management Objective

State listed species where the BLM has not entered into a conservation agreement and species listed by the BLM as sensitive or assessment species will be managed on public domain lands and on O&C lands where protection does not conflict with sustained yield forest management in areas dedicated to timber production. This is so that special status designation would no longer be warranted and so that actions will not contribute to the need to list the species under the Endangered Species Act. Where conflicts with sustained yield management occur, protections on O&C lands will only be applied to prevent extinction of a species even if it is not yet listed under the Endangered Species Act.

Management Actions

- Management would be consistent with approved conservation plans. See *Appendix G. Wildlife*.
- Protections measures include altering the type, timing, and intensity of actions; and other strategies designed to maintain populations of species.
- For the Columbia white-tailed deer, the record of decision for the North Bank Habitat Management Area would continue to be implemented. The final environmental impact statement and record of decision for the North Bank Habitat Management Area are incorporated by reference.
- For the greater sage grouse, the Greater Sage Grouse Conservation Assessment and Strategy for Oregon would continue to be implemented. It is incorporated by reference.

Management Objective

Assist the Oregon Department of Fish and Wildlife in meeting big game management goals on public domain lands and on O&C lands where the goals are consistent with the O&C Act.

Management Actions

- Roads would be closed to motorized vehicles within the designated deer and elk winter range to achieve a maximum level of 1.5 miles of open road per square mile of federal land between November 1 and April 15. Administrative use of all roads would occur, as needed, on a year-round basis. See *Map 13 (Bald eagle, deer, and elk habitat management areas)*.
- Roads would be closed to motorized vehicles, except for administrative purposes, between November 1 and April 15 in the Klamath Winter Range, which includes the deer-season road closure areas of South Gerber, Willow Valley, Harpold Ridge, Bryant Mountain, North Bryant, Windy Ridge, and Lorella. See *Map 13 (Bald eagle, deer, and elk habitat management areas)*.

- Visual barriers from 25 to 50 feet wide would be maintained, where appropriate, along roads within the designated deer and elk winter range. See *Map 13 (Bald eagle, deer, and elk habitat management areas)*.
- Native forage species would be planted along roadsides, skid trails, and on landings, or forage plots would be created when forage quality is determined to be a limiting factor in achieving the management goals of the Oregon Department of Fish and Wildlife.
- Forage would be included when implementing silvicultural treatments or habitat management activities.
- Encroaching western juniper would be thinned or removed to maintain and improve forage for big game. These treatments would protect old juniper and would consider edge effect, escape cover, and forage.

Administrative Actions

Administrative actions are routine transactions and activities that are required to serve the public and to provide optimum management of resources.

Administrative actions would occur at approximately the same levels as during the past 10 years. These actions would include:

- competitive and commercial recreation activities
- lands and realty actions (including the issuance of grants, leases, and permits)
- resolution of trespasses
- facility maintenance
- improvements to existing facilities
- road maintenance
- issuance of hauling permits
- recreation site maintenance
- recreation site improvement
- hazardous materials removal
- law enforcement
- surveys to determine legal land or mineral estate ownership
- engineering support to assist in mapping
- designing and implementing projects
- sampling (specifically using the *3P fall, buck, and scale* sampling method)
- incidental removal of trees, snags, or logs for safety or operational reasons

Administrative Withdrawal Land Use Allocation

The administrative withdrawal land use allocation includes lands that are withdrawn from the harvest land base for a variety of reasons, including:

- areas dedicated to specific purposes (such as roads, buildings, maintenance yards, quarries, and other facilities and infrastructure);
- areas of critical environmental concern and recreation sites (such as campgrounds, trails, and day use areas); and
- areas that are identified through the timber production capability classification (TPCC) system as withdrawn from sustained yield timber production or identified as nonforest.

Management Objectives and Management Actions

The management objectives and management actions for areas of critical environmental concern and recreation sites/facilities are addressed in the alternatives under the specific programs.

Areas identified as withdrawn from the harvest land base through the timber production capability classification system do not have specific management objectives or management actions. They may be managed similarly to the adjacent or surrounding land use allocations, if those uses are not incompatible with the reason for which the lands were withdrawn (as identified by the timber production capability classification codes). Additional areas would be periodically added to those areas withdrawn through updates to the timber production capability classification system when on-the-ground examinations indicate an area meets the criteria for withdrawal.

Roads, maintenance yards, buildings, quarries, and other facilities also do not have specific management objectives or management actions but would be managed for the purpose for which the facilities were constructed.

The Alternatives

This section describes what is unique between the individual alternatives. The previous section identified the land use allocations, management objectives, and management actions that would apply to the resources, programs, and land use allocations under the three action alternatives.

Management actions would be used only where and when necessary and practical to achieve management objectives. The following would be among the considerations in determining how and where to appropriately implement management actions:

- Site-specific circumstances made the application of the management action unnecessary to achieve resource management plan objectives.
- Site-specific circumstances made the application of the management action impractical.
- The application of the management action would be inconsistent with other resource management plan decisions.

Activities that are not specifically mentioned in management actions would be permitted if they are not inconsistent with management objectives.

Preferred Alternative

The preferred alternative is the alternative that best meets the purpose and need (see *Chapter 1*). Based on the analysis in this draft environmental impact statement, the BLM identifies Alternative 2 as the preferred alternative. Considering the economic, environmental, social, and other selection factors, the BLM believes this alternative would best fulfill its statutory mission and responsibilities. Alternative 2 would:

- contribute to the recovery of species listed under the Endangered Species Act,
- maintain or improve water quality,
- reduce fire hazard risks in most districts,
- meet recreational demand with a variety of recreational settings, and
- produce the highest economic return to local communities from a sustained yield of timber.

Comments from state and federal agencies, local governments, tribes, and the public on this draft environmental impact statement will assist the BLM in preparing the proposed resource management plans and the final environmental impact statement. These comments can be used by the BLM to modify an action alternative to create a proposed decision. Examples of modifications that the BLM will consider in developing the proposed resource management plans are:

- Increasing the fire resiliency of forests in the Medford District and the Klamath Falls Resource Area of the Lakeview District.

- Ways to manage the harvest land base that will increase the rate of recovery of the northern spotted owl and the marbled murrelet in the short term (less than 50 years) while suitable habitat develops in the large blocks managed for long-term recovery.
- Speeding the redevelopment of structurally complex forests after regeneration harvesting.

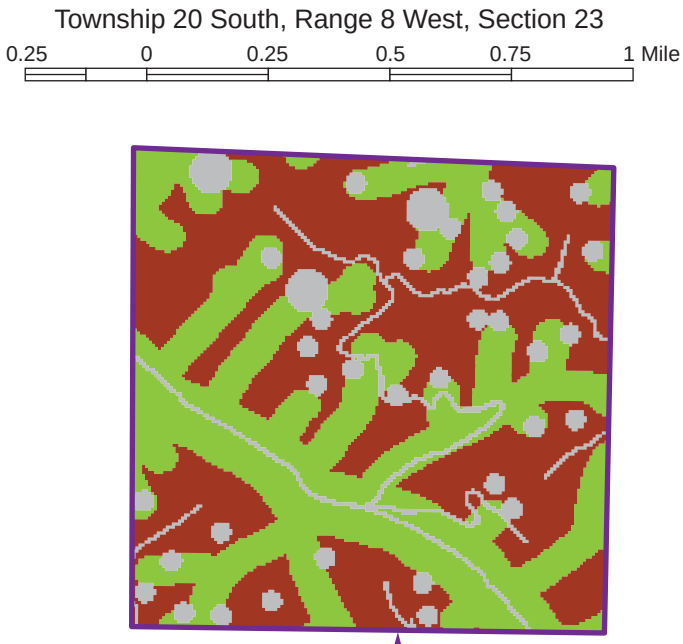
No Action Alternative

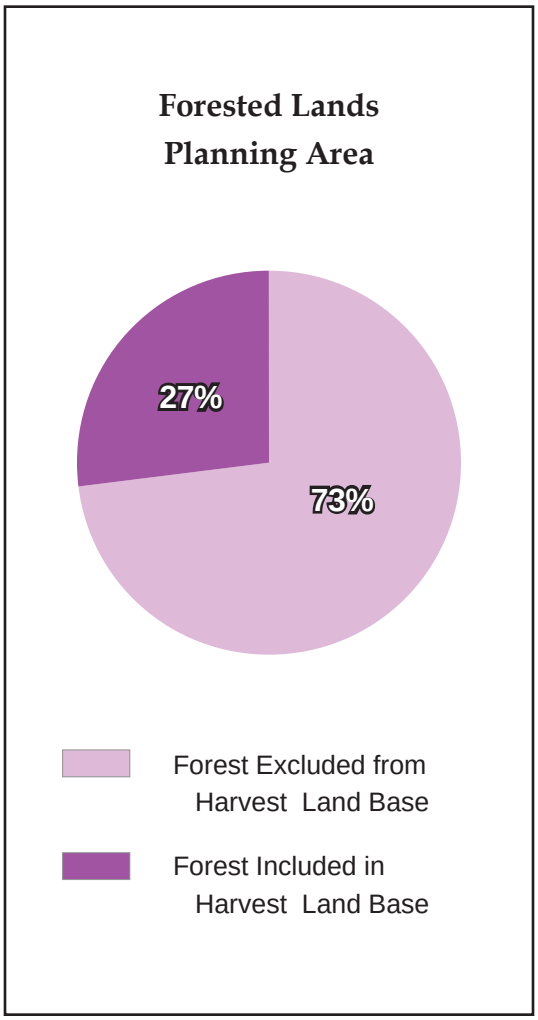
For details about the No Action Alternative, refer to the 1995 resource management plans for the districts of Salem, Eugene, Coos Bay, Roseburg, and Medford, and the Klamath Falls Resource Area of the Lakeview District, as amended. The No Action Alternative, as analyzed in this environmental impact statement, includes Survey and Manage standards and guidelines consistent with the January 2001, Record of Decision and Standards and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and other Mitigation Measures Standards and Guidelines in Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl, but does not include the March 2004, Record of Decision to Remove or Modify the Survey and Manage Mitigation Measure Standards and Guidelines in Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl or the March 2004, Record of Decision, Amending Resource Management Plans for Seven Bureau of Land Management Districts and Land and Resource Management Plans for Nineteen National Forests Within the Range of the Northern Spotted Owl, Decision to Clarify Provisions Relating to the Aquatic Conservation Strategy. The two March 2004 Records of Decision have been the subject to litigation, and their implementation is uncertain at this time. Implementation of these two plan amendments would change the effects of the No Action Alternative from the effects analyzed in this environmental impact statement. However, the effects of such a changed No Action Alternative would still be within the range of effects analyzed in this environmental impact statement. That is, these amendments to the No Action alternative would change the effects of the No Action Alternative to be more similar to the action alternatives. For example, an amendment that would remove the Survey and Manage standards and guidelines from the No Action Alternative would result in effects more like the action alternatives, all of which do not include the Survey and Manage standards and guidelines.

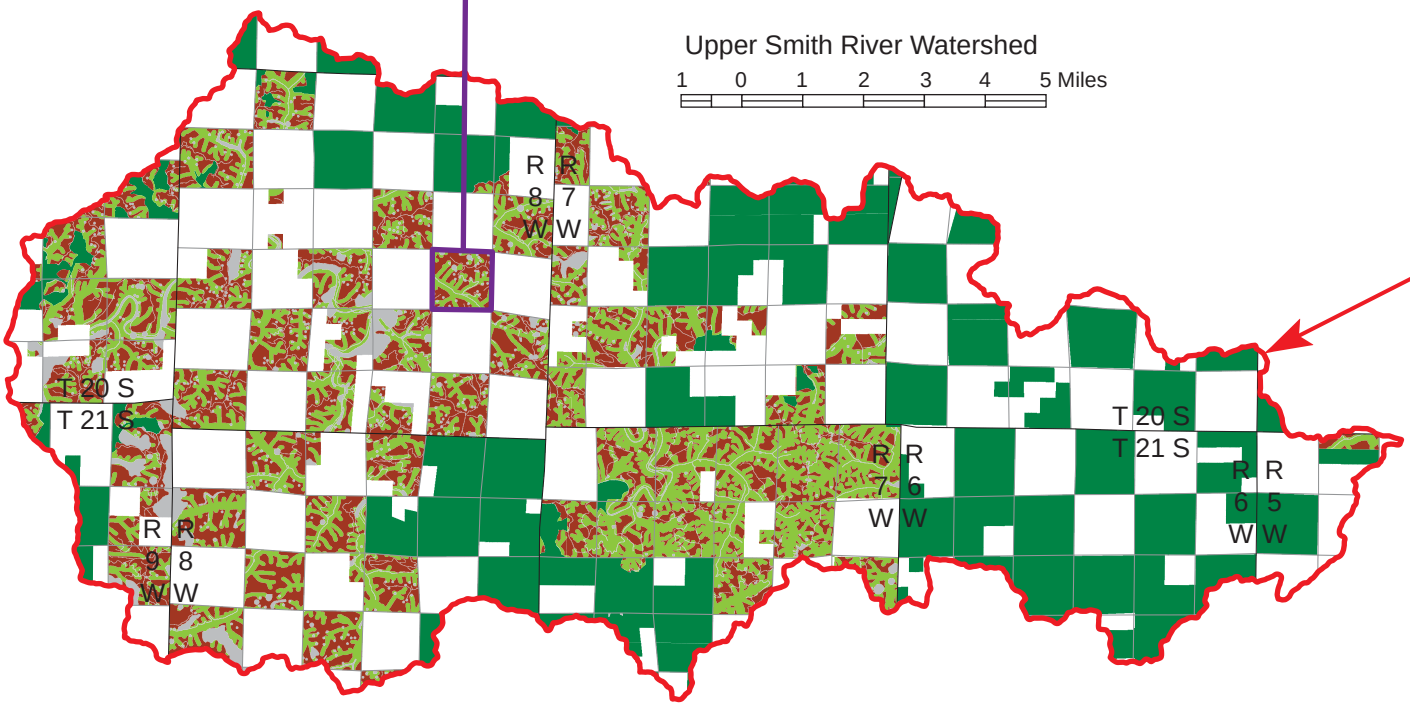
Plan maintenance for the 1995 resource management plans is documented in the district annual program summary and monitoring reports that were published from 1996 through 2005. These district annual program summary and monitoring reports are incorporated by reference.

See *Map 2 (Land use allocations under the No Action Alternative)* that follows this discussion. Also see the map packet (*Maps 1*, *5*, and *9*) for detailed views of the land use allocations.

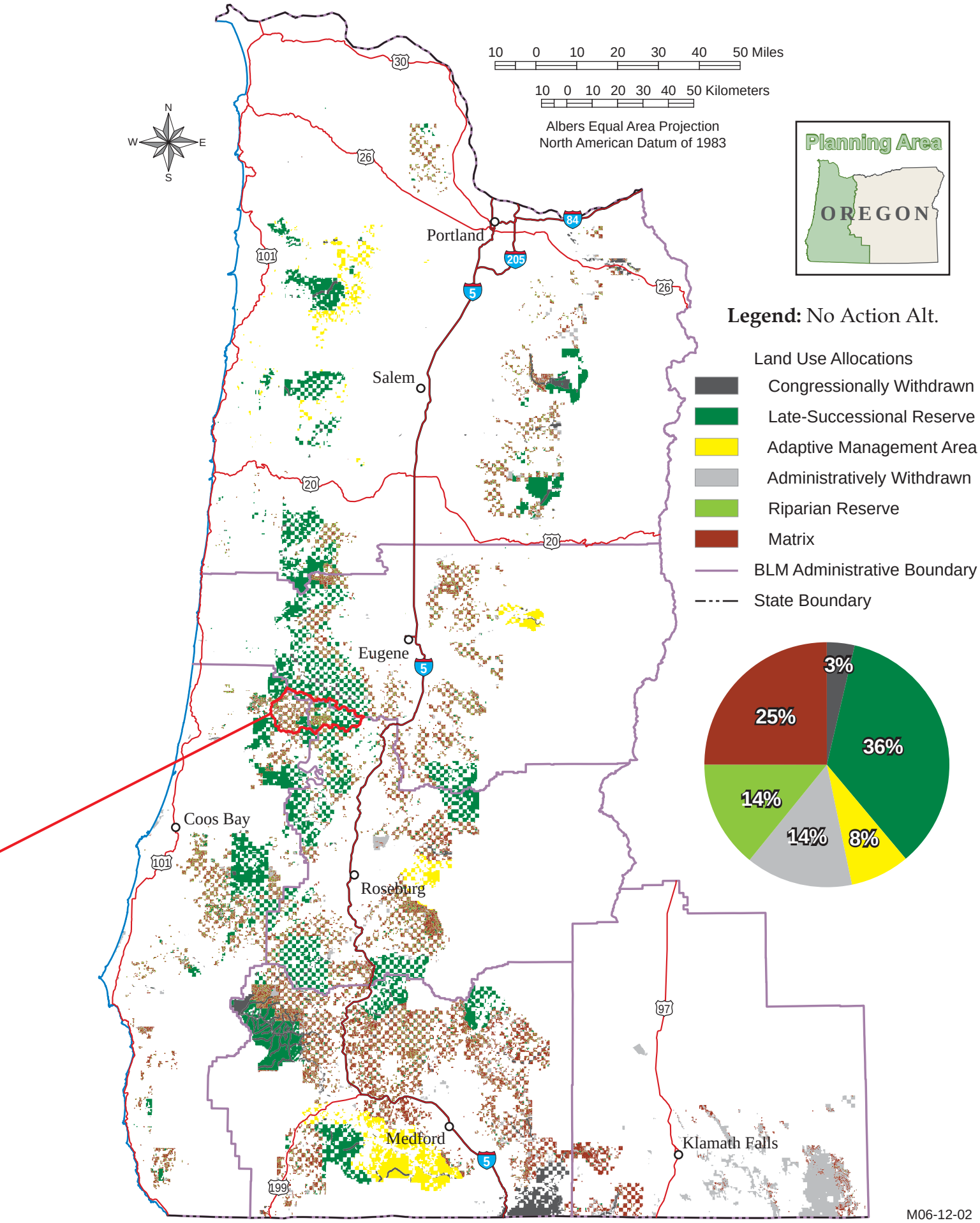
Source: Bureau of Land Management Corporate Data revised for WOPR Analysis. No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data.







Map 2. Land use allocations under the No Action Alternative


10 0 10 20 30 40 50 Miles
10 0 10 20 30 40 50 Kilometers
Albers Equal Area Projection
North American Datum of 1983
N
W
E
S
Planning Area
OREGON
Legend: No Action Alt.
Land Use Allocations
Congressionally Withdrawn
Late-Successional Reserve
Adaptive Management Area
Administratively Withdrawn
Riparian Reserve
Matrix
BLM Administrative Boundary
State Boundary
3%
36%
8%
14%
14%
25%
Portland
Salem
Eugene
Coos Bay
Roseburg
Medford
Klamath Falls
30
26
101
84
205
5
20
97
199

Alternative 1

This action alternative is described in terms of those land use allocations that vary by alternative, which include:

- late-successional management area
- riparian management area
- timber management area
- areas of critical environmental concern and research natural areas

Late-Successional Management Area

Under Alternative 1, the late-successional management area land use allocation would be established as follows:

- In the areas shown on *Map 3 (Land use allocations under Alternative 1)*. Also see the map packet (*Maps 2*, *6*, and *10*) for detailed views of the land use allocations.
- In the areas of contiguous marbled murrelet habitat and recruitment habitat (stands capable of becoming habitat for the marbled murrelet within 25 years) that are within 0.5 mile of any occupied site. Occupation would be determined by the presence of an active nest, a fecal ring, eggshell fragments, or birds demonstrating occupying behavior (i.e., flying below the forest canopy within or adjacent to a stand).

Management Objective

Maintain or promote the development of structurally complex forests.

Management Actions

- Thinning would be applied to promote the development of structurally complex forests. Timber from thinning would be available for sale.
- Snags and coarse woody debris would be retained or created when thinning stands of larger trees, which are generally those with a stand average diameter of quadratic mean diameter (QMD) greater than 14 inches.

  See *Table 23 (Snag and coarse woody debris (CWD) retention or creation for stands of larger trees (stand average diameter of QMD > 14 in.))* and *Map 14 (Forest vegetation series)*.

Table 23. Snag and coarse woody debris (CWD) retention or creation for stands of larger trees (stand average diameter of QMD > 14 in.)

Vegetation Series	Snag Retention or Creation		CWD Retention or Creation		
	Total	Component Diameters	Total	Component Diameters	Component Lengths
Western hemlock	6 tpa	> 14 in. dbh	240 ft./ac.	> 14 in.	> 20 ft.
Douglas fir and true firs	3 tpa	> 14 in. dbh	120 ft./ac.	> 14 in.	> 16 ft.
Tanoak	4 tpa	> 14 in. dbh	120 ft./ac.	> 14 in.	> 16 ft.
dbh (diameter breast height)		ft. (linear feet)		tpa (trees per acre)	

- Snags and coarse woody debris would be retained or created in thinning harvests in stands of smaller trees, which are generally those with a stand average diameter of quadratic mean diameter (QMD) less than or equal to 14 inches.

  See *Table 24 (Snag and coarse woody debris (CWD) retention or creation for stands of smaller trees (stand average diameter of QMD ≤ 14 in.))* and *Map 14 (Forest vegetation series)*.

Table 24. Snag and coarse woody debris (CWD) retention or creation for stands of smaller trees (stand average diameter of QMD ≤ 14 in.)

Vegetation Series	Snag Retention or Creation		CWD Retention or Creation		
	Total	Component Diameters	Total	Component Diameters	Component Lengths
Western hemlock	3 tpa	> 12 in. dbh	120 ft./ac.	> 12 in.	> 20 ft.
Douglas fir and true firs	2 tpa	> 10 in. dbh	60 ft./ac.	> 10 in.	> 16 ft.
Tanoak	2 tpa	> 10 in. dbh	60 ft./ac.	> 10 in.	> 16 ft.
dbh (diameter breast height)		ft. (linear feet)		tpa (trees per acre)	

- Snag and coarse woody debris retention or creation requirements would be met by any combination of new snags and coarse woody debris from live conifer trees and the retention of existing levels of snags (Class I and Class II) and coarse woody debris (Class I and Class II).
- Snag and coarse woody debris retention or creation levels would be met at the scale of the harvest unit. Snag and coarse woody debris levels per acre would be variable within harvest units.
- Salvage would not occur in stands that are disturbed by a fire, windstorm, disease, or insect infestations, except to reduce hazards in wildland urban interface areas.

Riparian Management Area

Under Alternative 1, the riparian management area land use allocation would be established according to *Table 25 (Criteria established for the riparian management area land use allocation under Alternative 1)*. For a representation of those areas, see *Map 3 (Land use allocations under Alternative 1)*. Also see the map packet (*Maps 2*, *6*, and *10*) for detailed views of the land use allocations.

Note: The *site-potential tree height* for the purposes of determining the riparian management areas would be based on district averages that are measured at a scale that is no finer than the fifth-field watershed.

Table 25. Criteria established for the riparian management area land use allocation under Alternative 1

Riparian Management Areas	Distance
Perennial and Intermittent Fish-Bearing Streams and Perennial Non-Fish-Bearing Streams	One site-potential tree height on each side of a stream extending from the edge of an active stream channel and including its channel migration zone
Intermittent Non-Fish-Bearing Streams	Half of one site-potential tree height on each side of a stream extending from the edge of its active stream channel
Natural Wetlands	Half of one site-potential tree height extending from a body of water or wetland to the outer edge of its riparian vegetation or to the extent of seasonally saturated soil, whichever is greatest
Natural Lakes and Ponds	One site-potential tree height extending from a body of water to the outer edge of its riparian vegetation or to the extent of seasonally saturated soil, whichever is greatest
Constructed Ponds and Wetlands	The body of water and the area to the outer edge of its riparian vegetation
Nonforest Ecosystems on the East Side of the Klamath Falls Resource Area	The extent of the water influence zone as indicated by hydrophilic vegetation

Management Objectives

- Maintain or promote the development of mature or structurally complex forests.
- Provide for the riparian and aquatic conditions that supply stream channels with shade, sediment filtering, leaf litter and large wood, and root masses that stabilize stream banks.

Management Actions

- Thinning and other silvicultural treatments would be applied along smaller-order streams (generally, first-, second-, and third-order streams) to promote the development of mature forests.
- Thinning and other silvicultural treatments would be applied along larger-order streams (generally, fourth-order and larger streams) to promote the development of structurally complex forests.

- Snags and coarse woody debris would be retained in thinning operations, except for safety or operational reasons (e.g., maintaining access to roads and facilities).
- Salvage would not occur in stands that are disturbed by a fire, windstorm, disease, or insect infestations, except to reduce hazards in wildland urban interface areas.
- Timber from thinning and salvage operations would be available for sale.

Timber Management Area

Under Alternative 1, the timber management area land use allocation would be established to consist of the commercial forest lands that are not included in the following land use allocations:

- lands of the National Landscape Conservation System
- late-successional management areas
- riparian management areas
- administratively withdrawn areas

See *Map 3 (Land use allocations under Alternative 1)*. Also see the map packet (*Maps 2*, *6*, and *10*) for detailed views of the land use allocations.

Management Objectives

- Manage forests to achieve a high level of continuous timber production that could be sustained through a balance of growth and harvest.
- Offer for sale an annual allowable sale quantity.

Management Actions

- Timber would be offered for sale from regeneration harvest units. See *Table 26 (Timber offered for sale from regeneration harvest units)* and *Map 29 (Sustained yield units)*.

Table 26. Timber offered for sale from regeneration harvest units

District	10-Year Volume (mmbf)
Salem	900
Eugene	1,070
Roseburg	570
Coos Bay	590
Medford	952
Klamath Falls Resource Area (Lakeview District)	90

- Timber would be offered for sale from commercial thinning harvest units. See *Table 27 (Timber offered for sale from commercial thinning harvest units)*.

Table 27. Timber offered for sale from commercial thinning harvest units

District	10-Year Volume (mmbf)
Salem	100
Eugene	100
Roseburg	60
Coos Bay	60
Medford	68
Klamath Falls Resource Area (Lakeview District)	0

- Annual offering of the allowable sale quantity would potentially vary up to 10% from the declared allowable sale quantity to allow for variations in yield from different harvest areas and to allow for the preparation and sale of logical, operationally feasible, and economically viable sale areas.
- Cumulative total offering of the allowable sale quantity would be maintained within 5% over two or more years by adjusting annual offerings within the allowed 10% variation.
- Regeneration harvests would be conducted to remove volume and replace slower growing stands with young, rapidly growing stands. Generally, regeneration harvests would be scheduled for stands to maximize potential growth and yield. Regeneration harvests would be applied to younger stands for purposes that include the management of age class distribution, the management of diseased stands, and the management of overstocked stands with poor vigor and low crown ratio. The minimum age of stands that would be considered suitable for regeneration harvesting would be 40 years of age in the western hemlock and the tanoak vegetation series and 60 years of age in the Douglas fir and true firs vegetation series. See *Map 14 (Forest vegetation series)*.
- No merchantable material would be reserved from removal in regeneration harvest units. Noncommercial snags and coarse woody debris would be retained, except for safety or operational reasons.
- Commercial thinning would be applied to recover anticipated mortality; to adjust stand composition or dominance; to reduce stand susceptibility to disturbances such as a fire, windstorm, disease, or insect infestation; and to improve merchantability and value.

- Stand density would be maintained at levels between full occupancy and the onset of density-related mortality to the extent practical.
- Stands with a composition of commercially undesirable tree species or an inadequate stocking of desirable tree species would be converted to stands that are fully stocked with desirable tree species.
- Trees killed from disturbances, such as a fire, windstorm, disease, or insect infestation, would be salvaged to recover volume and economic value within the time necessary to avoid loss of value through deterioration.

Areas of Critical Environmental Concern and Research Natural Areas

Under Alternative 1, 92 areas of critical environmental concern and research natural areas would be designated. At the end of this chapter, see *Map 15 (Areas of critical environmental concern within the planning area)* and *Table 41 (Areas of critical environmental concern under the alternatives)*.

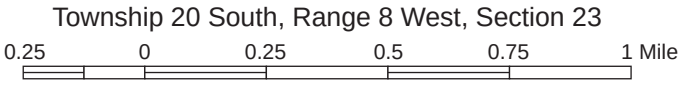
Management Objective

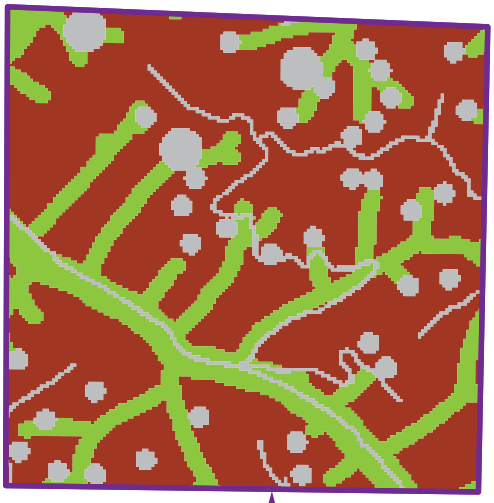
Maintain or restore important and relevant values in areas of critical environmental concern, which include research natural areas and outstanding natural areas.

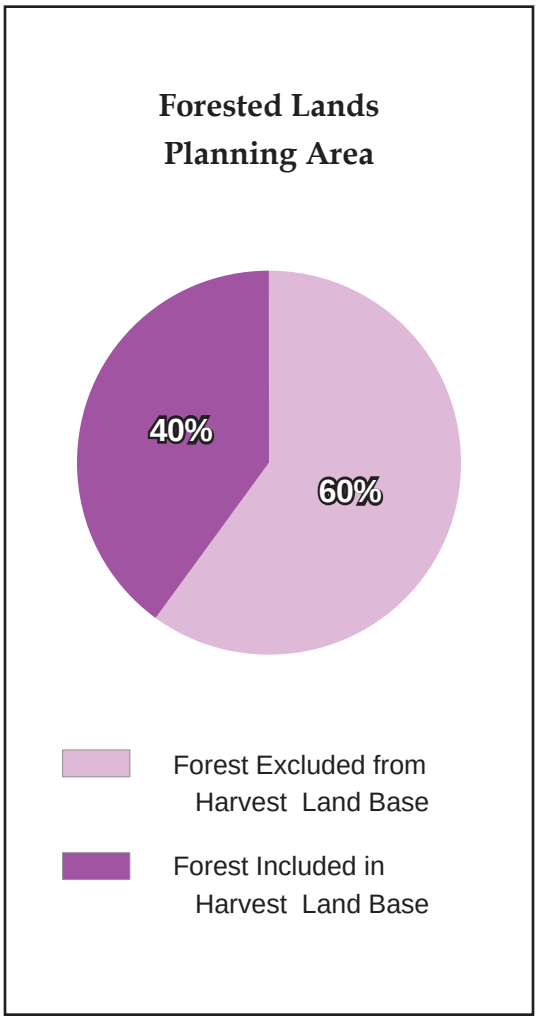
Management Action

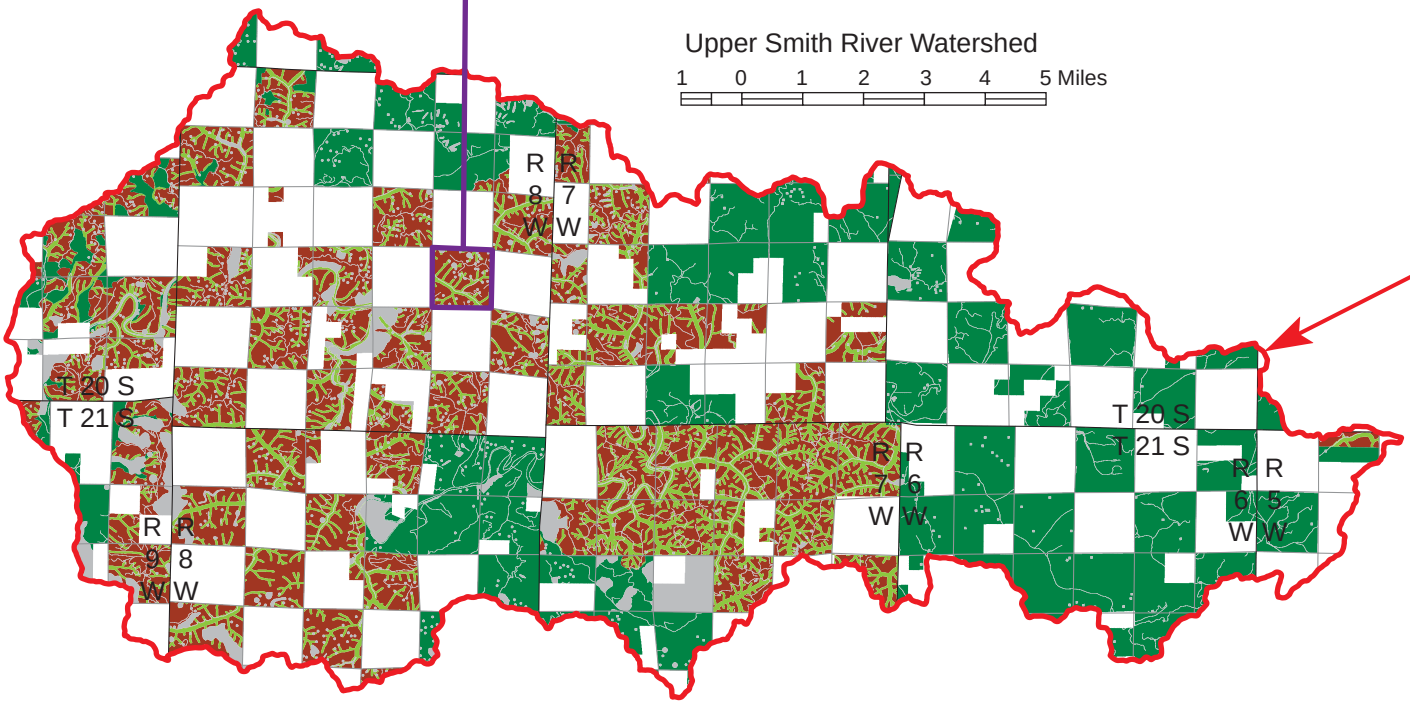
Maintenance or restoration activities would occur to protect important and relevant values.

Source: Bureau of Land Management Corporate Data revised for WOPR Analysis. No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data.

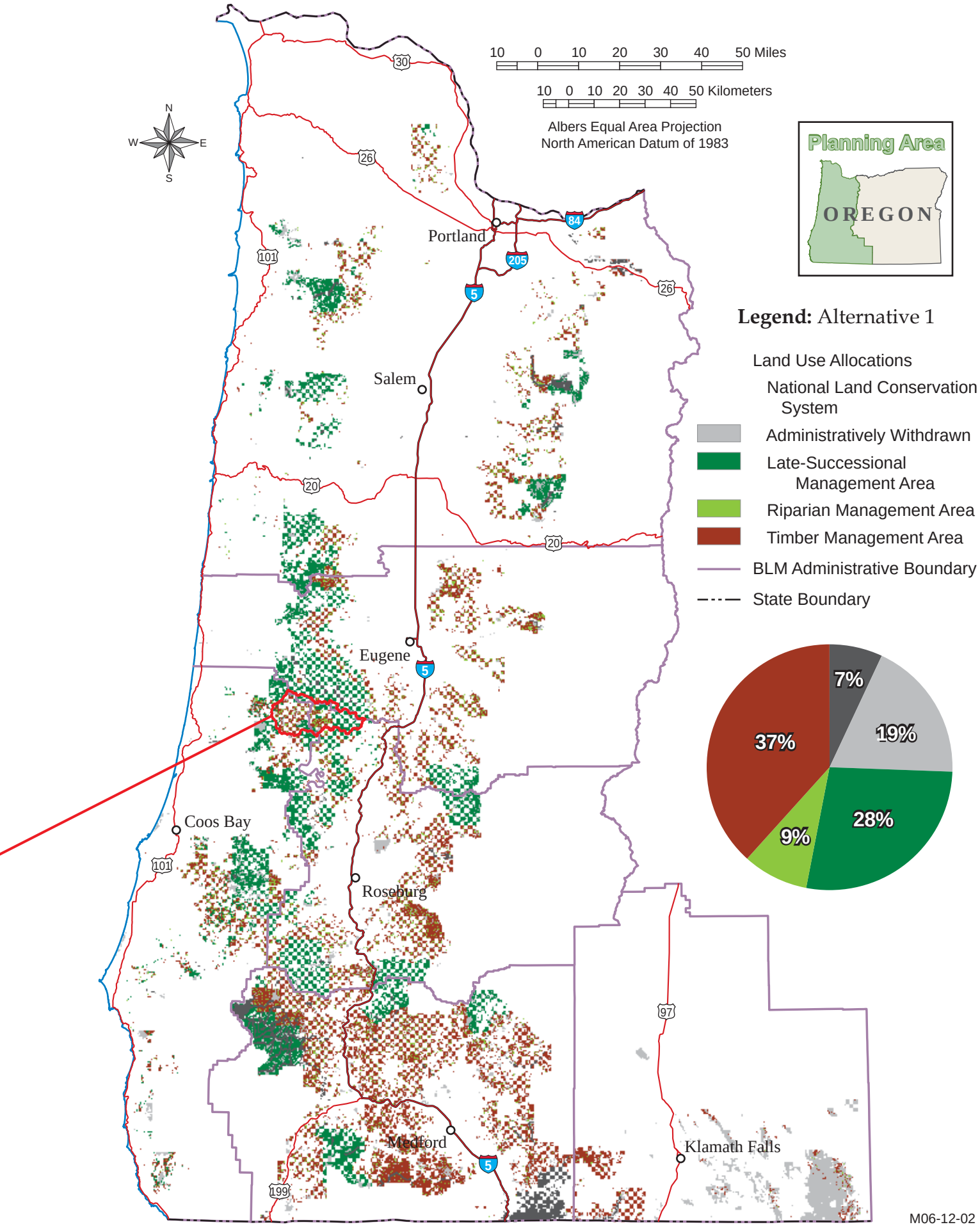








Map 3. Land use allocations under Alternative 1


10 0 10 20 30 40 50 Miles
10 0 10 20 30 40 50 Kilometers
Albers Equal Area Projection
North American Datum of 1983
N
W
E
S
Planning Area
OREGON
Legend: Alternative 1
Land Use Allocations
National Land Conservation System
Administratively Withdrawn
Late-Successional Management Area
Riparian Management Area
Timber Management Area
BLM Administrative Boundary
State Boundary
7%
19%
28%
9%
37%
Portland
Salem
Eugene
Coos Bay
Roseburg
Medford
Klamath Falls
30
26
84
205
5
101
20
97
199

M06-12-02

Alternative 2

This action alternative is described in terms of those land use allocations that vary by alternative, which include:

- late-successional management area
- riparian management area
- timber management area
- areas of critical environmental concern and research natural areas
- management area adjacent to the Coquille Forest

Late-Successional Management Area

Under Alternative 2, the late-successional management area land use allocation would be established as follows:

- In the areas shown on *Map 4 (Land use allocations under Alternative 2)*. Also see the map packet (*Maps 3*, *7*, and *11*) for detailed views of the land use allocations.
- In the areas of contiguous marbled murrelet habitat and recruitment habitat (stands capable of becoming habitat for the marbled murrelet within 25 years) that are within 0.5 mile of occupied sites identified as of the end of the 2005 field season. Occupation would be determined by the presence of an active nest, a fecal ring, eggshell fragments, or birds demonstrating occupying behavior (i.e., flying below the forest canopy within or adjacent to a stand).

Management Objectives

- Maintain habitat for the northern spotted owl and the marbled murrelet.
- Promote the development of habitat for the northern spotted owl in stands that do not currently meet suitable habitat criteria.
- Recover economic value from timber harvested after a stand-replacement disturbance, such as a fire, windstorm, disease, or insect infestation.

Management Actions

- Thinning would be applied to promote the development of mature or structurally complex forests, and to promote the development of suitable habitat for the northern spotted owl. Timber from thinning would be offered for sale.

- Snags and coarse woody debris would be retained or created when thinning stands of larger trees, which are generally those with a stand average diameter of quadratic mean diameter (QMD) greater than 14 inches.

  See *Table 28 (Snag and coarse woody debris (CWD) retention or creation for stands of larger trees (stand average diameter of QMD > 14 in.))* and *Map 14 (Forest vegetation series)*.

Table 28. Snag and coarse woody debris (CWD) retention or creation for stands of larger trees (stand average diameter of QMD > 14 in.)

Vegetation Series	Snag Retention or Creation		CWD Retention or Creation		
	Total	Component Diameters	Total	Component Diameters	Component Lengths
Western hemlock	6 tpa	> 14 in. dbh	240 ft./ac.	> 14 in.	> 20 ft.
Douglas fir and true firs	3 tpa	> 14 in. dbh	120 ft./ac.	> 14 in.	> 16 ft.
Tanoak	4 tpa	> 14 in. dbh	120 ft./ac.	> 14 in.	> 16 ft.

dbh (diameter breast height) ft. (linear feet) tpa (trees per acre)

- Snags and coarse woody debris would be retained or created when thinning stands of smaller trees, which are generally those with a stand average diameter of quadratic mean diameter (QMD) less than or equal to 14 inches.

  See *Table 29 (Snag and coarse woody debris (CWD) retention or creation for stands of smaller trees (stand average diameter of QMD ≤ 14 in.))* and *Map 14 (Forest vegetation series)*.

Table 29. Snag and coarse woody debris (CWD) retention or creation for stands of smaller trees (stand average diameter of QMD ≤ 14 in.)

Vegetation Series	Snag Retention or Creation		CWD Retention or Creation		
	Total	Component Diameters	Total	Component Diameters	Component Lengths
Western hemlock	3 tpa	> 12 in. dbh	120 ft./ac.	> 12 in.	> 20 ft.
Douglas fir and true firs	2 tpa	> 10 in. dbh	60 ft./ac.	> 10 in.	> 16 ft.
Tanoak	2 tpa	> 10 in. dbh	60 ft./ac.	> 10 in.	> 16 ft.

dbh = diameter breast height ft. = linear feet tpa = trees per acre

- Snag and coarse woody debris retention or creation requirements would be met by any combination of new snags and coarse woody debris from live conifer trees and the retention of existing levels of snags (Class I and Class II) and coarse woody debris (Class I and Class II).

- Salvage of timber after a stand-replacement disturbance, such as a fire, windstorm, disease, or insect infestation, would occur to recover economic value while retaining snags and coarse woody debris according to *Table 30 (Snag and coarse woody debris (CWD) retention for salvaging of timber after a stand-replacement disturbance)*.

Table 30. Snag and coarse woody debris (CWD) retention for salvaging of timber after a stand-replacement disturbance

Vegetation Series	Snag Retention		CWD Retention		
	Total	Component Diameters	Total	Component Diameters	Component Lengths
Western hemlock	8 tpa	> 20 in. dbh	480 ft./ac.	> 20 in.	> 20 ft.
Douglas fir and true firs	4 tpa	> 16 in. dbh	240 ft./ac.	> 16 in.	> 16 ft.
Tanoak	4 tpa	> 20 in. dbh	240 ft./ac.	> 20 in.	> 20 ft.

dbh (diameter breast height) ft. (linear feet) tpa (trees per acre)

- Snag and coarse woody debris retention or creation levels would be met at the scale of the harvest unit. Snag and coarse woody debris retention would be variable per acre throughout the area salvaged. If sufficient snags or coarse woody debris of the minimum sizes were not available, an equivalent number of smaller snags or coarse woody debris would be retained. Noncommercial snags and coarse woody debris would be retained, except for safety or operational reasons.

Riparian Management Area

Under Alternative 2, the riparian management area land use allocation would be established according to *Table 31 (Zones and the zone-specific management actions of the riparian management area land use allocation under Alternative 2)*. For a representation of those areas, see *Map 4 (Land use allocations under Alternative 2)*. Also see the map packet (*Maps 3*, *7*, and *11*) for detailed views of the land use allocations.

Table 31. Zones and the zone-specific management actions of the riparian management area land use allocation under Alternative 2

Zones	Zone-Specific Management Actions
Perennial and Intermittent Fish-Bearing Streams and Perennial Non-Fish-Bearing Streams	
Stream bank zone (0 to 25 ft.[1])	• Harvesting would not be allowed, except for safety or operational reasons • Ground-based harvesting equipment would not be allowed
Water influence zone (25 to 100 ft.)	• Harvesting where mature or structurally complex forest stands already exist would not be allowed, except for safety or operational reasons • 80% effective shade or potential shade from 25 to 60 ft., whichever is less, would be maintained • At least 50% canopy closure from 60 to 100 ft. would be maintained after harvests • Snag and coarse woody debris would be retained, except for safety or operational reasons • Thinning and other silvicultural treatments would be applied along smaller-order streams (generally, first-, second-, and third-order streams) to promote the development of mature forests • Thinning and other silvicultural treatments would be applied along larger-order streams (generally, fourth-order and larger streams) to promote the development of structurally complex forests
[1] Measured from the edge of the channel migration zone.	
Debris-Flow Prone[2] Intermittent Streams	
Stream bank zone (0 to 25 ft.) [extends from the unstable area to the fish-bearing stream]	• Harvesting would not be allowed, except for safety or operational reasons • Ground-based harvesting equipment would not be allowed

Table continues on the next page.

Zones	Zone-Specific Management Actions
Debris-Flow Prone[2] Intermittent Streams (cont.)	
Water influence zone (25 to 100 ft.) [extends from the unstable area to the fish-bearing stream]	• Harvesting where mature or structurally complex forest stands already exist would not be allowed, except for safety or operational reasons • Snag and coarse woody debris would be retained, except for safety or operational reasons • Thinning and other silvicultural treatments would be applied along smaller-order streams (generally, first-, second-, and third-order streams) to promote the development of mature forests
[2] Intermittent streams that are below unstable headwalls (as identified by the timber production capability classification (TPCC) codes indicating significant instability (i.e., FGNW, FPNW, and FGR2)) that would periodically deliver large wood to fish-bearing streams. Intermittent streams that would not deliver large wood to fish-bearing streams because of geomorphic conditions (such as stream junction angle and low stream gradient) or roads would not be included.	
Lakes, Natural Ponds, and Wetlands	
Greater than 1/4 acre (0 to 25 ft.[3])	• Harvesting would not be allowed, except for safety or operational reasons • Ground-based harvesting equipment would not be allowed
Greater than 1/4 acre (25 to 100 ft.[2])	• At least 50% of the existing live tree basal area or 110 sq. ft. of basal area per acre, whichever is greater, would be retained • Retention would favor trees greater than 20 in. dbh
Less than 1/4 acre (0-50 ft.[2])	• At least 50% of the existing live tree basal area or 110 sq. ft. of basal area per acre, whichever is greater, would be retained • Retention would favor trees greater than 20 in. dbh
[3] Measured from the high waterline or wetland boundary, whichever is greater.	
Constructed Ponds, Ditches, and Canals	
Stream bank zone (0 to 25 ft.)	• Harvesting would not be allowed, except for safety or operational reasons • Ground-based harvesting equipment would not be allowed
Intermittent Non-Fish-Bearing Streams	
Stream bank zone (0 to 25 ft.)	• Ground-based harvesting equipment would not be allowed • 12 conifer trees per acre would be retained • Shrubs, forbs, and noncommercial trees would be retained, except for safety or operational reasons

Management Objectives

- Maintain or promote the development of mature or structurally complex forests.
- Provide for the riparian and aquatic conditions that supply stream channels with shade, sediment filtering, leaf litter and large wood, and root masses that stabilize stream banks.

Management Actions Common to All Zones of the Riparian Management Areas

- Snags and coarse woody debris would be retained in thinning operations, except for safety or operational reasons.
- Salvage would not occur in stands that are disturbed by a fire, windstorm, disease, or insect infestations, except to reduce hazards in wildland urban interface areas.
- Timber from thinning and salvage operations would be available for sale.

Timber Management Area

Under Alternative 2, the timber management area land use allocation would be established to consist of the commercial forest lands that are not included in the following land use allocations:

- lands of the National Landscape Conservation System
- late-successional management area
- riparian management area
- administratively withdrawn areas
- management area adjacent to the Coquille Forest

See *Map 4 (Land use allocations under Alternative 2)*. Also see the map packet (*Maps 3*, *7*, and *11*) for detailed views of the land use allocations.

Management Objectives

- Manage forests to achieve a high level of continuous timber production that could be sustained through a balance of growth and harvest.
- Offer for sale an annual allowable sale quantity.

Management Actions

- Timber would be offered for sale from regeneration harvest units. See *Table 32 (Timber offered for sale from regeneration harvest units)* and *Map 29 (Sustained yield units)*.

Table 32. Timber offered for sale from regeneration harvest units

District	10-Year Volume (mmbf)
Salem	1,610
Eugene	1,520
Roseburg	990
Coos Bay	1,320
Medford	1,296
Klamath Falls Resource Area (Lakeview District)	90

- Timber would be offered for sale from commercial thinning harvest units. See *Table 33 (Timber offered for sale from commercial thinning harvest units)*.

Table 33. Timber offered for sale from commercial thinning harvest units

District	10-Year Volume (mmbf)
Salem	110
Eugene	130
Roseburg	80
Coos Bay	110
Medford	14
Klamath Falls Resource Area (Lakeview District)	0

- Annual offering of the allowable sale quantity would potentially vary up to 10% from the declared allowable sale quantity to allow for variations in yield from different harvest areas and to allow for the preparation and sale of logical, operationally feasible, and economically viable sale areas.
- Cumulative total offering of the allowable sale quantity would be maintained within 5% over two or more years by adjusting annual offerings within the allowed 10% variation.
- Regeneration harvests would be conducted to remove volume and replace slower-growing stands with young, rapidly growing stands. Generally, regeneration harvests would be scheduled for stands to maximize potential growth and yield. Regeneration harvests would be applied to younger stands for purposes that include the management of age class distribution, the management of diseased stands, and the management of overstocked stands with poor vigor and low crown ratio. The minimum age of stands that would be considered suitable for regeneration harvesting would be 40 years

of age in the western hemlock and the tanoak vegetation series and 60 years of age in Douglas fir and true firs vegetation series.

- Commercial thinning would be applied to recover anticipated mortality; to adjust stand composition or dominance; to reduce stand susceptibility to disturbances such as a fire, windstorm, disease, or insect infestation; and to improve merchantability and value.
- Stand density would be maintained at levels between full occupancy and the onset of density-related mortality to the extent practical.
- Stands with a composition of commercially undesirable tree species or an inadequate stocking of desirable tree species would be converted to stands that are fully stocked by desirable tree species.
- Trees killed from disturbances, such as a fire, windstorm, disease, or insect infestation, would be salvaged to recover volume and economic value within the time necessary to avoid loss of value through deterioration.

Areas of Critical Environmental Concern and Research Natural Areas (Land Use Allocations)

Under Alternative 2, 93 areas of critical environmental concern and research natural areas would be designated. At the end of this chapter, see Map 15 (Areas of critical environmental concern within the planning area) and Table 41 *(Existing and potential areas of critical environmental concern (ACECs) designated by alternative*).

Management Objective

Maintain or restore important and relevant values in areas of critical environmental concern, which include research natural areas and outstanding natural areas.

Management Action

Maintenance or restoration activities would occur to protect important and relevant values.

Management Area Adjacent to the Coquille Forest Land Use Allocation

Under Alternative 2, a management area adjacent to the Coquille Forest would be established. See *Map 16 (BLM management area adjacent to the Coquille Forest)*.

Management Objective

Coordinate the management of the adjacent BLM-administered lands with the Coquille Forest lands.

Management Actions

The Coquille Tribe's September 2006 *Management Direction for Tribal Cooperative Management Areas (TCMAs)* document provides the management direction for the Coquille Forest. The management of the 15,000 acres of BLM-administered lands that are adjacent to the Coquille Forest would adopt the management directions in this tribal plan for managing the comparable resources in this adjacent area. Those management directions are incorporated by reference. Since the management in this adjacent area would be in a manner that is consistent with the tribal plan, the tribal plan would be considered by the BLM to conform to the BLM's resource management plans in its entirety.

See *Map 16 (BLM management area adjacent to the Coquille Forest)*.

Riparian Management Areas

Note: The following management actions would apply only to the BLM-administered lands that are adjacent to the Coquille Forest.

Table 34. Criteria established for the riparian management areas of the lands that are adjacent to the Coquille Forest as part of Alternative 2

Perennial and Intermittent Fish-Bearing Streams	
0 to 25 ft.	• Avoid harvesting, except for restoration purposes • Require full suspension during cable logging • Leave any trees damaged or felled during logging activities
25 to 50 ft.	• Manage for mature forest conditions; maintain a minimum of 80% effective stream shade • Retain no less than 50% canopy cover • Actively manage, where necessary, to achieve desired future conditions in a timely manner • Allow no harvesting where mature forest conditions exist or when mature forest is achieved • Require full suspension during cable logging, whenever feasible, or else require one-ended suspension • Limit ground-based equipment, when possible • Retain all dead and downed material that is present prior to an operation
50 to 100 ft.	• Retain 10 to 45 conifer trees per acre or per 35 to 157 sq. ft. of basal area, which is 20 to 90 trees/1,000 ft. • Retain all snags if safety allows • Retain all dead and downed material that is present prior to an operation
Perennial Non-Fish-Bearing Streams	
0 to 25 ft.	• Avoid harvesting, except for restoration purposes • Require full suspension during cable logging • Leave any trees damaged or felled during logging activities
Perennial Non-Fish-Bearing Streams (cont.)	
25 to 50 ft.	• Manage for mature forest conditions; maintain a minimum of 80% effective stream shade • Retain no less than 50% canopy cover • Actively manage, where necessary, to achieve desired future conditions in a timely manner • Allow no harvesting where mature forest conditions exist or when mature forest is achieved • Require full suspension during cable logging, whenever feasible • Retain all dead and downed material that is present prior to an operation
Intermittent Non-Fish-Bearing Streams	
• Maintain the integrity of the stream channel • Retain 10 to 15 conifer trees per acre or per 35 to 45 sq. ft. of basal area, which is 20 to 30 trees/1,000 ft., where operationally feasible • Retain all snags if safety allows • Retain all dead and downed material that is present prior to the operation	

Forest Management

Note: The following management actions would apply only to the BLM-administered lands that are adjacent to the Coquille Forest.

- A well-distributed pattern of early and mid-seral stands would be maintained.
- A minimum of 120 linear feet of logs per acre in a cutting area (comprised of logs that are at least 16 inches in diameter at the large end and at least 16 feet in length) would be retained.
- From 0 to 6 green conifer trees would be retained after regeneration harvests to provide a source of snag recruitment.
- Stands would be managed under an average rotation age of 80 years, but regeneration harvests would be allowed in stands as young as 60 years of age to develop the desired age class distribution across the landscape and to provide for some commodity output.

Soils and Water

Note: This management action would apply only to the BLM-administered lands that are adjacent to the Coquille Forest.

The best management practices set forth in the plan for the tribal cooperative management area would be applied during all ground and vegetation disturbing activities.

Federally Listed Species under the Endangered Species Act

Note: The following management actions would apply only to the BLM-administered lands that are adjacent to the Coquille Forest.

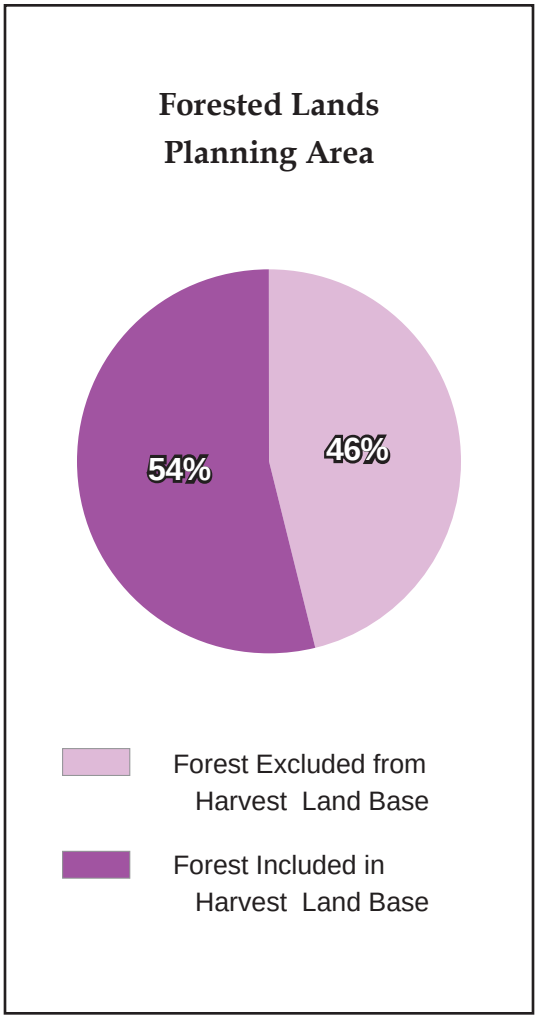
- Field surveys would be conducted, according to protocols and other established procedures, unless surveys are deemed unnecessary through project planning and environmental assessment.
- Consideration would be given to modifying, relocating, or abandoning proposed actions to avoid contributing to the need to list a federal candidate species based on consultation with the appropriate regulatory agency.

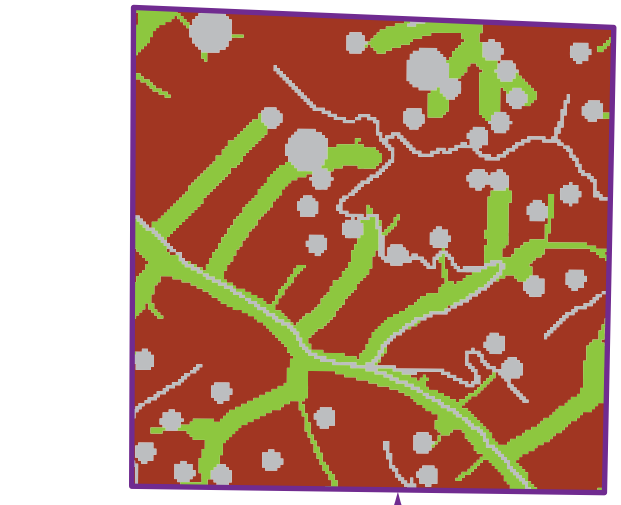
Roads

Note: The following management actions would apply only to the BLM-administered lands that are adjacent to the Coquille Forest.

- New stream-crossing structures would be designed to accommodate at least a 100 year flood, including the associated bedload and debris.
- Fish passage would be provided and maintained at all road crossings of existing and potential fish-bearing streams.

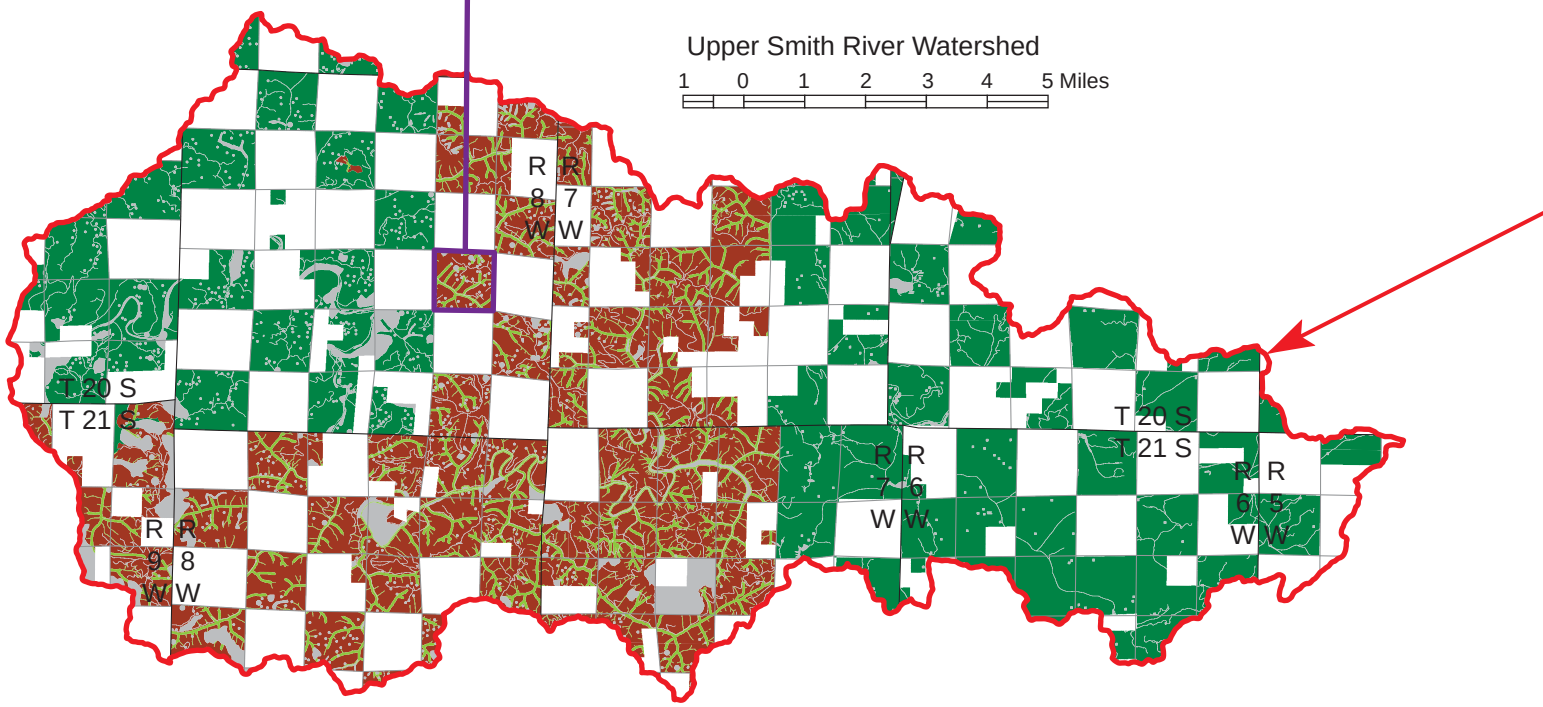
Source: Bureau of Land Management Corporate Data revised for WOPR Analysis. No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data.



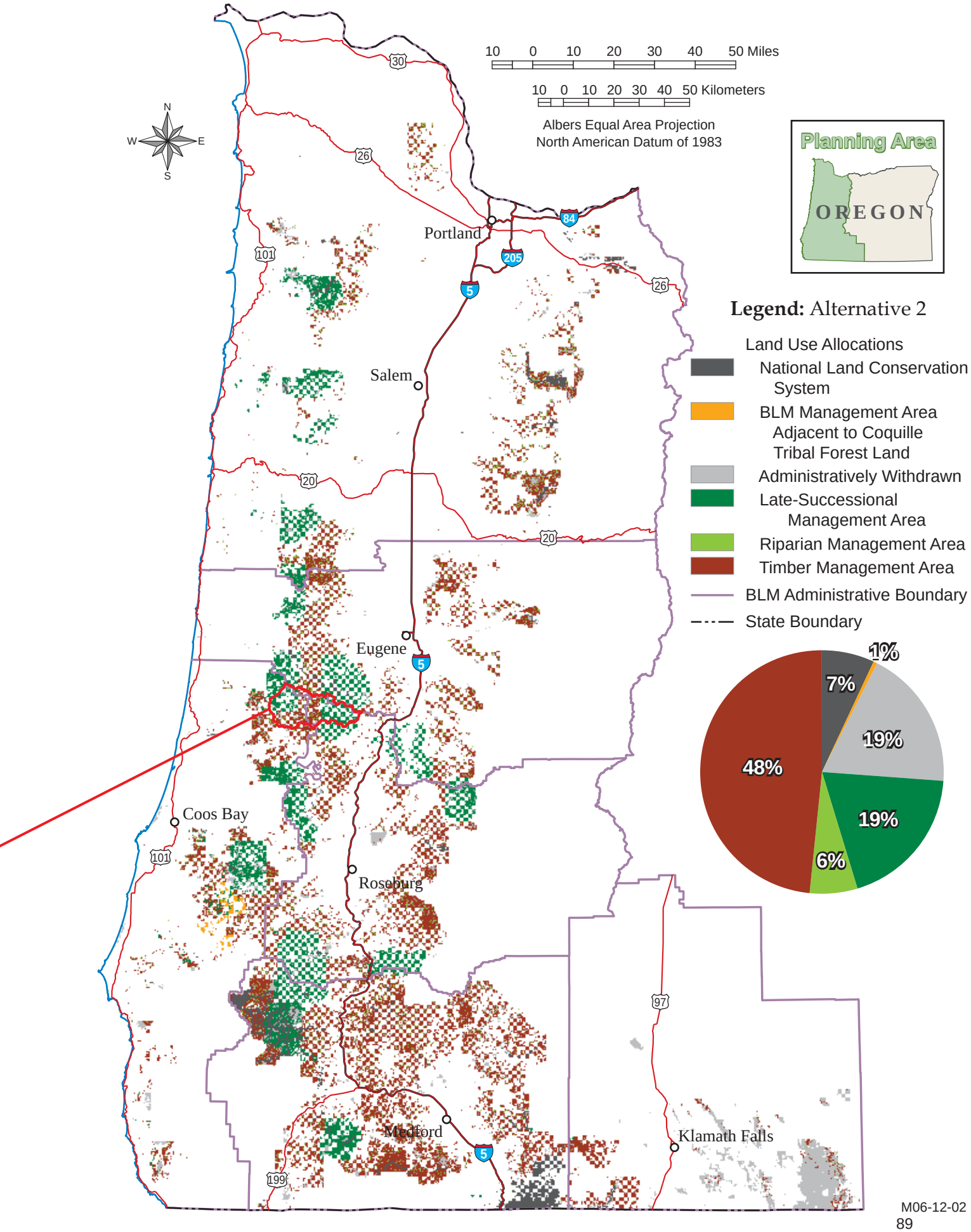


Township 20 South, Range 8 West, Section 23

0.25 0 0.25 0.5 0.75 1 Mile



Map 4. Land use allocations under Alternative 2


10 0 10 20 30 40 50 Miles
10 0 10 20 30 40 50 Kilometers
Albers Equal Area Projection
North American Datum of 1983
N
W
E
S
Planning Area
OREGON
Legend: Alternative 2
Land Use Allocations
National Land Conservation System
BLM Management Area Adjacent to Coquille Tribal Forest Land
Administratively Withdrawn
Late-Successional Management Area
Riparian Management Area
Timber Management Area
BLM Administrative Boundary
State Boundary
1%
7%
19%
19%
6%
48%
Portland
Salem
Eugene
Coos Bay
Roseburg
Medford
Klamath Falls
30
26
84
205
5
101
20
97
199

M06-12-02

Alternative 3

This action alternative is described in terms of those land use allocations that vary by alternative, which include:

- general landscape area
- riparian management area
- areas of critical environmental concern and research natural areas
- management area adjacent to the Coquille Forest

General Landscape Area

Under Alternative 3, the general landscape area land use allocation would consist of all lands other than the:

- lands of the National Landscape Conservation System
- riparian management areas
- administratively withdrawn areas
- lands adjacent to the Coquille Forest

See *Map 5 (Land use allocations under Alternative 3)*. Also see the map packet (*Maps 4*, *8*, and *12*) for detailed views of the land use allocations.

Management Objectives

- Provide for the habitat conditions that are required for late-successional species.
- Maintain or promote the development of mature or structurally complex forests.
- Achieve continuous timber production that could be sustained through a balance of growth and harvest.
- Offer for sale an annual allowable sale quantity.

Management Actions

- Annual offering of the allowable sale quantity would potentially vary up to 10% from the declared allowable sale quantity to allow for variations in yield from different harvest areas and to allow for the preparation and sale of logical, operationally feasible, and economically viable sale areas.
- Cumulative total offering of the allowable sale quantity would be maintained within 5% over two or more years by adjusting annual offerings within the allowed 10% variation.

- Regeneration harvests would be applied as shown in *Table 35 (Harvest interval, green tree retention, and snag and coarse woody debris (CWD) retention or creation levels per vegetation series for regeneration harvests under Alternative 3)*.

Table 35. Harvest interval, green tree retention, and snag and coarse woody debris (CWD) retention or creation levels per vegetation series for regeneration harvests under Alternative 3

Vegetation Series	Harvest Interval (years)	Green Tree Retention		Snag Retention or Creation		CWD Retention or Creation		
		Total	Component Diameters	Total	Component Diameters	Total	Component Diameters	Component Lengths
Western hemlock	360	6 tpa	> 20 in. dbh	4 tpa	> 20 in. dbh	240 ft./ac.	> 20 in.	> 20 ft.
Douglas fir and true firs	240	9 tpa	> 16 in. dbh	2 tpa	> 16 in. dbh	120 ft./ac.	> 16 in.	> 16 ft.
Tanoak		6 tpa	> 20 in. dbh	2 tpa	> 20 in. dbh	120 ft./ac.	> 20 in.	> 20 ft.

dbh (diameter breast height) ft. (linear feet) tpa (trees per acre)

- Regeneration harvests would not be applied in the areas that are generally south of Grants Pass in the Medford District and in the Klamath Falls Resource Area of the Lakeview District.
- Forest stands would be salvaged after disturbances where economically feasible within the time necessary to avoid loss of value through deterioration. Salvage would emulate a partial harvest or a regeneration harvest depending on the nature and extent of the disturbance.
- Regeneration harvests would be applied to stands that are at or beyond the harvest interval for regeneration harvesting if 50% or more of the acres in an assessment area (defined as a physiographic province within a sustained yield unit) are older than the following threshold stand ages:
  - 90 years of age in the assessment areas of Salem/Coast Range, Salem/West Cascades, Eugene/Coast Range, Eugene/West Cascades, Coos Bay/Coast Range, Coos Bay/Klamath, Roseburg/Coast Range, and Roseburg/West Cascades
  - 140 years of age in the assessment areas of Roseburg/Klamath and Medford/West Cascades (outside of the uneven-aged management area)

  See *Map 17 (Location of assessment areas (physiographic provinces within sustained yield units) under Alternative 3)*. Also see the map packet (*Maps 4, 8,* and *12*) for detailed views of the land use allocations.
- Partial harvests and commercial thinning would be applied to stands that are at or beyond the harvest interval for partial harvesting if less than 50% of the acres in an assessment area (defined as a

physiographic province within a sustained yield unit) are older than the following threshold stand ages:

- 90 years of age in the assessment areas of Salem/Coast Range, Salem/West Cascades, Eugene/Coast Range, Eugene/West Cascades, Coos Bay/Coast Range, Coos Bay/Klamath, Roseburg/Coast Range, and Roseburg/West Cascades
- 140 years of age in the assessment areas of Roseburg/Klamath and Medford/West Cascades (outside of the uneven-aged management area)

See *Map 17 (Location of assessment areas (physiographic provinces within sustained yield units) under Alternative 3)*. Also see the map packet (*Maps 4, 8,* and *12*) for detailed views of the land use allocations.

- Partial harvests would be applied as shown in *Table 36 (Harvest interval, green tree retention, and snag and coarse woody debris (CWD) retention or creation levels per vegetation series for partial harvests under Alternative 3)*.

Table 36. Harvest interval, green tree retention, and snag and coarse woody debris (CWD) retention or creation levels per vegetation series for partial harvests under Alternative 3

Vegetation Series	Harvest Interval (years)	Green Tree Retention		Snag Retention or Creation		CWD Retention or Creation		
		Total	Component Diameters	Total	Component Diameters	Total	Component Diameters	Component Lengths
Western hemlock	120	30 tpa	> 16 in. dbh	4 tpa	> 20 in. dbh	240 ft./ac.	> 20 in.	> 20 ft.
Douglas fir and true firs	80	20 tpa	> 12 in. dbh	2 tpa	> 12 in. dbh	120 ft./ac.	> 12 in.	> 12 ft.
Tanoak	60	20 tpa	> 16 in. dbh	2 tpa	> 16 in. dbh	120 ft./ac.	> 16 in.	> 16 ft.

dbh (diameter breast height) ft. (linear feet) tpa (trees per acre)

- The harvest intervals for regeneration harvests and partial harvests in *Table 35* and *Table 36* are approximate schedules for harvesting timber stands, not minimum ages of trees to be cut. Individual or clumps of trees may be harvested for operational reasons. Harvests may occur at stand ages above the described harvest intervals because of the current age-class distribution as well as operational and planning constraints. Regardless of a stand's age at the time of harvest, the same stand would not be harvested again until after the harvest interval.
- Green tree retention levels would be met from conifer trees.
- Green tree, snag, and coarse woody debris retention or creation levels in *Table 35* and *Table 36* are averages that would be met at the scale of the harvest unit, and levels would be highly variable within harvest units.

- Existing snags and coarse woody debris would be supplemented with created snags and coarse woody debris to meet the levels in *Table 35* and *Table 36*.
- Commercial thinning would be applied, as needed, to a stand of any age to maintain the growth and vigor of the stand, and to adjust the species composition of the stand.
- Trees killed from disturbances, such as a fire, windstorm, disease, or insect infestation, would be salvaged to recover volume and economic value within the time necessary to avoid loss of value through deterioration.
- When salvaging after disturbances such as a fire, windstorm, disease, or insect infestation that approximate a regeneration harvest (i.e., the density of surviving trees that is comparable to the green tree retention levels given in *Table 35*), green trees, snags, and coarse woody debris would be retained, if they are available, in the quantities shown in *Table 35* in this chapter.
- When salvaging after disturbances such as a fire, windstorm, disease, or insect infestation that approximate a partial harvest (i.e., the density of surviving trees that is comparable to the green tree retention levels given in *Table 36*), green trees, snags, and coarse woody debris would be retained, if they are available, in the quantities shown in *Table 36* in this chapter.
- Stands with a composition of commercially undesirable tree species or an inadequate stocking of desirable tree species would be converted to stands that are fully stocked by desirable tree species. In converting hardwood stands to the desired conifer species, green tree, snag, and coarse woody debris retention or creation requirements for stand-replacement harvests would be applied with the following exception: hardwood trees may be substituted for conifer trees for green tree, snag, and coarse woody debris retention or creation.
- Owl activity centers of 215 acres of suitable nesting, roosting, and foraging habitat would be retained within 5/8 of a mile of each known northern spotted owl center of activity as identified in the Northern Spotted Owl Database. If 215 acres of habitat are not available within 5/8 of a mile of an owl center of activity, no further acres would be retained. This habitat would be retained until 50% or more of the acres in an assessment area (defined as a physiographic province within a sustained yield unit) are older than the following threshold stand ages:
  - 90 years of age in the areas that are generally north of Grants Pass, which include the assessment areas of Salem/Coast Range, Salem/West Cascades, Eugene/Coast Range, Eugene/

West Cascades, Coos Bay/Coast Range, Coos Bay/Klamath, Roseburg/Coast Range, and Roseburg/West Cascades

  - 140 years of age in the areas that are generally south of Grants Pass, which include the assessment areas of Roseburg/Klamath and Medford/West Cascades (outside of the uneven-aged management area)
    For the uneven-aged management areas, 215 acres of suitable nesting, roosting, and foraging habitat would be retained for 5 decades, which is 50 years.

- Contiguous marbled murrelet habitat and recruitment habitat (stands capable of becoming habitat for the marbled murrelet within 25 years) would be retained within 0.5 mile of any occupied site. Occupation would be determined by the presence of an active nest, a fecal ring, eggshell fragments, or birds demonstrating occupying behavior (i.e., flying below the forest canopy within or adjacent to a stand). This habitat would be retained until 50% or more of the acres in an assessment area (defined as a physiographic province within a sustained yield unit) are older than the following threshold stand ages:
  - 90 years of age in the areas that are generally north of Grants Pass, which include the assessment areas of Salem/Coast Range, Salem/West Cascades, Eugene/Coast Range, Eugene/West Cascades, Coos Bay/Coast Range, Coos Bay/Klamath, Roseburg/Coast Range, and Roseburg/West Cascades
  - 140 years of age in the areas that are generally south of Grants Pass, which include the assessment areas of Roseburg/Klamath and Medford/West Cascades (outside of the uneven-aged management area)

Riparian Management Area

Under Alternative 3, the riparian management area land use allocation would be established according to *Table 37 (Zones and the zone-specific management actions of the riparian management area land use allocation under Alternative 3)*. For a representation of those areas, see *Map 5* (*Land use allocations under Alternative 3)*. Also see the map packet (*Maps 4*, *8*, and *12*) for detailed views of the land use allocations.

Table 37. Zones and the zone-specific management actions of the riparian management area land use allocation under Alternative 3

Zones	Zone-Specific Management Actions
Perennial and Intermittent Fish-Bearing Streams and Perennial Non-Fish-Bearing Streams	
Stream bank zone (0 to 25 ft.[1])	• Harvesting would not be allowed, except for safety or operational reasons • Ground-based harvesting equipment would not be allowed
Water influence zone (25 to 100 ft.)	• Harvesting where mature or structurally complex forest stands already exist would not be allowed, except for safety or operational reasons • 80% effective shade or potential shade from 25 to 60 ft., whichever is less, would be maintained • At least 50% canopy closure from 60 to 100 ft. would be maintained after harvests • Snag and coarse woody debris would be retained, except for safety or operational reasons • Thinning and other silvicultural treatments would be applied along smaller-order streams (generally, first-, second-, and third-order streams) to promote the development of mature forests • Thinning and other silvicultural treatments would be applied along larger-order streams (generally, fourth-order and larger streams) to promote the development of structurally complex forests
[1] Measured from the edge of the channel migration zone.	
Lakes, Natural Ponds, and Wetlands	
Greater than 1/4 acre (0 to 25 ft.[2])	• Harvesting would not be allowed, except for safety or operational reasons • Ground-based harvesting equipment would not be allowed
Greater than 1/4 acre (25 to 100 ft.[2])	• At least 50% of the existing live tree basal area or 110 sq. ft. of basal area per acre, whichever is greater, would be retained • Retention would favor trees greater than 20 in. dbh
Lakes, Natural Ponds, and Wetlands (cont.)	
Less than 1/4 acre (0-50 ft.[2])	• At least 50% of the existing live tree basal area or 110 sq. ft. of basal area per acre, whichever is greater, would be retained • Retention would favor trees greater than 20 in. dbh
[2] Measured from the high waterline or wetland boundary, whichever is greater.	

Zones	Zone-Specific Management Actions
Constructed Ponds, Ditches, and Canals	
Stream bank zone (0 to 25 ft.)	• Harvesting would not be allowed, except for safety or operational reasons • Ground-based harvesting equipment would not be allowed
Intermittent Non-Fish-Bearing Streams	
Stream bank zone (0 to 25 ft.)	• Harvesting would not be allowed, except for safety or operational reasons • Ground-based harvesting equipment would not be allowed

Management Objectives

- Maintain or promote the development of mature or structurally complex forests.
- Provide for the riparian and aquatic conditions that supply stream channels with shade, sediment filtering, leaf litter and large wood, and root masses that stabilize stream banks.

Management Actions

- Snags and coarse woody debris would be retained in thinning operations, except for safety or operational reasons.
- Salvage would not occur in stands that are disturbed by a fire, windstorm, disease, or insect infestations, except to reduce hazards in wildland urban interface areas.
- Timber from thinning and salvage operations would be available for sale.
- Prescribed burns would be used in areas of high fuel loadings to reduce the potential for uncharacteristic wildfires.

Areas of Critical Environmental Concern and Research Natural Areas (Land Use Allocations)

Under Alternative 3, 82 areas of critical environmental concern and research natural areas would be designated. At the end of this chapter, see *Map 15 (Areas of critical environmental concern within the planning area)* and *Table 41 (Areas of critical environmental concern under the alternatives).*

Management Objective

Maintain or restore important and relevant values in areas of critical environmental concern, which include research natural areas and outstanding natural areas.

Management Action

Maintenance or restoration activities would occur to protect important and relevant values.

Management Area Adjacent to the Coquille Forest Land Use Allocation

Under Alternative 3, a management area adjacent to the Coquille Forest would be established. See *Map 16 (BLM management area adjacent to the Coquille Forest)*.

Management Objective

Coordinate the management of the adjacent BLM-administered lands with the Coquille Forest lands.

Management Actions

The Coquille Tribe's September 2006 *Management Direction for Tribal Cooperative Management Areas (TCMAs)* document provides the management direction for the Coquille Forest. The management of the 15,000 acres of BLM-administered lands that are adjacent to the Coquille Forest would adopt the management directions in this tribal plan for managing the comparable resources in this adjacent area. Those management directions are incorporated by reference. Since the management in this adjacent area would be in a manner that is consistent with the tribal plan, the tribal plan would be considered by the BLM to conform to the BLM's resource management plans in its entirety.

See *Map 16 (BLM management area adjacent to the Coquille Forest)*.

Riparian Management Areas

Note: The following management actions would apply only to the BLM-administered lands that are adjacent to the Coquille Forest.

Table 38. Criteria established for the riparian management areas of the lands that are adjacent to the Coquille Forest as part of Alternative 3

Perennial and Intermittent Fish-Bearing Streams	
0 to 25 ft.	• Avoid harvesting, except for restoration purposes • Require full suspension during cable logging • Leave any trees damaged or felled during logging activities
25 to 50 ft.	• Manage for mature forest conditions; maintain a minimum of 80% effective stream shade • Retain no less than 50% canopy cover • Actively manage, where necessary, to achieve desired future conditions in a timely manner • Allow no harvesting where mature forest conditions exist or when mature forest is achieved • Require full suspension during cable logging, whenever feasible, or else require one-ended suspension • Limit ground-based equipment, when possible • Retain all dead and downed material that is present prior to an operation
50 to 100 ft.	• Retain 10 to 45 conifer trees per acre or per 35 to 157 sq. ft. of basal area, which is 20 to 90 trees/1,000 ft. • Retain all snags if safety allows • Retain all dead and downed material that is present prior to an operation
Perennial Non-Fish-Bearing Streams	
0 to 25 ft.	• Avoid harvesting, except for restoration purposes • Require full suspension during cable logging • Leave any trees damaged or felled during logging activities
Perennial Non-Fish-Bearing Streams (cont.)	
25 to 50 ft.	• Manage for mature forest conditions; maintain a minimum of 80% effective stream shade • Retain no less than 50% canopy cover • Actively manage, where necessary, to achieve desired future conditions in a timely manner • Allow no harvesting where mature forest conditions exist or when mature forest is achieved • Require full suspension during cable logging, whenever feasible • Retain all dead and downed material that is present prior to an operation
Intermittent Non-Fish-Bearing Streams	
• Maintain the integrity of the stream channel • Retain 10 to 15 conifer trees per acre or per 35 to 45 sq. ft. of basal area, which is 20 to 30 trees/1,000 ft., where operationally feasible • Retain all snags if safety allows • Retain all dead and downed material that is present prior to the operation	

Forest Management

Note: The following management actions would apply only to the BLM-administered lands that are adjacent to the Coquille Forest.

- A well-distributed pattern of early and mid-seral stands would be maintained.
- A minimum of 120 linear feet of logs per acre in a cutting area (comprised of logs that are at least 16 inches in diameter at the large end and at least 16 feet in length) would be retained.
- From 0 to 6 green conifer trees would be retained after regeneration harvests to provide a source of snag recruitment.
- Stands would be managed under an average rotation age of 80 years, but regeneration harvests would be allowed in stands as young as 60 years of age to develop the desired age class distribution across the landscape and to provide for some commodity output.

Soils and Water

Note: This management action would apply only to the BLM-administered lands that are adjacent to the Coquille Forest.

The best management practices set forth in the plan for the tribal cooperative management area would be applied during all ground- and vegetation-disturbing activities.

Federally Listed Species under the Endangered Species Act

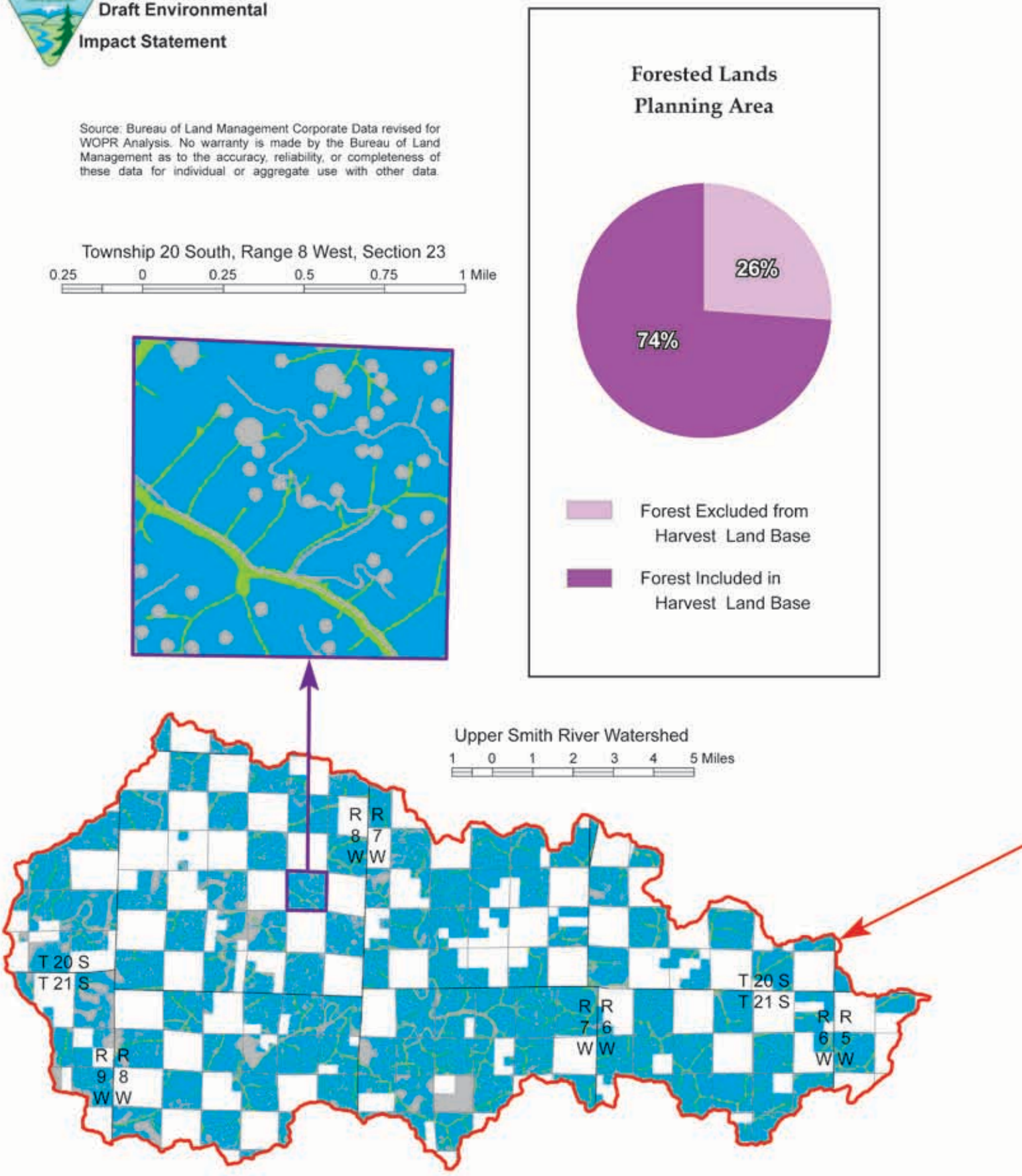
Note: The following management actions would apply only to the BLM-administered lands that are adjacent to the Coquille Forest.

- Field surveys would be conducted, according to protocols and other established procedures, unless surveys are deemed unnecessary through project planning and environmental assessment.
- Consideration would be given to modifying, relocating, or abandoning proposed actions to avoid contributing to the need to list a federal candidate species based on consultation with the appropriate regulatory agency.

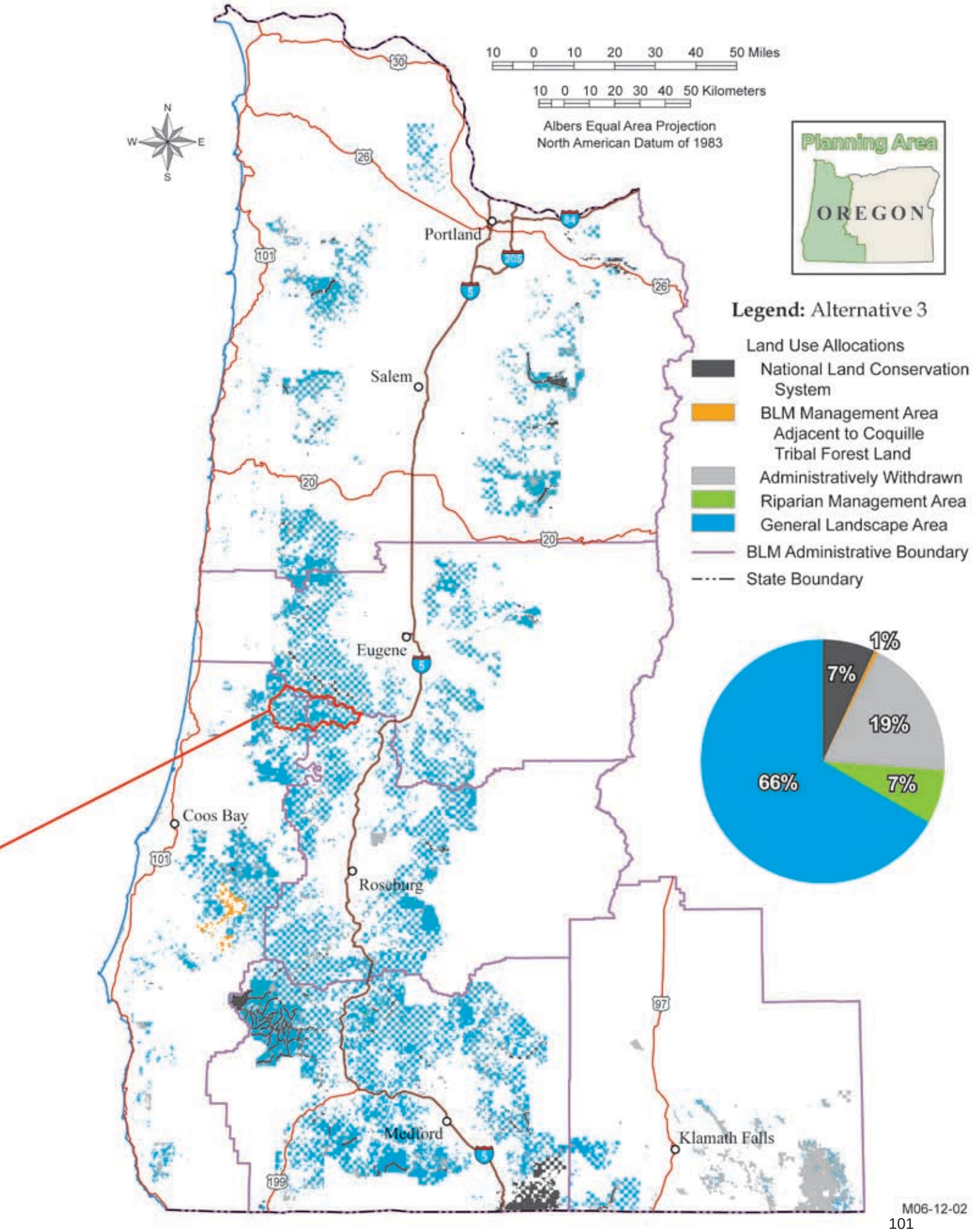
Roads

Note: The following management actions would apply only to the BLM-administered lands that are adjacent to the Coquille Forest.

- New stream-crossing structures would be designed to accommodate at least a 100 year flood, including the associated bedload and debris.
- Fish passage would be provided and maintained at all road crossings of existing and potential fish-bearing streams.



Map 5. Land use allocations under Alternative 3


10 0 10 20 30 40 50 Miles
10 0 10 20 30 40 50 Kilometers
Albers Equal Area Projection
North American Datum of 1983
N
W
E
S
Planning Area
OREGON
Legend: Alternative 3
Land Use Allocations
National Land Conservation System
BLM Management Area Adjacent to Coquille Tribal Forest Land
Administratively Withdrawn
Riparian Management Area
General Landscape Area
BLM Administrative Boundary
State Boundary
1%
7%
19%
7%
66%
Portland
Salem
Eugene
Coos Bay
Roseburg
Medford
Klamath Falls
30
26
101
84
205
5
20
97
199

M06-12-02

Subalternatives

Subalternatives are variations of an alternative that add, remove, or modify certain management actions. The analysis of subalternatives allows the BLM to examine concepts that were contained in the alternatives. These examinations provide the public and the responsible official with information that is useful to more fully understand the alternatives and to arrive at subsequent decisions.

The analysis of the subalternatives is focused and limited to the specific analytical question that is associated with a subalternative. This is in contrast to the broader analysis that is associated with the No Action Alternative and the three action alternatives. Some subalternatives, however, may be incorporated into or used in modifying an action alternative in the final environmental impact statement analysis.

The following are the subalternatives examined in this draft environmental impact statement.

Alternative	Subalternatives
No Action	None
Alternative 1	1. Allow no harvesting of stands that are older than 80 years of age. 2. Allow no harvesting of stands that are older than 200 years of age. 3. Allow no regeneration harvesting until thinning opportunities are exhausted. 4. Increase the size of the late-successional management area to include all critical habitat of the northern spotted owl.
Alternative 2	Change the rotation to emulate the timber industry's short rotation.
Alternative 3	Apply the landscape target of 50% in late-successional habitat condition to only those areas where the government land ownership (federal, state, and local) is half or more of the total ownership.

Subalternatives Analyzed

Subalternatives for Alternative 1

Allow no harvesting of stands that are older than 80 years of age and allow no harvesting of those that are older than 200 years of age (two analyses)

Analytical Question: What would be the effect on forest structural conditions, habitat, and timber harvest levels if no harvesting was permitted in older forests?

The analysis of these subalternatives is intended to examine the issue of the management of old-growth forests. Some members of the public commented through the scoping process that all old-growth forests should be reserved from timber harvesting. Because there are varied opinions as to what constitutes older forests, these subalternatives examine the reservation of forest stands that are older than 80 years of age and those that are older than 200 years of age. The analysis of these subalternatives is limited to forest ecology, wildlife, and timber.

Allow no regeneration harvesting until thinning opportunities are exhausted

Analytical Question: Is thinning sustainable for meeting the annual allowable sale quantity?

The analysis of this subalternative examines how long a thinning-only approach to harvesting could sustain the allowable sale quantity of the alternative. The analysis will also examine the effect of such a harvesting regime on the value of the timber harvested. The analysis of this subalternative is in response to comments received during scoping that advocated forest management that would use thinning only with no regeneration harvesting. The analysis of this subalternative is limited to timber and economics.

Increase the size of the late-successional management area to include all critical habitat of the northern spotted owl

Analytical Question: How would increasing the size of late-successional management areas to include all northern spotted owl critical habitat affect timber harvest levels?

Although Alternative 1 would create large reserves that incorporate much of the critical habitat for the northern spotted owl, there would be some critical habitat that would not be included in the reserve system. The analysis of this subalternative is limited to timber.

Subalternative for Alternative 2

Change the rotation to emulate the timber industry's short rotation

Analytical Question: What would be the economic gain of using a short rotation and how would such management affect habitat?

This analysis examines what economic benefits would result from increased intensive forest management and how compatible the intensive forest management would be with wildlife objectives. The analysis of this subalternative is limited to timber, economics, and wildlife.

Subalternative for Alternative 3

Apply the landscape target of 50% in late-successional habitat condition to only those areas where the government land ownership (federal, state, and local) is half or more of the total ownership

Analytical Question: How would applying the landscape target to only areas of high government ownership affect harvest levels and habitat?

The analysis of this subalternative examines the sensitivity of timber harvest level and habitat outcomes to the varying of the landscape target. The analysis is intended to provide insight into the ability to achieve habitat objectives by varying management action in areas of high government ownership and low government ownership. This analysis has particular relevance to the uneven checkerboard pattern of the O&C lands. The analysis of this subalternative is limited to timber and wildlife.

Alternatives Considered but Eliminated from Detailed Study

An environmental impact statement must rigorously explore and objectively evaluate all reasonable alternatives. The range of alternatives is limited by the requirement to fulfill the purpose and need, which is the reason or reasons for the agencies to be proposing action. See *Chapter 1* for the purpose and need.

When an alternative is eliminated from detailed study, it is because it was found to be unreasonable in some way. An alternative may be found to be unreasonable when it:

1. Does not meet the purpose and need.
2. Is substantially similar to an alternative being considered in detail or it would have substantially similar effects to an alternative being considered in detail.
3. Would not be feasible or practical to implement.
4. Would be exorbitant to implement.
5. Cannot be analyzed for its effects because of its implementation being remote or speculative.

Eliminated Alternatives

These alternatives, which were considered but eliminated from detailed study, were the result of proposals received from the public through the scoping process or proposed by agency staff during the process of formulating reasonable alternatives that would met the purpose and need.

Vary Management Based on High versus Low Government Ownership

This alternative would vary management objectives at the landscape level and vary management actions based on the checkerboard ownership pattern of the BLM lands.

Landscape-level areas with greater than 50% state and federal ownership would be managed primarily to develop habitat for late-successional forest-related species. These areas would provide the opportunity for creating large blocks of contiguous habitat in the future.

Where the combined state and federal ownership is below 50%, the BLM's lands would be managed for early and mid-successional forests with structural legacies. A majority of the commercial timber harvesting activities would occur in these areas.

This alternative was eliminated from detailed study because it is a variation of Alternative 3, which sets landscape objectives for the development of late-successional forests. A subalternative of Alternative 3 varies these landscape targets in areas relative to a high or low government ownership pattern. Analysis of this subalternative is intended to provide information regarding the ability of the BLM to achieve management objectives given the checkerboard ownership pattern of the BLM lands.

Use Historic Variability, Retention of All Mature and Old-Growth Stands, and Small Tree Harvesting

This alternative would manage within the historic range of variability, would protect mature and old-growth stands, and would harvest only small-diameter trees. It would focus on restoration, fuels reduction, and maintenance of the protections of the Northwest Forest Plan.

This alternative was eliminated from detailed study because it would not meet the purpose and need, which states that the resource management plan revisions must meet all applicable laws. One of the applicable laws is the O&C Act. The O&C Act requires that the O&C lands that are classified as timberlands are to be managed for permanent forest production following the principles of sustained yield, which includes the selling, cutting, and removing of timber.

However, the alternatives that were analyzed in detail contain the essential elements of this alternative. Alternatives 1, 2, and 3 all provide for restoration, the reduction of fuels, and the protection or development of mature or structurally complex forests. Therefore, a redundant detailed analysis is unnecessary.

Protect All Forests That Are Over 80 Years of Age

This alternative would protect all forests that are over 80 years of age and prohibit logging and the building of new roads in all large unroaded areas. In stands that are less than 80 years of age, active restoration would occur, including thinning, road removal, replacing culverts to improve fish passage, trail maintenance, prescribed burns, and riparian restoration.

This alternative was eliminated from detailed study because it would not meet the purpose and need, which states that the resource management plan revisions must meet all applicable laws. One of the laws is the O&C Act. This alternative would exclude timber harvesting on large acreages of O&C lands and would eventually exclude all harvesting on all O&C lands, once their forests reached the age of 80 years. Therefore, this alternative would not meet the O&C Act's requirement to manage the O&C lands that are classified as timberlands for permanent forest production following the principles of sustained yield, which includes the selling, cutting, and removing of timber. Also note that no law exists that requires the protection of forests that are over the age of 80 years.

However, a subalternative of Alternative 1 analyzed the effects of not allowing the regeneration harvesting of older stands until the appropriate thinning of all available younger stands has been accomplished. Additionally, two analyses were completed to evaluate the impacts of the reservation of older stands (i.e., those that are at ages greater than 80 and those that are at ages greater than 200 years). Since these subalternatives are substantially similar to this alternative, a redundant detailed analysis is unnecessary.

Two-Phased Management Approach

This alternative would focus on the recovery and restoration of habitat for threatened and endangered species. After species recover and are delisted, this alternative would then focus on harvesting.

This alternative was eliminated from detailed study because it would not meet the purpose and need, which states that the resource management plan revisions must meet all applicable laws. Two of the applicable laws are the O&C Act and the Endangered Species Act. The Endangered Species Act does not specifically require that timber harvesting be delayed in the entire classification of older stands in order to allow for the recovery of any one or combination of species. Additionally, it is unknown how long delisting or recovery would take, or even if it would occur for some species. This alternative would indefinitely postpone timber harvesting. Therefore, this alternative would not meet the O&C Act's requirement to manage the O&C lands

that are classified as timberlands for permanent forest production following the principles of sustained yield, which includes the selling, cutting, and removing of timber.

However, a subalternative of Alternative 1 analyzed the effects of not allowing the regeneration harvesting of older stands until the appropriate thinning of all available younger stands has been accomplished. Since this subalternative is substantially similar to this alternative, a redundant detailed analysis is unnecessary.

Harvest Only Naturally Selected Dead and Dying Trees

This alternative would remove only "naturally selected dead and dying trees, conditioned upon meeting the needs of other species." Timber harvesting of such trees would be accomplished with small equipment from a network of narrow roads.

This alternative was eliminated from detailed study because it would not meet the purpose and need, which states that the resource management plan revisions must meet all applicable laws. One of the applicable laws is the O&C Act. The O&C Act requires that the O&C lands that are classified as timberlands are to be managed for permanent forest production following the principles of sustained yield, which includes determining and declaring the annual productive capacity of such lands with the timber from those lands (not less than the annual sustained yield capacity) being sold annually.

Also, while this management approach may be practical for managing a small woodlot on relatively flat terrain, such an approach is impractical for managing a landscape of the size and ruggedness that is managed by the BLM in western Oregon. The level of roaded access and survey efforts that would be necessary to identify and harvest the trees that die on BLM lands in western Oregon every year would be prohibitively expensive both in financial and environmental terms.

No Old-Growth Harvesting

This alternative would reserve all old-growth stands and focus harvesting on small-diameter trees.

This alternative was eliminated from detailed study because it would not meet the purpose and need, which states that the resource management plan revisions must meet all applicable laws. One of the applicable laws is the O&C Act. In a 1990 opinion by the United States Court of Appeals for the Ninth Circuit (*Headwaters, Inc. v. BLM*), the court ruled that the O&C Act was a dominant use act.

> *"Nowhere does the legislative history suggest that wildlife habitat conservation or conservation of old growth is a goal on a par with timber production, or indeed that it is a goal of the O&C Act at all."*

Precluding the harvesting of timber from old-growth stands that are not needed to comply with some other law, such as the Endangered Species Act, would violate the O&C Act's requirement to manage the O&C lands that are classified as timberlands for permanent forest production following the principles of sustained yield, which includes the selling, cutting, and removing of timber.

However, a subalternative of Alternative 1 analyzed the effects of not allowing the regeneration harvesting of older stands until the appropriate thinning of all available younger stands has been accomplished. Additionally, two analyses were completed to evaluate the impacts of the reservation of older stands by using two variations of what is considered an older stand (i.e., 80 years per the Northwest Forest Plan for late-successional/old-growth stands and 200 years per the BLM for old-growth stands). Since these subalternatives are substantially similar to this alternative, a redundant detailed analysis is unnecessary.

No Logging

This alternative would prohibit all timber harvesting and allow only custodial management of the federal forests.

This alternative was eliminated from detailed study because it would not meet the purpose and need, which states that the resource management plan revisions must meet all applicable laws. One of the applicable laws is the O&C Act. The O&C Act requires that the O&C lands that are classified as timberlands are to be managed for permanent forest production following the principles of sustained yield, which includes the selling, cutting, and removing of timber.

However, a reference analysis analyzed the effects of not harvesting. Since this reference analysis is substantially similar to this alternative, a redundant detailed analysis is unnecessary.

Transfer Forested BLM Lands to the USDA Forest Service

This proposal would transfer all BLM lands in the area of the Northwest Forest Plan to the U.S. Forest Service.

This alternative would not be feasible or practical to implement because the BLM does not have the authority to transfer the management of its lands. The transfer of lands from one agency of one federal department to another requires congressional action; in this case, from the BLM under the United States Department of the Interior to the U.S. Forest Service under the Department of Agriculture.

This alternative is also beyond the scope of the resource management plan revisions because it would not address any of the elements of the purpose and need that are given in *Chapter 1*.

Repeal or Change the O&C Act

This alternative would repeal the O&C Act or change it to a multiple-use act from a timber dominant-use act.

This alternative would not be feasible for the BLM to implement because only Congress can repeal or amend laws.

This alternative is also beyond the scope of the resource management plan revisions because it would not address any of the elements of the purpose and need that are given in Chapter 1.

Comparison of the Alternatives

Table 39 provides a comparison of the key features of the alternatives, focusing on features that vary among the action alternatives. *Table 40* provides a comparison of the key impacts of the alternatives. For the explicit details, refer to the management objectives and management actions that are listed for each alternative.

Table 39. Comparison of the key features of the four alternatives

Features	No Action Alternative	Alternative 1	Alternative 2	Alternative 3
Late-Successional Vegetation	• Maintains the Northwest Forest Plan's late-successional reserve (LSR) • Allows no treatment of stands that are older than 80 years	• Establishes a late-successional management area (LSMA) • Treats LSMA to promote the development of structurally complex forests	• Establishes a late-successional management area (LSMA) • Treats LSMA to promote the development of suitable habitat	Establishes a landscape target for regeneration harvesting that requires 50% or more of the acres in an assessment area (physiographic province within a sustained yield unit) be of the required age for harvesting.
Critical Habitat Units (CHUs) for the Northern Spotted Owl and the Marbled Murrelet	• CHUs for the marbled murrelet completely match with the LSR • CHUs for the northern spotted owl partially match the LSR	• CHUs for the marbled murrelet completely match with the LSMA • CHUs for the northern spotted owl partially match the LSMA	• CHUs for the marbled murrelet partially match with the LSMA • CHUs for the northern spotted owl partially match the LSMA	No special management
Northern Spotted Owl Activity Centers	Retains the owl activity centers that were known as of January 1994	Retains no owl activity centers in the timber management area (TMA)	Retains no owl activity centers in the timber management area (TMA)	• Retains 215 acre owl activity centers in the general landscape area • Manages the owl activity centers until the landscape target is reached
Marbled Murrelet Sites	Retains sites	Retains sites	Retains known sites as of 10/2005	Retains sites until the landscape target is reached
Rotation Age for Regeneration Harvesting	Approximately 80 to 100 years	Approximately 80 to 100 years	Approximately 80 to 100 years	360 years in the Western hemlock and Douglas fir zones and 240 years in the Tanoak zone
Green Tree Retention	• North of Grants Pass: 6 to 8 trees per acre • South of Grants Pass: 18 to 25 trees per acre • In connectivity diversity blocks: 12 to 18 trees per acre	None	None	6 to 9 trees per acre depending on vegetation series
Snag Retention	1.1 snags per acre	• In the LSMA: 2 to 6 snags per acre depending on vegetation series • In the TMA: Noncommercial only	• In the LSMA: 2 to 6 snags per acre depending on vegetation series • In the TMA: Noncommercial only	2 to 4 snags per acre depending on vegetation series

Down Wood
(ft./ac. = linear feet per acre)
	120 to 240 ft./ac.	• In the LSMA:
		  • 120 to 240 ft./ac. for stands with QMD > 14 in.
		  • 60 to 120 ft./ac. for stands with QMD ≤ 14 in.
		• In the TMA: Noncommercial only
			• In the LSMA:
			  • 40 to 240 ft./ac. for stands with QMD > 14 in.
			  • 20 to 120 ft./ac. for stands with QMD ≤ 14 in.
			• In the TMA: Noncommercial only
				• In the Western hemlock zone: 240 ft./ac.
				• In the Douglas fir/true fire and Tanoak zones: 120 ft./ac.

Features	No Action Alternative	Alternative 1	Alternative 2	Alternative 3
Salvaging	• Allows salvaging in the LSR reserves when a disturbance is greater then 10 acres • Allows salvaging in the matrix land use allocations for economic purposes	• Allows no salvaging in the LSMA, except to reduce hazards in the wildland urban interface areas • Allows salvaging in the wildland urban interface areas to reduce hazards • Allows salvaging in the TMA for economic purposes	• Allows salvaging in the LSMA for economic purposes with retention of legacy • Allows salvaging in the wildland urban interface areas to reduce hazards • Allows salvaging in the TMA for economic purposes	Allows salvaging for economic purposes with retention of legacy
Zones for Riparian Management Areas	For all fish-bearing streams: 2 site potential tree ht. For all non-fish-bearing streams: 1 site potential tree ht.	For all but intermittent non-fish-bearing streams: 1 site potential tree ht. For intermittent non-fish-bearing streams: 1/2 site potential tree ht.	For all but intermittent non-fish-bearing streams: • 0 to 25 ft. no harvest • 25 to 60 ft. 80% shade retention • 60 to 100 ft. 50% canopy retention For non-debris-flow prone intermittent non-fish-bearing streams: 0 to 25 ft. noncommercial vegetation + 12 tpa For debris-flow prone intermittent streams: • 0 to 25 ft. no harvest • 25 to 100 ft. managing for mature or structurally complex forests	For all but intermittent non-fish-bearing streams: • 0 to 25 ft. no harvest • 25 to 60 ft. 80% shade retention • 60 to 100 ft. 50% canopy retention For all intermittent non-fish-bearing streams: 0 to 25 ft. no harvest
Timber Management of Riparian Management Areas	Manages timber to meet Aquatic Conservation Strategy objectives	Manages timber to promote the development of mature or structurally complex forests	Manages timber to promote the development of mature or structurally complex forests	Manages timber to promote the development of mature or structurally complex forests
Restoration Priority	Key watersheds	Streams with a high intrinsic potential and high-priority populations (per recovery plans)	Streams with a high intrinsic potential and high-priority populations (per recovery plans)	Streams with a high intrinsic potential and high-priority populations (per recovery plans)
Fire and Fuels	• Suppresses all wildfires • Applies treatments to reduce fuel hazards	• Suppresses all wildfires • Applies treatments to reduce fuel hazards	• Suppresses all wildfires • Applies treatments to reduce fuel hazards	• Suppresses all wildfires • Applies treatments to reduce fuel hazards • South of Grants Pass: applies prescription of partial harvest with no final regeneration harvesting
Areas of Critical Environmental Concern	94	92	93	82
Subalternatives	None	1. Allows no harvesting of stands older than 80 years 2. Allows no harvesting of stands older than 200 years of age 3. Allows no regeneration harvesting until thinning opportunities are exhausted 4. Adds all critical habitat of the northern spotted owl to the LSMA	Changes the rotation to emulate the timber industry's practices short rotation	Applies the landscape target of 50% to only those areas where government land ownership (federal, state, and local) is half or more of the total ownership

LSMA = late-successional management area LSR = late-successional reserve QMD = quadratic mean diameter TMA = timber management area

Table 40. Comparison of the key impacts of the four alternatives

Resource		No Action Alternative	Alternative 1	Alternative 2	Alternative 3
Socioeconomics					
Change in Cumulative Jobs (from 8,948 current)		**-3,770**	**-516**	**3,442**	**-1,275**
Annual County Payment ($ million)		42	69	108	52
(percentage of 2005 payment) (%)		37	60	94	45
BLM Annual Budget ($ million)		180	209	246	199
(increase from 2006 Budget) (%)		17	37	60	29
Present Net Value of Timber (in 50 years) ($ million)		108	343	962	46
Timber					
Annual Sale Quantity (ASQ) (mmbf)		268	456	727	471
Annual Non ASQ Volume (mmbf)		87	81	40	2
10 Year Revenues ($ billion)		0.84	1.37	2.16	1.03
Special Forest Products					
Availability		Abundant relative to demand			
Invasive Plants					
Risk of Introduction or Spread		Lowest risk for introduction and spread		Highest risk for introduction	Highest risk for spread
Special Status Species					
Botany - Risk of local extirpation of conifer associates		Low	Moderate		
Botany – Risk of extinction		Low			
Wildlife - Risk of local extirpation for forest floor highly endemic		Low	Slight Increase	Slight Increase	Slight Increase
Wildlife - Risk of local extirpation for (riparian associate)		Low	Low	Slight increase	Slight increase
Wildlife – Risk of extinction		Low			
Wildlife					
MAMU Habitat Creation (Coast Range and Klamath Provinces)	**100 years**	Increases			
	50 years	Increase		Decrease	
NSO Suitable Habitat Creation (>50yrs)		Creates large blocks			No large blocks
Suitable Habitat Outside Blocks (<50 Yrs)		Increases	Maintains	Decreases	N/A
NSO Dispersal Habitat Quantity		Maintains high percentage			
NSO Dispersal Habitat Quality		Increases	Increases	Maintains	Increases

Resource	No Action Alternative	Alternative 1	Alternative 2	Alternative 3
Fish				
Large Wood Contribution	Increases to near maximum in long term		Slightly less, but increases to near maximum in long term	
Potential Fish Productivity (steelhead, chinook, coho)	< 3% change across alternatives			
Water				
Peak Flows	Four sixth-field watersheds susceptible (out of 1,106)			
Temperature	Maintains or improves shade		Maintains or improves shade (except Coquille)	
Fine Sediment	Increases < 1,000 tons/year (358,000 tons/year current)			
Fire and Fuels				
Hazard and Severity (All except Klamath Falls RA	Reduces hazard and severity			
Hazard and Severity (Klamath Falls RA)	Decreases	Increases		Decreases
Resiliency (Medford District and Klamath Falls RA)	Increases resiliency	Reduces resiliency	Reduces resiliency	Increases resiliency
Air				
Quality	Air quality, Class 1 visibility areas, and air quality maintenance areas protected			
Recreation				
Demand and Experiences	Meets recreational demand and improves quality of visitor experiences			
Wilderness Characteristics				
Maintained (%)	63	60	52	53
Visual Resource Management				
Class II Maintained (%)	73	64	55	46
Class III Maintained (%)	69	57	43	39
Soils				
Residual Soil Disturbance in 2016 (acres)	8,400	10,700	10,800	15,300
Soil Productivity	Maintains			
Grazing				
Authorizations (acres)	560,000	418,500 (Reduction: Medford/Klamath Falls = inactive permits/ leases; Coos Bay = 16 acres active leases)		
Forage Production in 2106 (in AUMs)	28,950	19,673	19,867	22,805
Wild Horses				
Herd Management Level	Maintained (and forage increases)			
Areas of Critical Environmental Concern				
Relevant and Important Values Maintained	211 (all)	153	159	137
Cultural				
Number Damaged	≤ 2% of the number of sites damaged per decade			
Energy and Minerals				
Availability and Quantity	Maintains similar levels of availability and quantity of energy and mineral resources			

Tables for Areas of Critical Environmental Concern

The tables in this section provide the number and names of areas of critical environmental concern that would be designated under the alternatives. See *Map 15 (Areas of critical environmental concern within the planning area)* at the end of this chapter. For additional details about the areas of critical environmental concern, see *Appendix M. Areas of Critical Environmental Concern and Research Natural Areas*.

Table 41. Existing and potential areas of critical environmental concern (ACECs) designated by alternative

Designated	No Action Alternative	Alternative 1	Alternative 2	Alternative 3
Number of ACECs	94	92	93	82

Table 42. Areas of critical environmental concern under the alternatives

No. on Map	ACEC Name	Status	Total Area (acres)	Alternative 1	Alternative 2	Alternative 3
Salem District						
1	Beaver Creek	Potential	44	no	no	no
2	Crabtree Complex RNA/ONA	Existing	1,231	yes	yes_without_OC	yes_without_OC
3	Elk Creek	Existing	784	no	yes	no
4	Forest Peak RNA	Existing	155	yes	yes	yes
5	Grass Mountain RNA	Existing	930	yes	yes	yes
6	High Peak - Moon Creek RNA	Existing	1,490	yes	yes	yes
7	Jackson Bend	Existing	15	yes_without_OC	yes_without_OC	yes_without_OC
8	Little Grass Mountain	Existing	80			
9	Little North Fork Wilson River	Potential	1,822	yes	yes_without_OC	yes
10	Little Sink	Existing	81	yes	yes	yes
11	Lost Prairie	Existing	61	yes	yes	yes
12	Lower Scappoose Eagle	Potential	179	yes_without_OC	no	no
13	Marys Peak ONA	Existing	353	yes	yes	no
14	Marys Peak B	Potential	75	yes	yes	yes
15	McCully Mountain	Potential	101	no	no	no
16	Middle Santiam Terrace	Existing	182	yes	yes	yes
17	Mill Creek Ridge	Potential	114	yes	yes	no
18	Molalla Meadows	Potential	205	yes_without_OC	yes_without_OC	yes_without_OC
19	Nestucca River	Existing	1,163	no	yes	no
20	North Santiam	Existing	15	no	no	no

No. on Map	ACEC Name	Status	Total Area (acres)	Alternative 1	Alternative 2	Alternative 3
21	Rickreall Ridge	Existing	368	yes	yes	yes_without_OC
22	Saddleback Mountain RNA	Existing	300	yes	yes	yes
23	Sandy River Gorge ONA	Existing	9,780	yes_without_OC	yes_without_OC	yes_without_OC
24	Sheridan Peak	Existing	310			
25	Silt Creek	Potential	140	yes_without_OC	yes_without_OC	yes_without_OC
26	Snow Peak	Potential	1,667	no	no	no
27	Soosap Meadows	Existing	343	yes	no	no
28	The Butte RNA	Existing	39	yes	yes	yes
29	Valley of the Giants ONA	Existing	1,311	yes	yes	no
30	Walker Flat	Existing	11	yes_without_OC	yes_without_OC	yes_without_OC
31	Waterloo	Potential	9	yes	yes	yes
32	Wells Island	Potential	73	no	no	no
33	White Rock Fen	Existing	55	yes	no	no
34	Wilhoit Springs	Existing	133	no	no	no
35	Williams Lake	Existing	90	no	no	no
36	Yampo	Existing	13	yes	yes	yes
37	Yaquina Head ONA	Existing	91	yes	yes	yes
Eugene District						
38	Camas Swale RNA	Existing	308	yes	yes	yes
39	Coburg Hills RFI	Existing	855	no	no	no
40	Cottage Grove Lake RFI	Existing	15	no	yes	no
41	Cottage Grove Old Growth	Existing	80			
42	Cougar Mountain Yew Grove	Existing	90	no	no	no
43	Dorena Lake RFI	Existing	18	no	no	no
44	Dorena Prairie	Potential	8	yes	yes	yes
45	Esmond Lake	Potential	86	no	yes_without_OC	yes_without_OC
46	Fox Hollow RNA	Existing	159	yes	yes	yes
47	Grassy Mountain	Existing	74	yes_without_OC	yes_without_OC	yes_without_OC
48	Heceta Sand Dunes ONA	Existing	210	yes	yes	yes

No. on Map	ACEC Name	Status	Total Area (acres)	Alternative 1	Alternative 2	Alternative 3
49	Horse Rock Ridge RNA	Existing	378	yes	yes	yes
50	Hult Marsh	Existing	177	yes_without_OC	yes_without_OC	yes_without_OC
51	Lake Creek Falls	Existing	54			
52	Lorane Ponderosa Pine	Potential	104	yes_without_OC	yes_without_OC	yes_without_OC
53	Low Elevation Headwaters of the McKenzie River	Potential	9,765	no	no	no
54	McGowan Meadow	Potential	75	yes_without_OC	yes_without_OC	yes_without_OC
55	Mohawk RNA	Existing	290	yes	yes	yes
56	Oak Basin Prairies	Potential	223	yes_without_OC	yes_without_OC	yes_without_OC
57	Taylor Creek	Potential	155	no	no	no
58	Upper Elk Meadows RNA	Existing	217	yes	yes	yes
59	Willamette Valley Prairie/Oak and Pine Area	Potential	1,486	yes_without_OC	yes_without_OC	yes_without_OC
Roseburg District						
60	Bear Gulch RNA	Existing	351	yes	yes	yes
61	Beatty Creek RNA	Existing	864	yes	yes	yes
62	Bushnell-Irwin Rocks RNA	Existing	1,085	yes	yes	yes
63	Callahan Meadows	Potential	34	yes	yes	yes
64	China Ditch	Potential	60	no	no	no
65	Myrtle Island RNA	Existing	19	yes	yes	yes
66	North Bank	Existing	6,162	yes	yes	yes
67	North Myrtle Creek RNA	Existing	453	yes	yes	yes
68	North Umpqua River	Existing	1,791			
69	Red Pond RNA	Existing	141	yes	yes	yes
70	Stouts Creek	Potential	64	no	no	no
71	Tater Hill RNA	Existing	303	yes	yes	yes
72	Umpqua River Wildlife Area	Existing	855	no	no	no
Coos Bay District						
73	Brownson Ridge	Potential	399	no	no	no
74	Cherry Creek RNA	Existing	592	yes	yes	yes
75	China Wall	Existing	302	yes	yes	yes_without_OC
76	Euphoria Ridge	Potential	241	no	no	no
77	Hunter Creek Bog	Existing	721	yes	yes	yes
78	New River	Existing	876	yes	yes	yes
79	North Fork Chetco	Existing	603	yes	yes	yes

No. on Map	ACEC Name	Status	Total Area (acres)	Alternative 1	Alternative 2	Alternative 3
80	North Fork Coquille River	Existing	311	yes	yes_without_OC	no
81	North Fork Hunter Creek	Existing	1,757	yes	yes	yes
82	North Spit	Existing	682	yes	yes	yes
83	Rocky Peak	Potential	1,827	yes	yes	yes
84	Roman Nose	Potential	205	yes	yes	yes_without_OC
85	Steel Creek	Potential	1,381	yes_without_OC	yes_without_OC	no
86	Tioga Creek	Existing	42	yes	yes	no
87	Upper Rock Creek	Existing	472	yes	no	no
88	Wassen Creek	Existing	3,394	yes	no	no
	Medford District					
89	Baker Cypress	Existing	11	no	no	no
90	Bobby Creek RNA	Existing	1,915	yes	yes	yes
91	Brewer Spruce RNA	Existing	1,707	yes	yes	yes
92	Cobleigh Road	Potential	261	yes_without_OC	yes_without_OC	yes_without_OC
93	Crooks Creek	Existing	147	no	yes	no
94	Dakubetede Wildland	Potential	1,796	yes_without_OC	yes_without_OC	yes_without_OC
95	East Fork Whiskey Creek	Potential	3,188	no	yes	no
96	Eight Dollar Mountain	Existing	1,249	yes	yes	yes
97	French Flat	Existing	651	yes_without_OC	yes_without_OC	yes_without_OC
98	Grayback Glades RNA	Existing	1,022	yes	yes	yes
99	Hole-In-The-Rock	Existing	63	no	no	no
100	Holton Creek RNA	Existing	421	yes	yes	yes
101	Hoxie Creek	Existing	255	no	no	no
102	Iron Creek	Existing	286			
103	Jenny Creek	Existing	966			
104	King Mountain Rock Garden	Existing	68	yes_without_OC	yes_without_OC	yes_without_OC
105	Long Gulch	Potential	1,020	no	no	no
106	Lost Lake RNA	Existing	387	yes	yes	yes
107	Moon Prairie	Existing	92	no	no	no
108	North Fork Silver Creek RNA	Existing	499	yes	yes	yes
109	Oregon Gulch RNA	Existing	1,051	yes	yes	yes
110	Pickett Creek	Potential	32	yes	yes	yes
111	Pilot Rock	Existing	544			
112	Pipe Fork RNA	Existing	516	yes	yes	yes
113	Poverty Flat	Existing	29	yes	yes	yes

No. on Map	ACEC Name	Status	Total Area (acres)	Alternative 1	Alternative 2	Alternative 3
114	Reeves Creek	Potential	117	no	no	no
115	Rough and Ready	Existing	1,189	yes_without_OC	yes_without_OC	yes_without_OC
116	Round Top Butte RNA	Existing	605	yes	yes	yes
117	Scotch Creek RNA	Existing	1,799	yes	yes	yes
118	Sterling Mine Ditch	Existing	143	no	no	no
119	Table Rocks ONA	Existing	1,244	yes	yes	yes
120	Tin Cup	Existing	83	no	no	no
121	Waldo-Takilma	Potential	1,760	yes	yes	yes
122	Woodcock Bog RNA	Existing	265	yes	yes	yes
Klamath Falls Resource Area of the Lakeview District						
123	Bumpheads	Potential	112	yes	yes	yes
124	Four Mile Wetland	Potential	1,173	yes	yes	yes
125	Miller Creek	Existing	939	yes	yes	yes
126	Old Baldy RNA	Existing	355	yes	yes	yes
127	Tunnel Creek	Potential	72	yes_without_OC	yes_without_OC	yes_without_OC
128	Upper Klamath River	Existing	5,092	yes_without_OC	yes_without_OC	yes_without_OC
129	Upper Klamath River Addition	Potential	910	yes_without_OC	yes_without_OC	yes_without_OC
130	Wood River Wetland	Existing	3,225	yes	yes	yes
131	Yainax Butte	Existing	707	yes	yes	yes

Note:
- *yes_without_OC* means that an area would be designated without including the O&C timber harvest base acres.
- The grayed ACECs are those that were not analyzed further for designation under the action alternatives because they did not meet the relevance and importance criteria or did not need special management attention. The management direction for these areas would be the management direction in the current resource management plans, and would only be applied under the No Action Alternative.

Tables for District-Specific Recreation Management Actions

The tables in this section correspond with individual recreation management actions that were presented earlier in this chapter and are organized in this section as follows:

- Recreation
  - Special recreation management areas
  - Extensive recreation management areas
  - Recreation sites
  - Recreation trails
  - Potential recreation sites
  - Potential recreation trails
  - Backcountry byways
  - Potential backcountry byways
  - Environmental education areas
  - Recreation and public purpose leases
  - Off-highway vehicle area designations
  - Areas closed to off-highway vehicle use
  - Off-highway vehicle emphasis areas
  - Potential off-highway vehicle emphasis areas
  - Oregon State scenic waterways
- National Landscape Conservation System designated lands
  - Wild and scenic rivers
  - Wilderness areas
  - Wilderness study areas and wilderness instant study areas
  - Miscellaneous National Landscape Conservation System designated lands

The information in these tables is presented in the order of Salem, Eugene, Roseburg, Coos Bay, Medford (the five western Oregon BLM districts), and Klamath Falls (one of the resource areas of the Lakeview District). See *Maps 10, 11,* and *19* through *26* at the end of this chapter for the location of district-specific recreation areas, sites, and trails.

Note: Some of the names in some of the tables have numbers to their left. These numbers correspond to numbers that are on specified maps that locate the named designations. Only those designations that are common to all of the action alternatives are included on the maps.

Recreation

Special Recreation Management Areas

For the planning frameworks of those special recreation management areas that would be carried forward under all of the action alternatives, see *Appendix J. Recreation*.

Table 43. District-specific special recreation management areas

	Special Recreation Management Areas	No Action Alternative (acres)	All Action Alternatives (acres)
	Salem District		
1	Alsea Falls	N/A	13,270
2	Fishermen's Bend	177	178
3	Little North Santiam River	3,282	3,282
	Marys Peak (potential)	N/A	--
	Mill Creek (potential)	N/A	--
4	Molalla River/Table Rock	11,875	11,875
	Mt. Hood Corridor	2,681	--
5	Nestucca River	1,074	1,074
	North Fork Siletz (potential)	N/A	--
	Sandy River	756	--
6	Sandy River/Mt. Hood Corridor	N/A	11,568
7	Yaquina Head	100	100
8	Yellowstone	38,257	38,261
	Subtotals	**57,445**	**79,608**
	Eugene District		
	Gilkey Creek (potential)	N/A	--
9	Lower Lake Creek	1,873	1,873
10	McKenzie River	1,525	1,226
11	Row River Trail	15,115	171
12	Shotgun Creek	278	413
	Siuslaw River (potential)	N/A	--
13	Upper Lake Creek	12,675	12,676
	Subtotals	**31,446**	**16,359**
	Roseburg District		
14	Cow Creek	1,809	1,809
15	North Umpqua	1,903	8,512
16	Umpqua	2,240	457
	Subtotals	**5,952**	**10,778**

	Special Recreation Management Areas	No Action Alternative (acres)	All Action Alternatives (acres)
	Coos Bay District		
17	Coos Bay Shorelands	1,754	1,754
18	Dean Creek Elk Viewing Area	1,136	1,136
	Gregory Point (potential)	N/A	--
19	Loon Lake	126	126
20	New River	1,133	1,133
21	Sixes River	161	161
22	Tioga	N/A	34,013
	Subtotals	**4,310**	**38,324**
	Medford District		
	Galesville Lake (potential)	N/A	--
23	Hyatt Lake/Howard Prairie Lake	17,765	17,765
	Lost Creek Lake (potential)	N/A	--
24	Pacific Crest National Scenic Trail	7,088	7,088
25	Rogue National Wild and Scenic River	11,510	11,510
	Subtotals	**36,362**	**36,362**
	Klamath Falls Resource Area		
26	Gerber	N/A	104,421
27	Hamaker Mountain	1,286	1,286
28	Pacific Crest National Scenic Trail	500	500
29	Stukel Mountain	11,853	11,853
30	Upper Klamath River	5,766	6,144
31	Wood River Wetland	N/A	3,122
	Subtotals	**22,526**	**127,326**
	Totals	**158,041**	**308,757**

Notes:
- N/A denotes that acres or miles for a designated or potential site, trail, area, or byway were not identified under the No Action Alternative.
- Two dashes (--) denote that a designated or potential site, trail, area, or byway either was not identified under the No Action Alternative or would not be carried forward under the action alternatives.

Extensive Recreation Management Areas

Table 44. District-specific extensive recreation management areas

Extensive Recreation Management Areas		No Action Alternative (acres)	All Action Alternatives (acres)
Salem District			
Cascades		113,640	105,509
Marys Peak		115,543	115,126
Tillamook		102,987	102,988
	Subtotals	**332,170**	**323,623**
Eugene District			
Siuslaw		147,969	147,969
Upper Willamette		137,305	150,888
	Subtotals	**285,274**	**298,857**
Roseburg District			
South River		201,120	201,119
Swiftwater		221,027	214,419
	Subtotals	**422,147**	**415,538**
Coos Bay District			
Myrtlewood		122,103	110,763
Umpqua		195,764	173,089
	Subtotals	**317,867**	**283,852**
Medford District			
Ashland		213,977	213,977
Butte Falls		203,761	203,761
Glendale		186,499	186,499
Grants Pass		227,627	227,627
	Subtotals	**831,864**	**831,864**
Klamath Falls Resource Area			
Klamath Falls		208,138	97,571
	Subtotals	**208,138**	**97,571**
	Totals	**2,397,460**	**2,251,305**

Recreation Sites

Table 45. District-specific recreation sites

	Recreation Sites	No Action Alternative (acres)	All Action Alternatives (acres)
	Salem District		
1	Alder Glen Campground and Day-Use Area	3	3
2	Alsea Falls Campground and Day-Use Area	25	25
3	Canyon Creek Day-Use Area	4	4
4	Dogwood Day-Use Area	11	11
5	Dovre Campground and Day-Use Area	3	3
6	Elk Bend Campground and Day-Use Area	3	3
7	Elk Flat OHV Staging Area	1	1
8	Elkhorn Valley Campground and Day-Use Area	78	78
9	Fan Creek Campground and Day-Use Area	1	1
10	Fishermen's Bend Campground and Day-Use Area	177	177
11	Grassy Flat OHV Staging Area	1	1
12	Hardy Creek Trail Head	3	3
13	Mill Creek Day-Use Area	5	5
14	Missouri Bend Day-Use Area	2	2
15	Old Miner's Meadow Group Use Area	2	2
16	Sheridan Peak Day-Use Area	1	1
17	Whipup OHV Staging Area	1	1
18	Wildwood Day-Use Area	556	556
19	Yaquina Head Day-Use Area	90	90
20	Yellowbottom Campground and Day-Use Area	13	13
	Subtotals	**980**	**980**
	Eugene District		
21	Clay Creek Campground	48	48
22	Culp Creek Trailhead	1	1
23	Lake Creek Falls Day Use Area	2	2
24	Lake Creek Falls Trailhead	1	1
25	Marten Rapids Day-Use Area	18	18
26	Mosby Creek Trailhead	6	6
27	Rennie Landing	1	1
28	Sharps Creek Campground	27	27
29	Shotgun Creek Day-Use Area	278	278
30	Silver Creek Landing Day Use Area	2	2
31	Taylor Landing Day-Use Area	4	4
32	Whitewater Day-Use Area	10	10
33	Whittaker Creek Campground	16	16
	Subtotals	**414**	**414**

	Recreation Sites	No Action Alternative (acres)	All Action Alternatives (acres)
	Roseburg District		
34	Cavitt Creek Falls	16	16
35	Cow Creek BCBW Kiosk	1	1
36	Cow Creek Recreational Gold Panning Area	19	19
37	Cow Creek Salmonid WWS	1	1
38	Eagleview Group Campground	11	11
	E-Mile Recreation Site	15	--
39	Hill Creek Wayside	1	1
40	Island Creek Day-Use Area	40	40
41	Lone Pine Group Campground	23	23
42	Lone Rock Drift Boat Launch	1	1
43	Millpond	33	33
44	Miner-Wolf Watchable Wildlife Site	5	5
45	North Bank Ranch, Jackson Creek Day-Use Area	2	2
46	North Bank Ranch, West Entrance	1	1
47	Osprey Boat Ramp	4	4
48	Rock Creek	21	21
49	Scaredman	13	13
50	Susan Creek Campground	27	27
51	Susan Creek Day-Use Area	19	19
52	Swiftwater Day-Use Area	5	5
53	Swiftwater Trailhead	8	8
54	Tyee	13	13
55	Wolf Creek Falls Trailhead	3	3
	Subtotals	**282**	**267**
	Coos Bay District		
56	Bear Creek Campground	80	80
	Big Tree Recreation Site	18	--
57	Burnt Mountain Campground	38	38
58	Cape Blanco Lighthouse (under permit from the US Coast Guard)	35	35
59	Dean Creek Elk Viewing Area	1,136	1,136
60	East Shore Campground	52	52
61	Edson Creek Campground	46	46
62	Fawn Creek Campground	5	5
63	Loon Lake Campground	76	76
64	North Spit Boat Ramp	24	24
	Palmer Butte	40	--
65	Park Creek Campground	58	58
66	Sixes River Campground	162	162
67	Smith River Falls Campground	47	47
68	Storm Ranch Day-Use Area	240	240
69	Vincent Creek Campground	4	4
	Subtotals	**2,061**	**2,003**

	Recreation Sites	No Action Alternative (acres)	All Action Alternatives (acres)
	Medford District		
70	Burma Pond Campground	15	15
71	Eight Dollar Mountain Wayside and Campground	20	20
72	Elderberry Flat Campground and Day-Use Area	80	80
73	Gold Nugget	53	53
74	Hyatt Lake Campground and Day-Use Area (partially within the Cascade Siskiyou National Monument)	745	745
75	Kenney Meadows	40	40
76	Little Hyatt Lake Day-Use Area	2	2
77	Mt. Bolivar Trailhead	2	2
78	Skull Creek Campground and Day-Use Area	5	5
79	Table Mountain Winter Play Area	10	10
80	Tucker Flat Campground and Day-Use Area	20	20
81	Woodrat Mountain Day-Use Area	20	20
	Subtotals	**1,012**	**1,012**
	Klamath Falls Resource Area		
82	Antelope Reservoir Day Use	2	2
83	Barnes Valley Boat Ramp	6	6
84	Basin Camp	11	11
85	Frain Ranch Campsites	310	310
86	Gerber Potholes Campsite	112	112
87	Gerber Recreation Site	496	496
88	Kilgore Reservoir Day Use	2	2
89	Klamath River Campground	33	33
90	Klamath River Spring Island Boat Launch Site	6	6
91	Lower Klamath Hills Day-Use Area	2	2
92	Miller Creek Campsite	9	9
93	Miller Creek Day Use	2	2
94	Pitchlog Creek Campsite	10	10
95	Rock Creek Campsite	1	1
96	Round Valley Day Use	2	2
97	Stan H. Spring Campsite	19	19
98	Stateline Boat Takeout	13	13
99	Surveyor Recreation Site	9	9
100	Topsy Campground	14	14
101	Twenty-One Reservoir Day Use	2	2
102	Upper Midway Campsite	12	12
103	Wildhorse Campsite	7	7
104	Willow Valley Reservoir Boat Ramp	27	27
105	Wood River Wetland Day-Use Area	3,200	3,200
	Subtotals	**4,307**	**4,307**
	Totals	**9,056**	**8,983**

Note: Two dashes (--) denote that a designated or potential site, trail, area, or byway either was not identified under the No Action Alternative or would not be carried forward under the action alternatives.

Recreation Trails

Table 46. District-specific recreation trails

	Recreation Trails	No Action Alternative (miles)	All Action Alternatives (miles)
	Salem District		
1	Alsea Falls Trail	4.0	4.0
2	Baty Butte/Silver King Trail	3.4	3.4
3	Boulder Ridge Trail	0.2	0.2
4	Eagle Creek Trail	0.5	0.5
5	McIntyre Ridge Trail	0.7	0.7
6	Molalla River Trails	24.6	24.6
7	Nasty Rock Trail	0.9	0.9
8	Table Rock Wilderness Trails	20.4	20.4
9	Upper Nestucca OHV Trail System	25.0	25.0
10	Valley-of-the-Giants Trail	0.8	0.8
	Subtotals	**80.5**	**80.5**
	Eugene District		
11	Clay Creek Trail	0.6	0.6
12	Eagles' Rest Trail	0.2	0.2
13	Lake Creek Falls Trail	0.2	0.2
14	Row River Trail	13.5	13.5
15	Shotgun Creek Trails	6.2	6.2
16	Shotgun (OHV) Trails	23.2	23.2
17	Tyrrell Forest Succession Trail	1.0	1.0
18	Whittaker Creek Old Growth National Recreation Trail	1.0	1.0
	Subtotals	**45.9**	**45.9**
	Roseburg District		
19	China Ditch Trail	0.4	0.4
20	Miner-Wolf Creek WW Trail	0.2	0.2
21	North Umpqua Trail	12.3	12.3
22	Sawmill Trail	1.2	1.2
23	Susan Creek Complex Trails	0.8	0.8
24	Susan Creek Day-Use Trail	0.8	0.8
25	Susan Creek Falls Trail	0.8	0.8
26	Susan Creek Indian Mounts Trail	0.3	0.3
27	Wolf Creek Falls Trail	1.2	1.2
	Subtotals	**18.0**	**18.0**

Table continues on the next page.

	Recreation Trails	No Action Alternative (miles)	All Action Alternatives (miles)
	Coos Bay District		
28	Blue Ridge	10	10
29	Doerner Fir	0.5	0.5
30	Euphoria Ridge	4	4
31	Floras Lake	1	1
32	Fourmile Creek	0.3	0.3
33	Loon Lake Waterfall	0.5	0.5
34	Lost Lake	1	1
35	New River/Storm Ranch	2	2
36	New River Water Trail	5	5
37	North Fork Hunter Creek	2	2
38	North Spit	9	9
	Subtotals	**35.3**	**35.3**
	Medford District		
39	Armstrong Gulch	1	1
40	Buck Prairie Cross Country Ski/Snowmobile Trails	17	17
41	Grayback Mountain	6.5	6.5
42	Grizzly Peak	5	5
43	Hidden Creek	1	1
44	Jacksonville Historic Landmark	5	5
45	Kelsey Pack	3	3
46	Kerby Peak	8	8
47	Listening Tree	1	1
48	London Peak Accessible	1	1
49	Lower London Peak Trail	2	2
50	Lower Table Rock	2	2
51	Mt. Bolivar	1.5	1.5
52	Mule Creek	3	3
53	Pacific Crest National Scenic Trail	40	40
54	Sterling Mine Ditch	10	10
55	Tunnel Ridge	41	41
56	Upper Table Rock	2	2
57	Wolf Gap	4	4
	Subtotals	**154**	**154**

Table continues on the next page.

	Recreation Trails	No Action Alternative (miles)	All Action Alternatives (miles)
	Klamath Falls Resource Area		
58	Gerber-Miller Creek-Potholes Trail	13	13
59	Keno Spencer Snowmobile Trail	6	6
60	Pacific Crest National Scenic Trail	1	1
61	Pederson Snowmobile Trail	7	7
62	Rock Slide Loop Snowmobile Trail	5	5
63	Surveyor Peak Snowmobile Trail	3	3
64	Wood River Wetland Trail	1	1
	Subtotals	**35**	**35**
	Totals	**368.7**	**368.7**

Potential Recreation Sites

Table 47. District-specific potential recreation sites

	Potential Recreation Sites	No Action Alternative (acres)	All Action Alternatives (acres)
	Salem District		
1	Alder Glen Expansion	--	1
2	Alsea Falls Expansion	--	96
3	Barlow	--	115
	Bear Creek	N/A	--
	Dick's Ridge	N/A	--
4	Marmot	--	155
5	Molalla River	--	86
	Parker Creek	N/A	--
	Quartzville Creek	N/A	--
	Valley of the Giants Trailhead	N/A	--
	Subtotals	**N/A**	**453**
	Eugene District		
6	Deer Creek	--	10
	Doe Creek	N/A	--
	Edwards Creek	N/A	--
	Esmond Lake	N/A	--
	Fall Creek	N/A	--
	Fall Creek Reservoir	N/A	--
	Frying Pan	N/A	--
	Haight Creek	N/A	--
7	Heceta Sand Dunes Day-Use Area	N/A	1
	Homestead	N/A	--
8	Hult Pond Campground	N/A	11
9	Hult Pond Day-Use Area	N/A	2
10	Lower Lake Creek Day-Use Area	N/A	3
	North Fork Gate Creek	N/A	--
11	Old Rennie Homestead	--	12
	Overland Trailhead	N/A	--
	Oxbow	N/A	--
	Red Bridge Trailhead	N/A	--
	Saleratus	N/A	--
	Sidog	N/A	--
	Siuslaw Bend	N/A	--
	Wolf Creek Falls	N/A	--
	Subtotals	**N/A**	**39**

Table continues on the next page.

	Potential Recreation Sites	No Action Alternative (acres)	All Action Alternatives (acres)
	Roseburg District		
	Brickyard Pond	N/A	--
	Chimney Rock Pond	N/A	--
12	Chimney Rock Viewpoint Wayside	--	2
13	Doc's Landing Day-Use Area and Boat Ramp	--	11
	Hardscrabble	N/A	--
14	Hubbard Creek OHV Staging Area	--	10
15	Iron Mountain Gold Panning Site	--	40
	Lavadoure Boat Ramp	N/A	--
	Michigan Springs	N/A	--
16	North Umpqua Trail Primitive Campsite	--	4
	Olalla-Thompson Creek	N/A	--
17	Pickett Bridge	--	10
	Red Top Pond	N/A	--
18	South River OHV Trailhead	--	5
19	Susan Creek Group Campground	--	10
20	Swiftwater OHV Trailhead	--	5
21	Tioga Bridge / Wayside / Trailhead	--	25
22	Upper Susan Creek Falls Trailhead	--	6
	Weaver Road Pond	N/A	--
	Subtotals	**N/A**	**128**
	Coos Bay District		
23	Big Bend	N/A	200
	East Fairview Boat Ramp	N/A	--
24	Fawn Creek Boat Ramp	N/A	11
25	McKinley Camp	N/A	10
	Smith River Falls Boat Ramp	N/A	--
26	Smith River Log Dump	N/A	5
	South Sisters Rock	N/A	--
27	Spruce Reach Island Day Use Area	--	15
28	Tioga Basin	N/A	30
	Umpqua Lighthouse	N/A	--
	Vincent Creek Boat Ramp	N/A	--
	Subtotals	**N/A**	**271**

Table continues on the next page.

	Potential Recreation Sites	No Action Alternative (acres)	All Action Alternatives (acres)
	Medford District		
29	Cold Springs	N/A	10
30	Galesville Reservoir	N/A	40
31	Illinois River Extension	N/A	40
32	Little Applegate Day-Use Area	--	20
33	North Fork Big Butte Creek	N/A	20
34	Riffle Creek	N/A	5
35	Sensinig Falls	N/A	40
36	Shady Branch	N/A	40
37	Skookum Creek Wayside	N/A	5
	Subtotals	**N/A**	**220**
	Klamath Falls Resource Area		
38	Alkali Springs Day Use	--	2
39	Bryant Mountain Horse Camp	2	2
40	Captain Jack Lake Camp	3	2
41	Clover Creek Day Use	30	2
42	Dog Hollow Reservoir Day Use	2	2
	Greensprings Highway Day Use	20	--
43	Hamaker Mountain Snow Park Day Use	30	2
44	Harpold Reservoir Camp	2	2
45	Hogback Mountain Day Use	10	1
46	Horton Rim Trailhead	--	2
47	Klamath River Bypass Reach Fishing Access # 5 and # 6 Day Use	--	4
48	Klamath River Powerhouse Shed Fishing Site Day Use	--	2
49	Malone Dam Day Use	--	2
50	Old Foundations Area Day Use	5	4
51	Smith Reservoir Camp	3	2
52	South Gerber Boat Ramp Day Use	--	1
53	Spencer Creek Day Use	20	1
54	Stukel Mountain Aspen Grove Camp	10	2
55	Stukel Mountain Glider Launch Day Use	5	2
56	Stukel Mountain Target Practice Day Use	20	2
57	Swan Lake Rim Trail Access	5	2
58	Van Meter Reservoir Camp	10	2
	Subtotals	**177**	**43**
	Totals	**N/A**	**1,154**

Notes:
- N/A denotes that acres or miles for a designated or potential site, trail, area, or byway were not identified under the No Action Alternative.
- Two dashes (--) denote that a designated or potential site, trail, area, or byway either was not identified under the No Action Alternative or would not be carried forward under the action alternatives.

Potential Recreation Trails

Table 48. District-specific potential recreation trails

	Potential Recreation Trails	No Action Alternative (miles)	All Action Alternatives (miles)
	Salem District		
1	Baty Butte/Silver King Trail Expansion	--	8.2
2	Corvallis-to-Sea Trail	--	1.6
3	Crabtree Mountain	--	12.8
4	CZ Mainline Linear Trail	--	1.0
5	Dovre Trail	--	0.1
	Elkhorn Creek Trails	N/A	--
6	Equestrian Trail	--	5.3
	Harry Mountain Trail	N/A	--
7	Jane Creek Trail	--	2.8
	Marys Peak Trail	N/A	--
8	Molalla Trails Expansion	--	2.5
9	Nestucca River Trail	--	7.8
	North Fork Alsea River Trail	N/A	--
10	Robb Mill Trail	--	3.1
11	Wilhoit Springs Trails	--	2.6
	Subtotals	**N/A**	**47.8**
	Eugene District		
12	Blue Mountain	N/A	0.8
13	Blue Mountain Trail	--	0.8
14	Hult Pond Equestrian Trails	N/A	7.2
15	Shotgun OHV Additions	N/A	3.1
	Siuslaw River Trail	N/A	--
16	South Bank McKenzie	N/A	5.1
17	Whittaker Creek Falls	N/A	1.5
	Subtotals	**N/A**	**18.5**

Table continues on the next page.

	Potential Recreation Trails	No Action Alternative (miles)	All Action Alternatives (miles)
	Roseburg District		
	Alexander Butte Trail	N/A	--
	Ben Irving Reservoir Trail	N/A	--
	Bushnell-Irwin Rocks Trail	N/A	--
	Cougar Creek Trail	N/A	--
	Cow Creek Bluffs Trail	N/A	--
	Deadman Mountain Trail	N/A	--
18	Eagleview to Tyee Trail	--	1
19	Millpond to Rock Creek Trail	--	2
	Red Top Pond Trail	N/A	--
	Salt Creek Trail	N/A	--
	Tyee Mountain Trail	N/A	--
20	Upper Susan Creek Falls Trail	--	1
	Wolf Creek Falls Tr. Extension	N/A	--
	Subtotals	**N/A**	**4**
	Coos Bay District		
21	Bear Creek Extension	--	3
22	Brummit Creek Trail System	--	10
23	Coos Head	N/A	3
24	Coos Head Trail System	--	3
25	Doerner Fir Extension	--	1
26	Hunter Creek Bog	N/A	1
27	McKinley Camp	N/A	1
28	Rocky Peak Trail	--	6
29	Roman Nose/Kentucky Creek	N/A	6
30	Upper Rock Creek	N/A	2
31	Wassen Creek	N/A	5
	Subtotals	**N/A**	**41**

Table continues on the next page.

	Potential Recreation Trails	No Action Alternative (miles)	All Action Alternatives (miles)
	Medford District		
32	Bald Ridge	N/A	2.5
33	Buck Rock-Berry Rock Loop	N/A	10
34	Galesville	N/A	8
35	Green top Loop	N/A	10
36	Kelsey Pack Trail Extension	N/A	2.5
37	King Mountain	N/A	1
38	Lake Selmac Loop	N/A	11
39	London Peak-Grave Creek	N/A	3
40	Medco Railroad (Eagle Point-Butte Falls)	N/A	50
41	Round Top Mountain	N/A	5
42	Upper Mule Creek	N/A	2
	Subtotals	**N/A**	**105**
	Klamath Falls Resource Area		
43	Applegate National Historic Trail	2	0.7
	Barnes Valley Creek	3	--
44	Bryant Mountain	16	10.4
45	Chase Mountain	13	6.1
	Clover Creek	0.5	--
46	Gerber-O.C.E. Trail	--	1.7
	Gerber Point	2.5	--
47	Gerber Potholes	4.5	5.4
48	Gerber Reservoir Loop Trail	--	18.2
49	Hamaker Mountain	5	5.1
50	Hogback Mountain Loop Trail	--	8.0
51	Horton Rim Trail	--	16.5
52	J.C. Boyle Reservoir-Keno Trail	--	0.2
	Klamath River Edge Trail	2.5	--
53	Lower Klamath Hills Trail	--	5.0
54	Old Baldy Trail	3.5	2.3
55	Spencer Creek	2	3.4
56	Stukel Mountain	--	6.1
57	Stukel Mountain OHV Trail	9	12.9
58	Surveyor Mountain/Johnson Creek	3	1.4
59	Swan Lake Rim	14	18.2
60	Upper Klamath River Trail (north side)	8.5	1.0
61	Upper Klamath River Trail (south side)	10	14.8
	Subtotals	**99**	**137.4**
	Totals	**N/A**	**353.7**

Notes:
- N/A denotes that acres or miles for a designated or potential site, trail, area, or byway were not identified under the No Action Alternative.
- Two dashes (--) denote that a designated or potential site, trail, area, or byway either was not identified under the No Action Alternative or would not be carried forward under the action alternatives.

Backcountry Byways

Table 49. District-specific backcountry byways

	Backcountry Byways	No Action Alternative (miles)	All Action Alternatives (miles)
	Salem District		
1	Nestucca River	29	29
2	Quartzville	12.5	12.5
3	South Fork Alsea River	11	11
	Subtotals	**52.5**	**52.5**
	Eugene District		
	No backcountry byways		
	Roseburg District		
4	Cow Creek	20	20
5	North Umpqua National Scenic Byway	8.4	8.4
	Subtotals	**28.4**	**28.4**
	Coos Bay District		
	No backcountry byways		
	Medford District		
6	Galice-Hellgate	15	15
7	Grave Creek-Marial	33	33
	Subtotals	**48**	**48**
	Klamath Falls Resource Area		
	No backcountry byways		
	Totals	**128.9**	**128.9**

Potential Backcountry Byways

Table 50. District-specific potential backcountry byways

	Potential Backcountry Byways	No Action Alternative (miles)	All Action Alternatives (miles)
	Salem District		
	No potential backcountry byways		
	Eugene District		
	Alsea	N/A	--
	Blue Mountain	N/A	--
8	Calapooya Divide	28.0	28.0
9	Coburg Hills	43.4	43.4
10	Lost Creek	19.7	19.7
11	Mill Pond	10.7	10.7
	Oxbow	N/A	--
12	Siuslaw River	25.3	25.3
	Whittaker Creek Area	N/A	--
	Subtotals	**127.1**	**127.1**
	Roseburg District		
	Coos Bay Wagon Road	N/A	--
	Loon Lake	N/A	--
	Smith River	N/A	--
	Subtotals	**N/A**	**0**
	Coos Bay District		
	Coos Bay Wagon Road	N/A	--
	Mill Creek/Loon Lake/Tyee	N/A	--
	Myrtlepoint to Sitkum Road	N/A	--
	Smith River Road	N/A	--
	South Sisters-Oxbow Access Road	N/A	--
	Subtotals	**N/A**	**0**
	Medford District		
13	Cow Creek-West Fork Evans Creek Road	N/A	40
14	Hyatt Lake-Howard Prairie Lake	N/A	10
15	Lower Cow Creek Road	N/A	18
16	McKee Bridge-Anderson Butte	N/A	16
17	Shale City	N/A	10
18	West Fork Cow Creek-Eden Valley	N/A	23
19	Williams-Selma	N/A	20
	Subtotals	**N/A**	**137**

Table continues on the next page.

	Potential Backcountry Byways	No Action Alternative (miles)	All Action Alternatives (miles)
	Klamath Falls Resource Area		
*	Gerber Area Watchable Wildlife Tour/Modoc Trail	30	28.8
*	Topsy Road	15	5.9
	Subtotals	**45**	**34.7**
	Totals	**172.1**	**298.8**

Notes:
- N/A denotes that acres or miles for a designated or potential site, trail, area, or byway were not identified under the No Action Alternative.
- Two dashes (--) denote that a designated or potential site, trail, area, or byway either was not identified under the No Action Alternative or would not be carried forward under the action alternatives.
- Asterisk (*) denotes that these potential backcountry byways are not included on the map due to missing GIS spatial data.

Environmental Education Areas

Table 51. District-specific environmental education areas

Environmental Education Areas	No Action Alternative (acres)	All Action Alternatives (acres)
Salem District		
Aquila Vista	178	178
Larch Mountain	183	183
Subtotals	**361**	**361**
Eugene District		
Cottage Grove Old Growth	437	437
McGowan Creek	79	79
Subtotals	**516**	**516**
Roseburg District		
No environmental education areas		
Coos Bay District		
Dean Creek Elk Viewing Area	--	1,136
New River ACEC	--	1,356
Powers	70	70
Subtotals	**70**	**2,562**
Medford District		
Eight Dollar Mountain	20	20
Upper and Lower Table Rocks	80	80
Subtotals	**100**	**100**
Klamath Falls Resource Area		
Clover Creek	6	6
Surveyor Forest	192	192
Subtotals	**198**	**198**
Totals	**1,245**	**3,737**

Note: Two dashes (--) denote that a designated or potential site, trail, area, or byway either was not identified under the No Action Alternative or would not be carried forward under the action alternatives.

Recreation and Public Purpose Leases

Table 52. District-specific recreation and public purpose leases

R&PP Leases	No Action Alternative (acres)	All Action Alternatives (acres)
Salem District		
JJ Collins Memorial Park (Columbia County)	2	2
Little North Fork (Marion County)	11	11
Oxbow (Multnomah County)	279	279
Scaponia (Columbia County)	5	5
Silver Falls State Park (State of Oregon)	230	230
Wells Island (Polk County)	73	73
Subtotals	**600**	**600**
Eugene District		
McKercher Park (Linn County)	2	2
Willamette River Greenway (Oregon State Parks)	3	3
Subtotals	**5**	**5**
Roseburg District		
E-Mile County Park (Douglas County)	NA	15
Richard Baker County Park (Douglas County)	7.5	7.5
Subtotals	**7.5**	**22.5**
Coos Bay* District		
Frona Park (Coos County)	80	80
Judge Hamilton Park (Coos County)	88	88
Laverne County Park (Coos County)	120	120
Middle Creek Park (Coos County)	78	78
Rock Prairie Park (Coos County)	160	160
Subtotals	**526**	**526**
*Recreational leases with Coos County were established prior to the R&PP Act as congressional withdrawals to Coos County for recreational purposes and are termed congressionally designated recreation withdrawals.		
Medford District		
Cantrall-Buckley Park (Jackson County)	12.1	12.1
Cathedral Hills (Josephine County)	400	400
Gold Ray Dam (Jackson County)	4.2	4.2
Illinois River Park (Oregon Department of Transportation)	80	80
Pinehurst School (Jackson County School District 94)	11.2	11.2
Subtotals	**507.5**	**507.5**
Klamath Falls Resource Area		
No R&PP leases		
Totals	**1,646**	**1,661**

Note: N/A denotes that acres or miles for a designated or potential site, trail, area, or byway were not identified under the No Action Alternative.

Off-Highway Vehicle Area Designations

Table 53. District-specific off-highway vehicle area designations

Off-Highway Vehicle Area Designations	No Action Alternative (acres)	All Action Alternatives (acres)
Salem District		
Open	160,614	0
Limited to existing roads and trails	48,771	0
Limited to existing roads and designated trails	87,144	0
Limited to designated roads and trails	16,192	291,969
Limited to designated roads	69,508	85,165
Closed	17,197	26,208
Eugene District		
Open (portion of Heceta Dunes)	0	77
Limited to existing roads and trails	320,883	0
Limited to designated roads and trails	0	308,595
Closed	3,547	5,187
Roseburg District		
Open	0	0
Limited to existing roads and trails	416,560	0
Limited to designated roads and trails	6,731	415,658
Closed	3,283	10,643
Coos Bay District		
Open	0	0
Limited to designated roads and trails	318,676	318,674
Closed	3,489	3,489
Medford District		
Open	139,878	0
Limited to existing roads and trails	26,514	0
Limited to designated roads and trails	661,357	825,188
Closed	46,371	42,298
Klamath Falls Resource Area		
Open	29,902	0
Limited to existing roads and trails	137,154	0
Limited to designated roads and trails	47,222	213,747
Closed	10,702	10,970
All Western Oregon BLM Lands		
Open	330,394	77
Limited to existing roads and trails	949,882	0
Limited to existing roads and designated trails	87,144	0
Limited to designated roads and trails	1,050,178	2,373,831
Limited to designated roads	69,508	85,165
Closed	84,589	98,795

Areas Closed to Off-Highway Vehicle Use

Table 54. District-specific areas closed to off-highway vehicle use

Closed (areas closed to off-highway vehicle use)	**No Action Alternative** (acres)	**All Action Alternatives** (acres)
Salem District		
Alsea Falls East Elk Emphasis Areas	0	520
Bummer Ridge Elk Emphasis Areas	0	3,566
Carolyn's Crown ACEC/RNA	229	229
Elk Creek ACEC	1,936	0
Forest Peak ACEC	142	142
Grass Mountain ACEC	698	705
Hunter/Church Creek Area	0	2,267
Larch Mountain EEA	183	0
Little Grass Mountain ACEC	44	44
Little Sink ACEC	80	80
Lost Prairie ACEC	61	0
Middle Santiam ACEC/ONA	94	96
Miscellaneous Recreation Sites (Alter Glen, Dove Creek, and Fan Creek)	7	0
Molalla River Non-Motorized Trail System	3,132	2,692
Moon Creek ACEC	1,582	1,493
Mt. Hood Corridor and Bull Run Watershed Management Unit	0	2,660
North Santiam ACEC	45	15
Pacific City	75	75
Progeny Test Sites	211	793
Raymond Creek Bald Eagle Roost Area	278	0
Rickreall Ridge ACEC	178	179
Saddleback Mountain ACEC	0	153
Sandy River Gorge ACEC/RNA	392	392
Skunk Creek Elk Emphasis Areas	660	690
Soosap Meadows ACEC	343	343
Table Rock Wilderness	6,351	6,613
The Butte ACEC	40	40
Valley of the Giants ACEC	153	55
Valsetz-Luckiamute CTMA Elk Emphasis Areas	0	1,981
White Rock Fen	51	51
Wilhoit Springs ACEC	132	132
Willamette River Parcels	0	89
Williams Lake ACEC	100	100
Yampo ACEC	0	13
Subtotals	**17,197**	**26,208**

Table continues on the next page.

Closed (areas closed to off-highway vehicle use)	**No Action Alternative** (acres)	**All Action Alternatives** (acres)
Eugene District		
Camas Swale ACEC/RNA	313	0
Cannery Dune	36	40
Coburg Hills Relic Forest Island ACEC	803	857
Collard Dune	40	36
Cottage Grove Lake ACEC	54	16
Cottage Grove Old Growth EEA (portion)	76	0
Cougar Mountain Yew Grove ACEC	90	90
Dorena Lake ACEC	19	19
Dorena Prairie ACEC	8	8
Esmond Lake ACEC	0	86
Fox Hollow RNA	161	161
Grassy Mountain ACEC	74	74
Heceta Sand Dunes ACEC (portion)	210	133
Horse Rock Ridge RNA	378	378
Hult Marsh ACEC	167	177
Lorane Ponderosa Pine ACEC	105	105
McGowan Creek EEA	79	79
McGowan Meadow ACEC	0	75
Mohawk RNA	290	290
Oak Basin ACEC	0	226
Row River Trail	143	0
Shotgun Creek SRMA	278	414
Taylor Creek ACEC	0	157
Upper Elk Meadows RNA	223	223
Willamette Valley Prairie, Oak, and Pine Proposed ACEC	0	1,543
Subtotals	**3,547**	**5,187**
Roseburg District		
Bear Gulch ACEC	347	347
Beatty Creek ACEC	172	865
Bushnell-Irwin Rocks ACEC	1,086	1,086
Myrtle Island ACEC	27	27
North Bank Habitat Management Area	0	6,608
North Myrtle Creek ACEC	453	453
Miscellaneous Recreation Trails (North Umpqua, Rock Creek, Susan Creek, and Wolf Creek Falls)	19	19
Progeny Test Sites	729	0
Red Ponds ACEC	146	146
Tater Hill ACEC	303	303
Umpqua River Wildlife Area (Brad's Creek, Cougar Creek, Golden Bar, Lost Creek, Marin Creek, Woodruff Mountain)	0	789
Subtotals	**3,282**	**10,643**

Table continues on the next page.

Closed (areas closed to off-highway vehicle use)	**No Action Alternative** (acres)	**All Action Alternatives** (acres)
Coos Bay District		
Cherry Creek RNA & ISA	564	564
China Wall ACEC	204	204
Dean Creek Elk Viewing Area (portion)	1,084	1,084
New River ACEC (portion)	897	897
North Spit Snowy Plover Habitat Restoration Areas	68	68
Powers Environmental Education Area	69	69
Progeny Test Sites & Seed Orchards	565	565
Tioga Creek ACEC (portion)	38	38
Subtotals	**3,489**	**3,489**
Medford District		
Bobby Creek RNA	1,915	1,915
Brewer Spruce Wilderness Instant Study Area	1,705	1,705
Eight Dollar Mountain EEA	43	43
Grayback Glades RNA	1,019	1,019
Holton Creek RNA	421	421
Lost Lake RNA	0	387
North Fork Silver Creek RNA	499	499
Old Baldy RNA	29	919
Oregon Gulch RNA	1,051	1,051
Pacific Crest National Scenic Trail Corridor	3,199	2,310
Pilot Rock ACEC	320	320
Pipe Fork RNA	517	517
Rogue Wild and Scenic River Corridor (wild and recreational sections)	15,951	11,502
Round Top Butte RNA	606	606
Scotch Creek RNA	1,800	1,800
Soda Mountain Wilderness Study Area	6,107	6,106
Sterling Mine Ditch Trail Corridor	143	143
Table Mountain Winter Snow Play Area	11	11
Table Rocks ACEC	1,244	1,244
Table Rocks EEA	40	40
Wetland areas	880	880
Wild Rogue Wilderness Area	8,607	8,596
Woodcock Bog RNA	264	264
Subtotals	**46,371**	**42,298**
Klamath Falls Resource Area		
Clover Creek	27	27
Gerber Reservoir (Barnes Valley, Ben Hall, and Pitch Log creeks)	3,859	3,943
Klamath Hills Wildlife Area	1,636	1,636
Miller Creek ACEC	792	792
Old Baldy RNA/Pacific Crest National Scenic Trail	526	526
Spencer Creek	80	264
Willow Valley/Antelope Creek	582	582

Closed (areas closed to off-highway vehicle use)		**No Action Alternative** (acres)	**All Action Alternatives** (acres)
Wood River Wetland		3,200	3,200
	Subtotals	**10,702**	**10,970**
	Totals	**84,588**	**98,795**

Notes: Some of the areas of critical environmental concern (ACECs) listed in the table actually vary by alternative. Only those areas carried forward under the selected alternative would be closed to off-highway vehicle use. For those that are not carried forward, off-highway vehicle use would be limited to designated roads and trails.

Off-Highway Vehicle Emphasis Areas

Table 55. District-specific off-highway vehicle emphasis areas

Off-Highway Vehicle Emphasis Areas	**No Action Alternative** (acres)	**Alt. 1** (acres)	**Alt. 2** (acres)	**Alt. 3** (acres)
Salem District				
1 Upper Nestucca	13,500	9,579	9,579	9,579
Eugene District				
2 Shotgun Creek	6,874	8,090	8,090	8,090
Roseburg District				
3 Hubbard Creek	12,041	12,041	12,041	12,041
Coos Bay District				
4 Blue Ridge	--	1,609	1,609	1,609
Medford District				
5 Anderson Butte	--	--	11,742	--
6 Coyote Creek	--	--	14,597	--
7 East Howard	--	--	6,812	--
8 Elderberry Flats	--	--	3,393	--
9 Elliot Creek	--	--	3,931	--
10 Ferris Gulch	2,200	--	2,222	--
11 Illinois Valley	--	--	4,681	--
12 Lake Creek	--	--	8,561	--
13 Quartz Creek	7,120	--	6,867	--
14 Salt Creek	--	--	4,692	--
15 Spencer Creek	--	--	7,468	--
16 Timber Mountain/ Johns Peak	16,250	--	16,375	--
17 Worthington Road/ Obenchain	--	--	9,410	--
Klamath Falls Resource Area				
No off-highway vehicle emphasis areas				
Totals	**57,985**	**31,319**	**137,070**	**31,319**

Note: Two dashes (--) denote that a designated or potential site, trail, area, or byway either was not identified under the No Action Alternative or would not be carried forward under the action alternatives.

Potential Off-Highway Vehicle Emphasis Areas

Table 56. District-specific potential off-highway vehicle emphasis areas

Potential Off-Highway Vehicle Emphasis Areas	No Action Alternative (acres)	All Action Alternatives (acres)
Salem District		
Crooked Finger	--	454
Flat Mountain	--	6,892
Tillamook	6,852	6,852
Eugene District		
No potential off-highway vehicle emphasis areas		
Roseburg District		
No potential off-highway vehicle emphasis areas		
Coos Bay District		
No potential off-highway vehicle emphasis areas		
Medford District		
No potential off-highway vehicle emphasis areas		
Klamath Falls Resource Area		
No potential off-highway vehicle emphasis areas		
Totals	**6,852**	**14,198**

Note: Two dashes (--) denote that a designated or potential site, trail, area, or byway either was not identified under the No Action Alternative or would not be carried forward under the action alternatives.

Oregon State Scenic Waterways

Table 57. District-specific Oregon State scenic waterways

State Scenic Waterways	Segment Description	Total Miles
	Salem District	
Clackamas River*	*Recreational segment*: Olallie Lake Scenic Area Boundary to North Fork Reservoir	54
Clackamas River	*Recreational segment*: River Mill Dam to Baker's Bridge at Carver	12
Nestucca River*	*Recreational segment*: McGuire Dam to the confluence with Ginger Creek *Scenic segment*: Ginger Creek to East Creek near Blaine	23
North Fork Clackamas River	*Scenic segment*: From source to North Fork Reservoir	12
Sandy River*	*Natural segment*: Dodge Park (Bull Run River) to Indian John Island *Scenic segment*: Indian John Island to Dabney Park	12.5
South Fork Clackamas River	*Scenic segment*: River mile four to confluence with mainstem of Clackamas River	4
Walker Creek	*Recreational segment*: Source to confluence with Nestucca River	3
*These river segments have joint state and federal management plans in place.		
	Eugene District	
	No Oregon State scenic waterways	
	Roseburg District	
	No Oregon State scenic waterways	
	Coos Bay District	
	No Oregon State scenic waterways	
	Medford District	
	No Oregon State scenic waterways	
	Klamath Falls Resource Area	
Klamath River	*Scenic segment*: J. C. Boyle Powerhouse to the Oregon/California State line	11
This river segment has a cooperative management agreement between the Oregon Parks and Recreation Department and the BLM.		
	Total	**131.5**

National Landscape Conservation System Designated Lands

Wild and Scenic Rivers

Designated Wild and Scenic Rivers and River Segments

Table 58. District-specific designated wild and scenic rivers and river segments

Designated	Classification	Outstandingly Remarkable Values	Total Miles	Acres (BLM lands only)
Salem District				
Clackamas (Segment 6)	Recreational	Fish, Recreation	1	143
Elkhorn Creek (Segment 1)	Wild	Scenery, Wildlife	5.8	142
Elkhorn Creek (Segment 2)	Scenic	Scenery, Wildlife	0.6	225
Quartzville Creek	Recreational	Recreation, Scenery	9.7	2,083
Salmon River (Segment 4)	Recreational	Botany, Ecology, Fish, Hydrology, Recreation, Scenery, Wildlife	3.2	0
Salmon River (Segment 5)	Scenic	Botany, Ecology, Fish, Hydrology, Recreation, Scenery, Wildlife	4.8	728
Sandy River (Segment 1)	Scenic	Culture, Fish, Recreation	3.8	445
Sandy River (Segment 2)	Recreational	Culture, Fish, Recreation, Scenery	8.7	279
		Subtotals	**37.6**	**4,045**
Eugene District				
No designated wild and scenic rivers or river segments				
Roseburg District				
North Umpqua River	Recreational	Culture, Fish, Hydrology, Recreation, Scenery	8.4	2,142
		Subtotals	**8.4**	**2,142**
Coos Bay District				
No designated wild and scenic rivers or river segments				
Medford District				
Rogue River (Applegate River to Grave Creek)	Recreational	Fish, Recreation, Scenery	27	4,911
Rogue River (Grave Creek to Mule Creek)	Wild	Fish, Recreation, Scenery	20	6,602
		Subtotals	**47**	**11,513**

Table continues on the next page.

Designated	Classification	Outstandingly Remarkable Values	Total Miles	Acres (BLM lands only)
Klamath Falls Resource Area				
Upper Klamath River	Scenic	Fish, History, Prehistory, Recreation, Scenery, Wildlife	11	2,780
		Subtotals	**11**	**2,780**
		Totals	**104**	**20,480**

Note: Mileage calculations include both BLM-administered and non-BLM-administered lands. Acreage calculations are for BLM-administered lands only and based on the amount of BLM-administered lands that are located within a half mile wide river corridor.

Suitable Wild and Scenic Rivers and River Segments

Table 59. District-specific suitable wild and scenic rivers and river segments

Suitable	Potential Classification	Outstandingly Remarkable Values	Total Miles	Acres (BLM lands only)
Salem District				
Molalla River (Segment B)	Recreational	Geology, Recreation, Scenery	13.2	2,988
Nestucca River (Segment A)	Recreational	Fish, Recreation, Scenery, Wildlife	15.5	3,016
		Subtotals	**28.7**	**6,004**
Eugene District				
McKenzie River (Segment A)	Recreational	Fish, Recreation, Scenery	11	962
Siuslaw River (Segment B)	Recreational	Fish, Wildlife	46	4,518
Siuslaw River (Segment C)	Recreational	Recreation, Wildlife	13	1,211
		Subtotals	**70**	**6,691**
Roseburg District				
No suitable wild and scenic rivers or river segments				
Coos Bay District				
No suitable wild and scenic rivers or river segments				
Medford District				
Big Windy Creek	Wild	Recreation, Scenery	6.8	1,928
Dulog Creek	Wild	Recreation, Scenery	1.8	480
East Fork Big Windy Creek	Wild	Recreation, Scenery	3.6	923
Howard Creek	Wild	Fish, Recreation, Scenery	7.0	1,752
		Subtotals	**19.2**	**5,083**
Klamath Falls Resource Area				
No suitable wild and scenic rivers or river segments				
		Totals	**117.9**	**17,778**

Note: Mileage calculations include both BLM-administered and non-BLM-administered lands. Acreage calculations are for BLM-administered lands only and based on the amount of BLM-administered lands that are located within a half mile wide river corridor.

Eligible Wild and Scenic Rivers and River Segments

Table 60. District-specific eligible wild and scenic rivers and river segments

Eligible	Potential Classification	Outstandingly Remarkable Values	Total Miles	Acres (BLM lands only)
Salem District				
Alsea River	Recreational	Fish, Recreation	16.5	312
Clackamas River	Recreational	Recreation, Scenery	15.4	44
Drift Creek (Segments A and B)	Recreational	Fish	30.1	112
Fall Creek	Recreational	Fish	11.7	642
Kilchis River	Recreational	Fish, Recreation, Wildlife	14.6	56
Little Luckiamute River	Recreational	Ecology	27.1	40
Little North Santiam River	Recreational	Fish, Recreation, Scenery	17.2	1,203
Lobster Creek (Segment B)	Recreational	Fish	16.6	305
Luckiamute River	Recreational	Ecology	61.2	553
Middle Santiam River	Recreational	Culture, Ecology	7.9	175
Nehalem River	Recreational	Recreation, Fish and Wildlife	122.0	36
Nestucca River (Segment B)	Recreational	Fish, Recreation, Scenery, Wildlife	8.0	216
North Fork Clackamas River	Scenic	Fish	14.4	358
North Fork Siletz River	Scenic	Ecology, Fish, Wildlife	10.6	826
North Fork Trask River	Recreational	None identified	11.9	732
North Santiam River (Segment A)	Scenic	Fish, Recreation, Scenery	19.1	217
North Santiam River (Segment B)	Recreational	Fish, Recreation	27.9	132
Sandy River (Segment A)	Recreational	Culture, Fish, Recreation	15.0	627
Sandy River (Segment B)	Recreational	Culture, Fish, Recreation, Scenery	11.8	872
Siletz River	Recreational	Fish, Recreation, Scenery	68.8	38
South Fork Trask River	Recreational	Fish, Wildlife	9.3	30
South Yamhill River	Recreational	Culture, Ecology	62.5	0
Table Rock Fork Molalla River	Recreational	Culture	13.4	1,385
Trask River	Recreational	Fish, Recreation, Wildlife	19.5	333

Table continues on the next page.

Eligible	Potential Classification	Outstandingly Remarkable Values	Total Miles	Acres (BLM lands only)
Salem District (cont.)				
Tualatin River	Recreational	Culture	80.6	312
Willamette River	Recreational	Culture, Ecology, Fish, Recreation, Wildlife	164.4	88
Wilson River	Recreational	Fish, Recreation, Wildlife	29.8	79
Yaquina River	Recreational	Fish	44.6	238
		Subtotals	**951.9**	**9,961**
Eugene District				
Fall Creek	Recreational	Recreation	6.0	1,126
Lake Creek (Segment B)	Recreational	Fish, Recreation	18.3	482
McKenzie River (Segment B)	Recreational	Fish, Recreation, Scenery, Wildlife	40.0	55
Nelson Creek	Recreational	Fish	7.0	542
North Fork Gate Creek	Recreational	Fish	7.9	201
South Fork Gate Creek	Recreational	Fish	8.9	106
		Subtotals	**88.1**	**2,512**
Roseburg District				
Cow Creek (West Fork to South Umpqua)	Recreational	Culture, Fish, History, Wildlife	26	744
South Umpqua (Tiller to North Umpqua)	Recreational	Culture, Fish, History, Wildlife	73	746
Umpqua (River Forks to Elkton)	Recreational	Culture, Fish, History, Recreation, Scenery	57	1,891
		Subtotals	**156**	**3,381**
Coos Bay District				
Sixes	Recreational	Fish, History	28	271
South Fork Coos	Recreational	Fish, Recreation	37	503
South Fork Coquille	Recreational	Fish, Prehistory	35	139
Umpqua (Mouth to Kellogg)	Recreational	Ecology, Fish, Geology, History, Prehistory, Recreation, Scenery	70	1,045
		Subtotals	**170**	**1,958**

Table continues on the next page.

Eligible	Potential Classification	Outstandingly Remarkable Values	Total Miles	Acres (BLM lands only)
Medford District				
Alder Creek	Wild	Recreation, Scenery	1	259
Anna Creek	Wild	Recreation, Scenery	1.7	915
Antelope Creek	Recreational	Fish	1	662
Applegate River	Recreational	Fish	46.3	629
Ash Creek	Wild	Recreation, Scenery	2.6	545
Bailey Creek	Wild	Recreation, Scenery	2.7	761
Big Butte Creek (including the south fork of Big Butte Creek)	Recreational	Fish	21.1	579
Booze Creek	Wild	Recreation, Scenery	0.9	328
Bronco Creek	Wild	Recreation, Scenery	1.5	383
Bunker Creek	Wild	Recreation, Scenery	6.4	1,619
Centennial Gulch	Wild	Recreation, Scenery	1.8	421
Cheney Creek	Recreational	Fish	4.2	651
Copsey Creek	Wild	Recreation, Scenery	1.1	346
Cow Creek	Recreational	Fish	30	1,219
Cowley Creek	Wild	Recreation, Scenery	0.8	164
Ditch Creek	Wild	Recreation, Scenery	2.1	423
East Fork Elk Valley Creek	Recreational	Fish	2.3	446
East Fork Whisky Creek	Wild	Recreation, Scenery	3.7	1,061
Elk Valley Creek	Recreational	Fish	5.0	370
Grave Creek	Recreational	Fish	10.9	3,402
Hewett Creek	Wild	Recreation, Scenery	2.2	568
Jenny Creek Ashland	Scenic	Fish, History	17.6	2,846
Jenny Creek Grants Pass	Wild	Recreation, Scenery	4.4	1,363
Kelsey Creek	Wild	Fish, Recreation, Scenery	4.8	2,162
Left Fork Foots Creek	Recreational	Fish	1.5	138

Table continues on the next page.

Eligible	Potential Classification	Outstandingly Remarkable Values	Total Miles	Acres (BLM lands only)
Medford District (cont.)				
Little Applegate River	Recreational	Fish	10	1,203
Little Windy Creek	Wild	Recreation, Scenery	2.5	783
Long Gulch Creek	Wild	Recreation, Scenery	2	494
Lost Creek	Wild	Scenery	0.9	1,191
Meadow Creek	Wild	Recreation, Scenery	3.8	1,043
Missouri Creek	Wild	Recreation, Scenery	4.4	1,077
Montgomery Creek	Wild	Recreation, Scenery	1.3	419
Mule Creek	Wild	Fish, Recreation, Scenery	7.6	3,053
Ninemile Creek	Recreational	Fish	1.6	836
North Fork Big Butte Creek	Recreational	Fish	13.4	1,741
North Fork Deer Creek	Recreational	Fish	2.9	615
North Fork Galice Creek	Recreational	Recreation, Scenery	5.5	1,557
North Fork Silver Creek	Recreational	Fish, Recreation, Scenery	6	1,707
Powell Creek	Recreational	Fish, Recreation, Scenery	7.7	1,446
Quail Creek	Wild	Recreation, Scenery	1.8	379
Quartz Creek	Wild	Recreation, Scenery	2.4	790
Quines Creek	Recreational	Fish	4.5	750
Riffle Creek	Recreational	Fish	3.6	651
Rock Creek	Recreational	Fish	6.0	351
Rogue River (Segment 1)	Recreational	Fish, Recreation	12.5	1
Rogue River (Segment 2)	Recreational	Fish, Recreation	18	227
Rogue River (Segment 3)	Recreational	Fish, Recreation	18	395
Rum Creek	Wild	Recreation, Scenery	3.2	978
Russian Creek	Wild	Recreation, Scenery	1.9	653
Sams Creek	Recreational	Fish	5.5	427
Slide Creek	Wild	Recreation, Scenery	1	220
Soda Creek	Recreational	Fish	3.8	705
South Fork Little Butte Creek	Recreational	Fish	16.3	419
Stanley Creek	Recreational	Fish	1.5	226
Star Gulch Creek	Recreational	Fish	8.1	2,321

Table continues on the next page.

Eligible	Potential Classification	Outstandingly Remarkable Values	Total Miles	Acres (BLM lands only)
Medford District (cont.)				
West Fork Illinois River	Scenic	Scenery	19	1,018
West Fork Whisky Creek	Wild	Recreation, Scenery	6	1,256
Whisky Creek (to east and west forks)	Wild	History, Recreation, Scenery	2.4	374
Whitehorse Creek	Recreational	Fish	3.5	600
Wildcat Creek	Wild	Recreation, Scenery	1.7	340
		Subtotals	**387.9**	**52,506**
Klamath Falls Resource Area				
No eligible wild and scenic rivers or river segments				
		Totals	**1,753.9**	**70,318**

Note: Mileage calculations include both BLM-administered and non-BLM-administered lands. Acreage calculations are for BLM-administered lands only and based on the amount of BLM-administered lands that are located within a half mile wide river corridor.

Wilderness Areas

Table 61. District-specific wilderness areas

Wilderness Areas	Administered by the BLM (acres)
Salem District	
Table Rock	5,706
Managed according to the 1987 *Table Rock Wilderness Management Plan* to preserve the area's undisturbed natural integrity.	
Eugene District	
No wilderness areas	
Roseburg District	
No wilderness areas	
Coos Bay District	
No wilderness areas	
Medford District	
Wild Rogue	8,629
This wilderness spans across both BLM and United States Forest Service (USFS) lands. Under a memorandum of understanding, the USFS administers the BLM's portion of this wilderness (the acres stated here).	
Klamath Falls Resource Area	
No wilderness areas	
Total	**14,335**

Wilderness Study Areas and Wilderness Instant Study Areas

Table 62. District-specific wilderness study and wilderness instant study areas

Wilderness Study and Wilderness Instant Study Areas	Classification	Administered by the BLM (acres)
Salem District		
Little Sink	Instant Study	80
Eugene District		
No wilderness study or wilderness instant study areas		
Roseburg District		
No wilderness study or wilderness instant study areas		
Coos Bay District		
Cherry Creek/Douglas fir	Instant Study	570
Medford District		
Brewer Spruce	Instant Study	1,705
Soda Mountain	Study	6,107
Klamath Falls Resource Area		
Mountain Lakes	Study	340
	Total	**8,802**

Miscellaneous National Landscape Conservation System Designated Lands

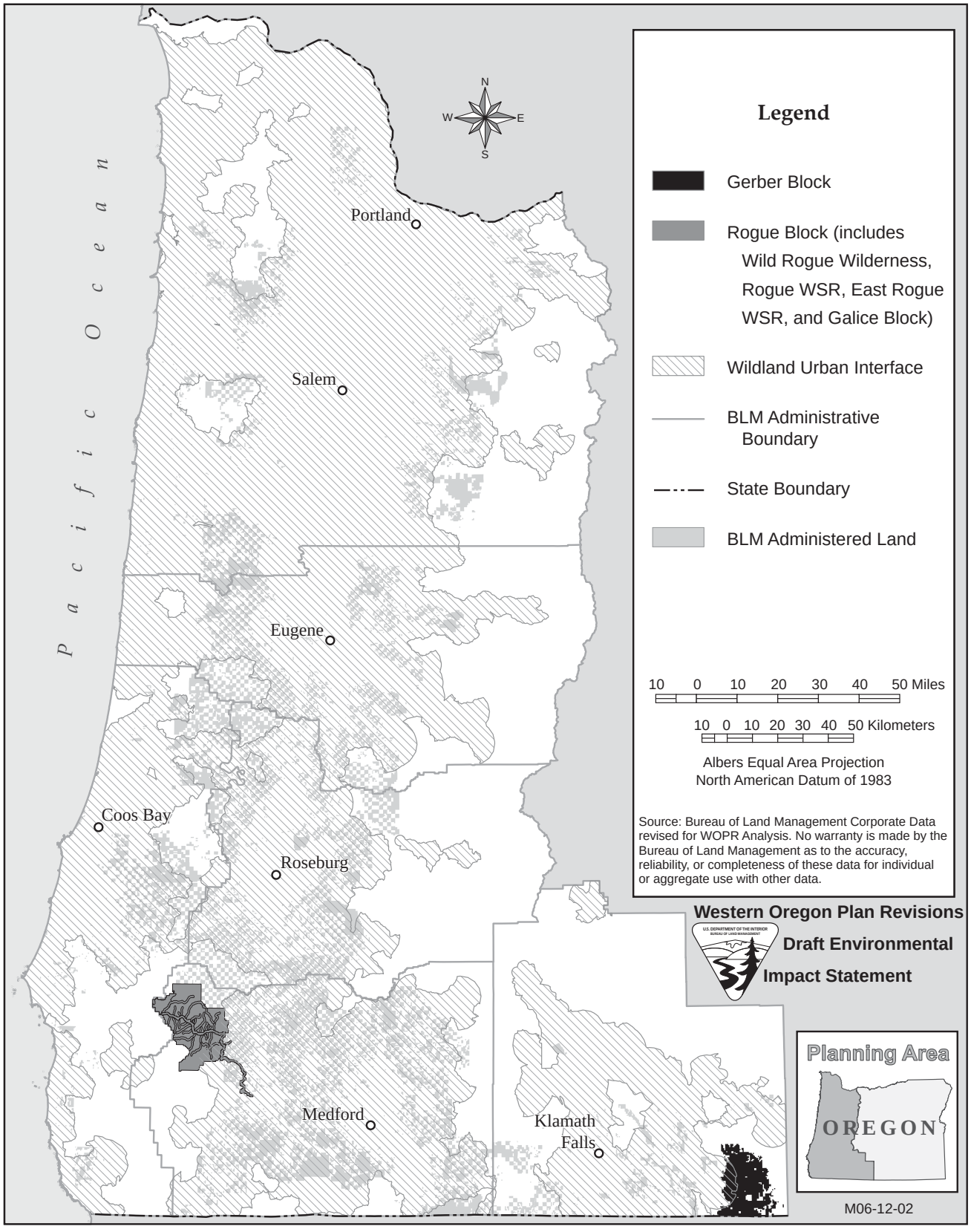
Table 63. District-specific miscellaneous National Landscape Conservation System designated lands

Miscellaneous National Landscape Conservation System Designated Lands	Administered by the BLM (acres)	(miles)
Salem District		
Bull Run Watershed Management Unit	658	
Mt. Hood Corridor	4,644	
Yaquina Head Outstanding Natural Area	102	
Eugene District		
No other miscellaneous National Landscape Conservation System designated lands		
Roseburg District		
No other miscellaneous National Landscape Conservation System designated lands		
Coos Bay District		
No other miscellaneous National Landscape Conservation System designated lands		
Medford District		
Cascade-Siskiyou National Monument	52,947	
Pacific Crest National Scenic Trail		40
Klamath Falls Resource Area		
Pacific Crest National Scenic Trail		1
Total	**58,351**	**41**

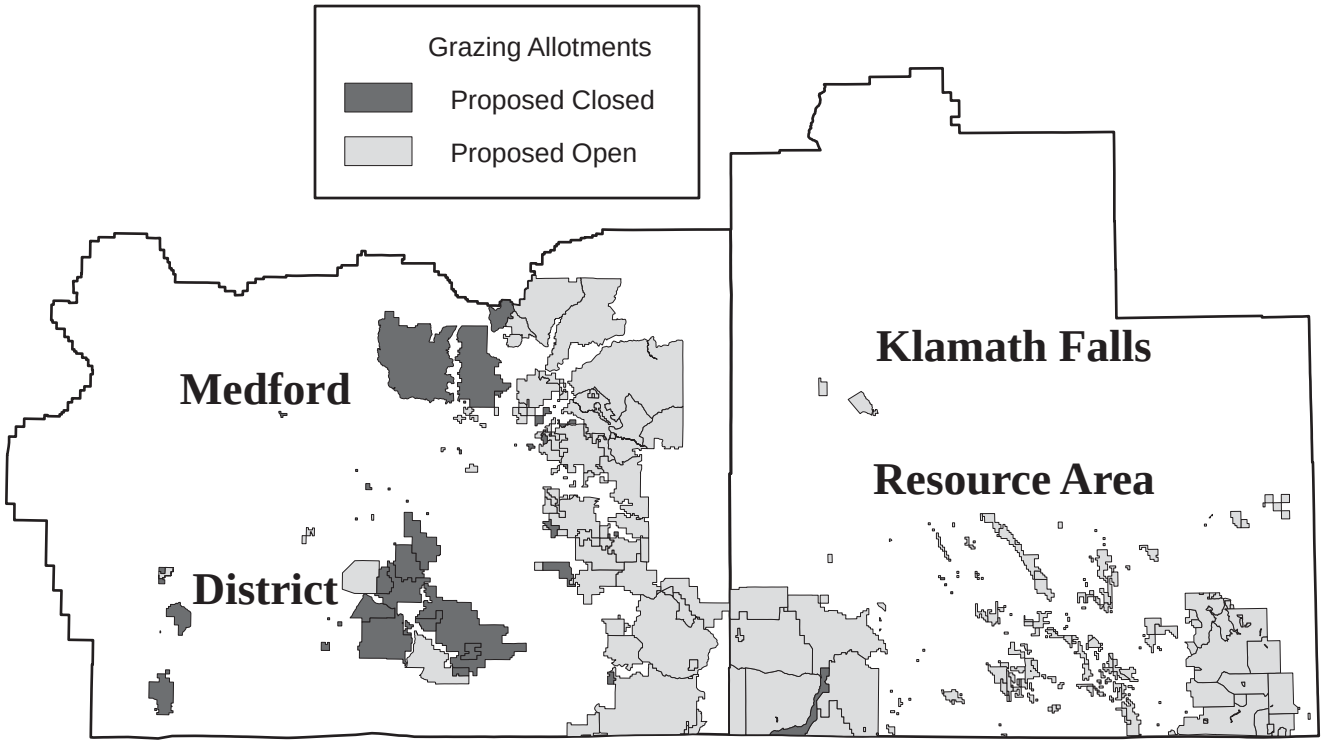
Maps

This section provides the resource and program maps referred to in this chapter.

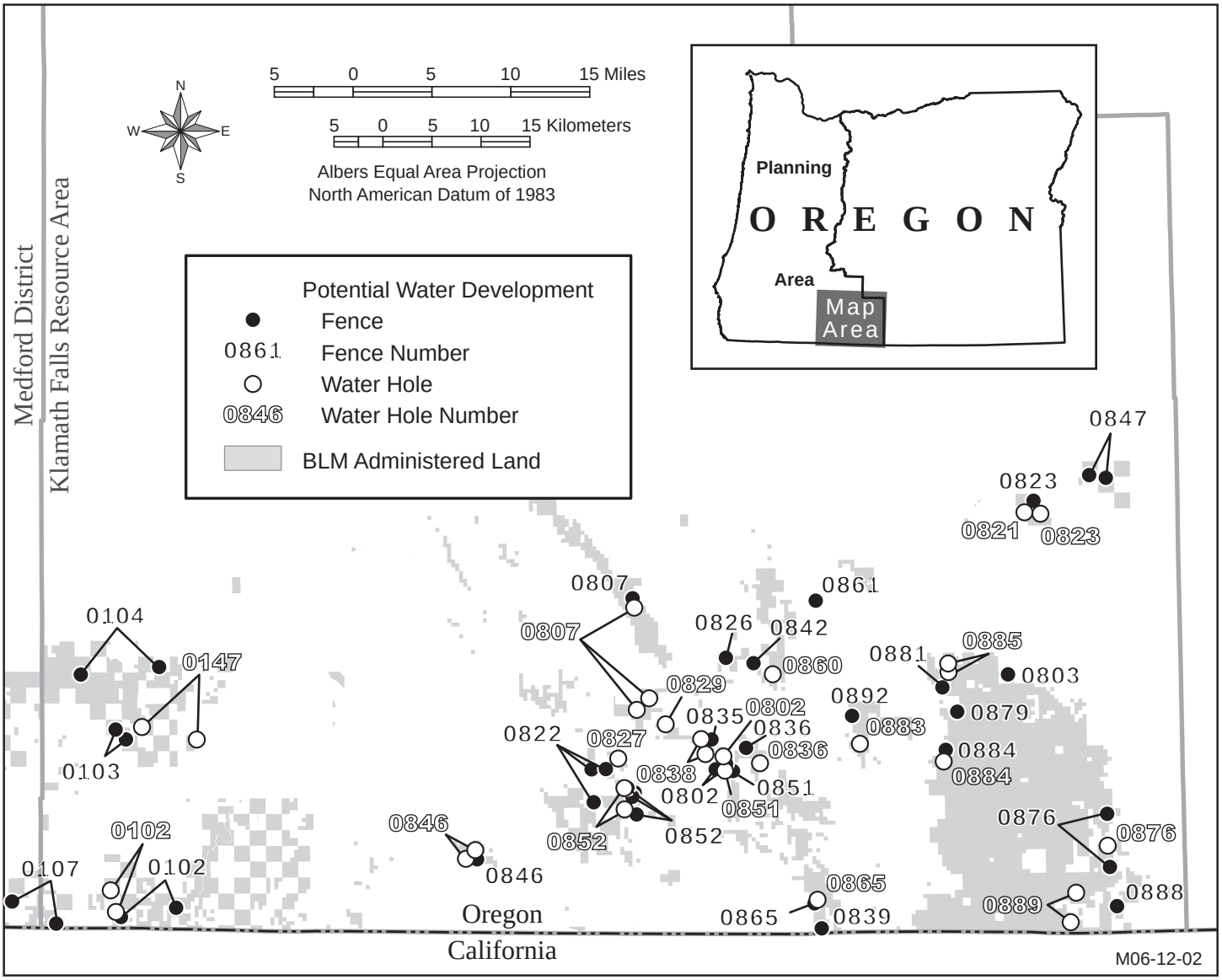
Map 6. Wildland urban interface



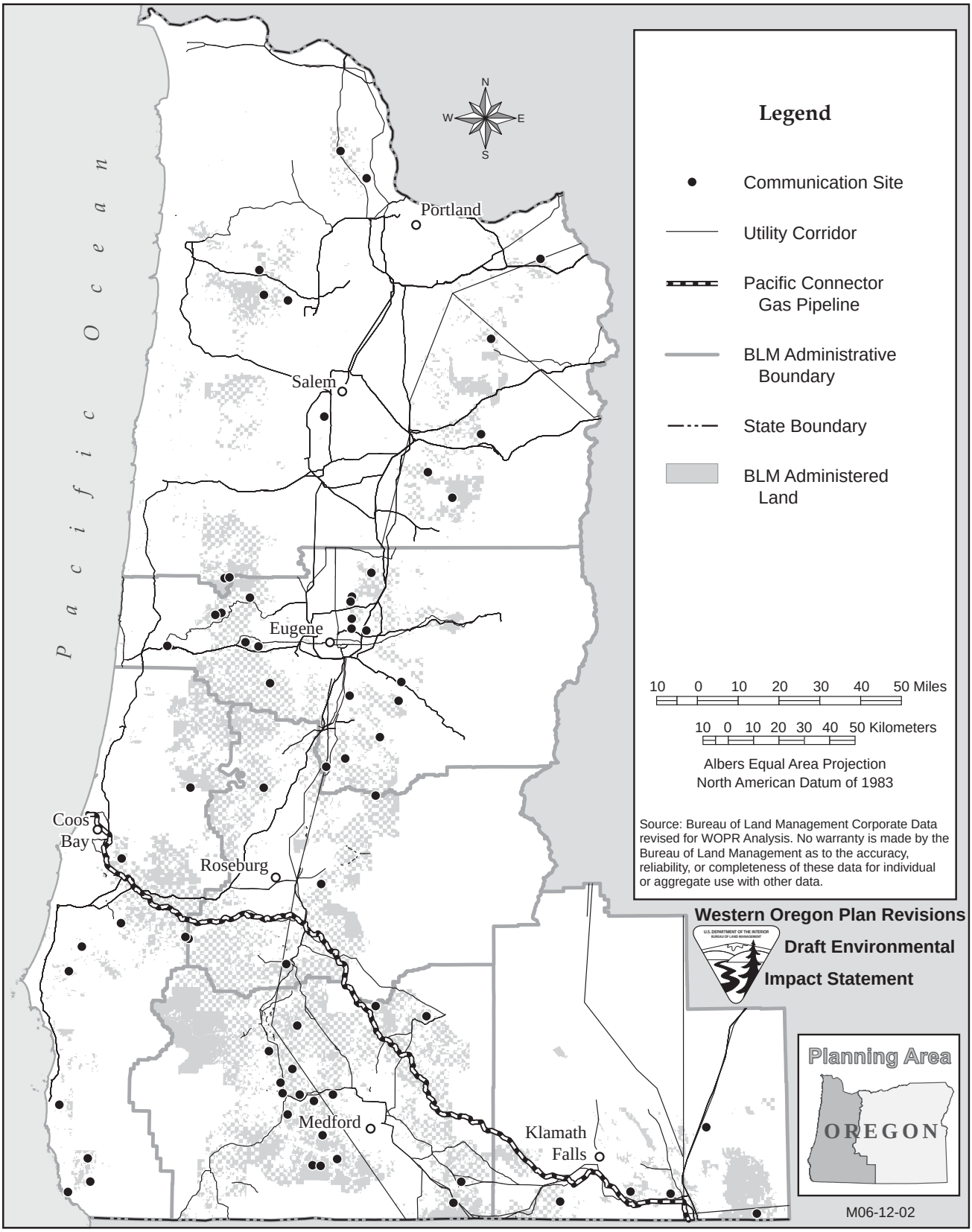
Map 7. Lands available for livestock grazing



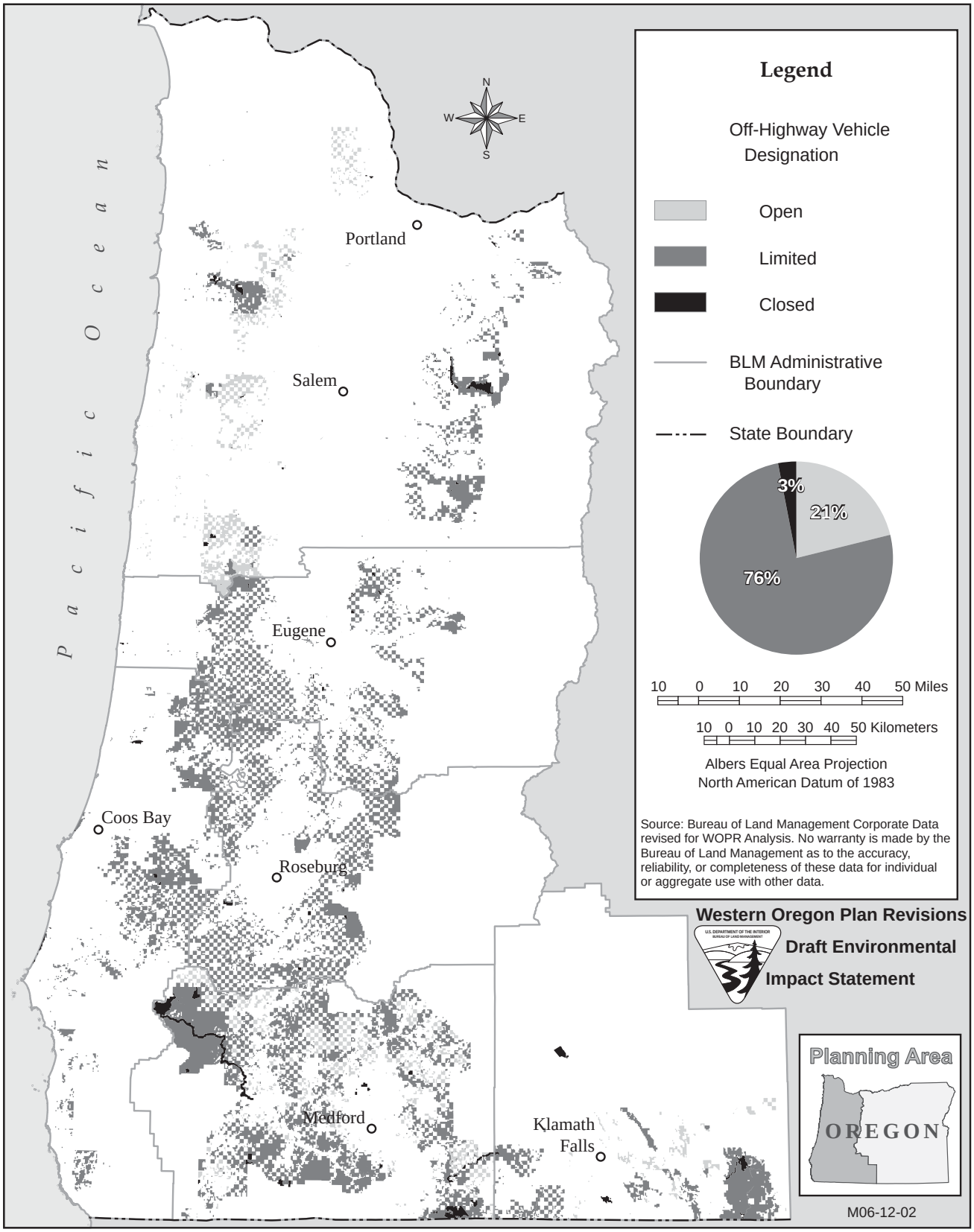
Map 8. Location of proposed range improvements in the Klamath Falls Resource Area



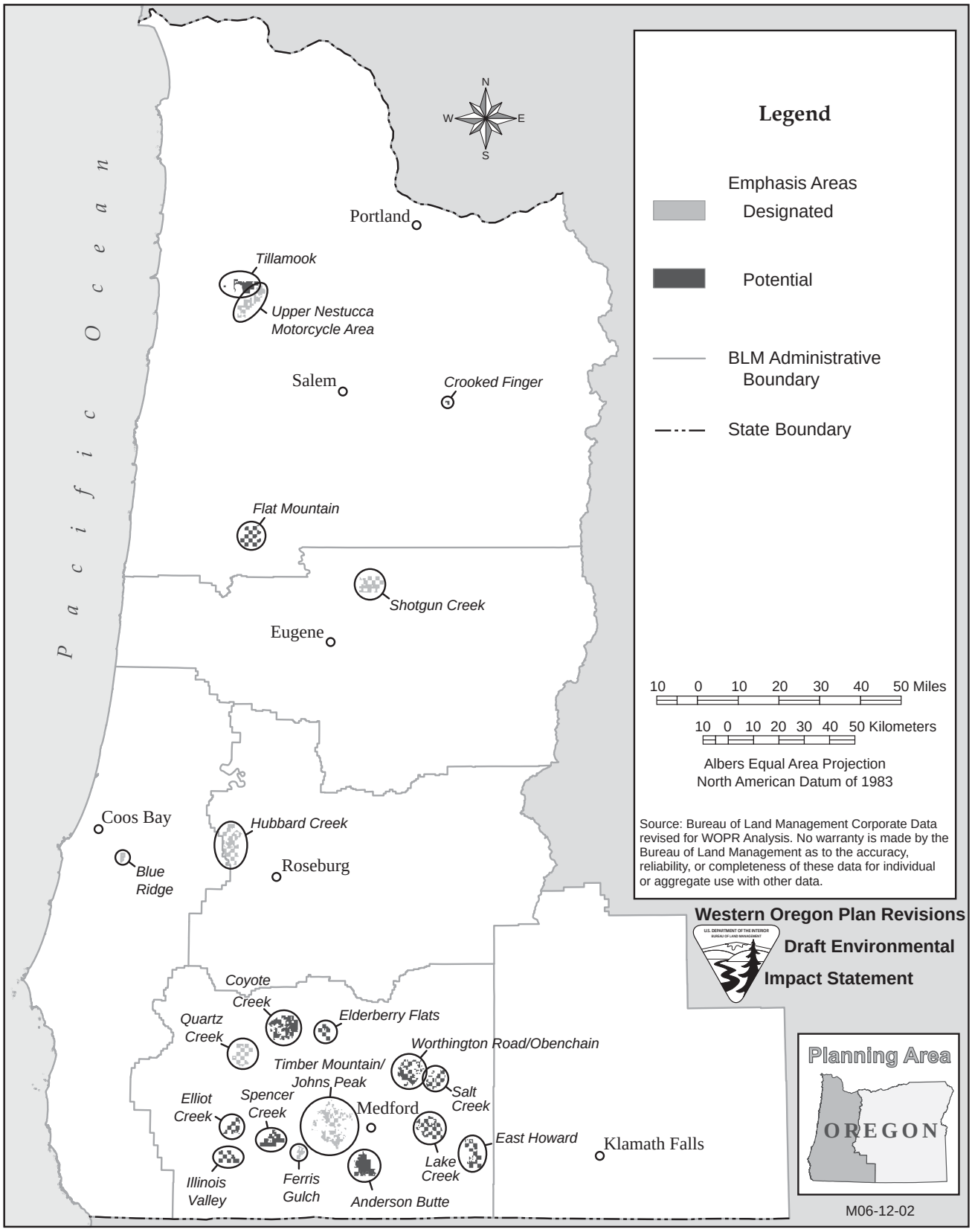
Map 9. Utility corridors



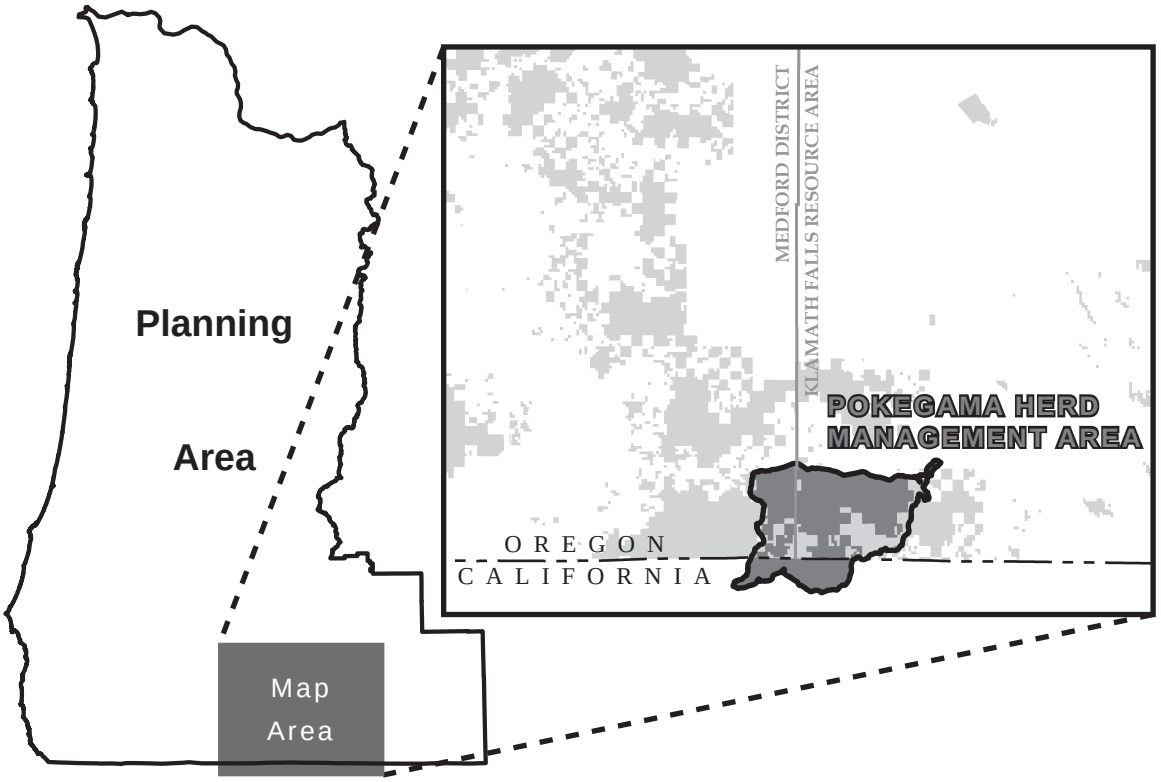
Map 10. Off-highway vehicle designations



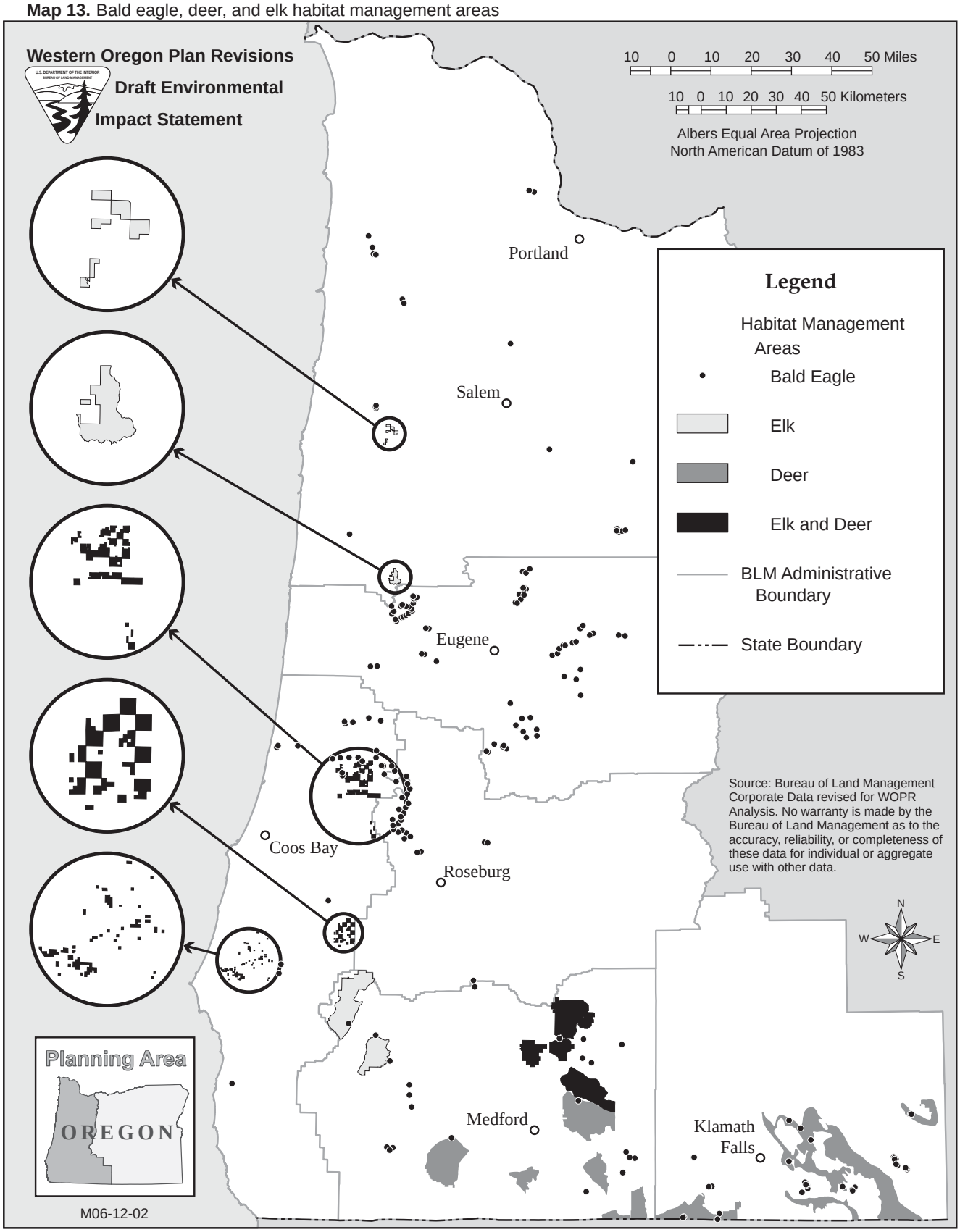
Map 11. Off-highway vehicle emphasis areas



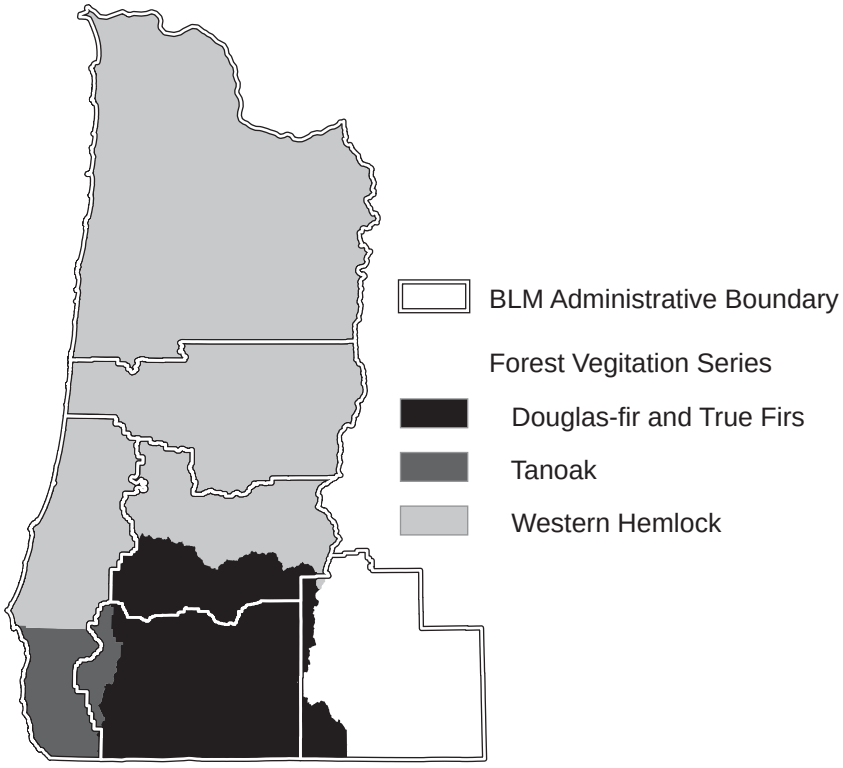
Map 12. Location of Pokegama Herd Management Area



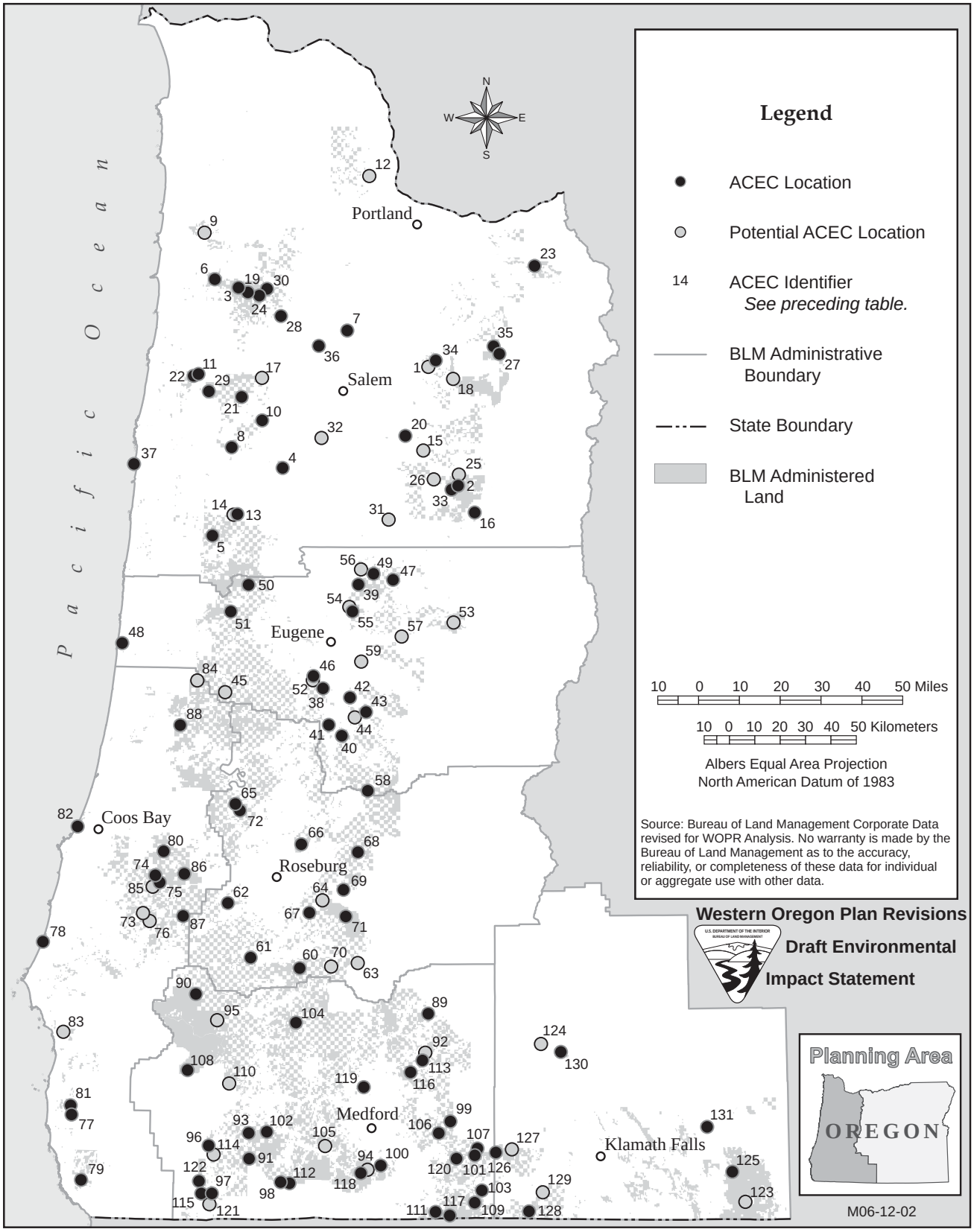
Map 13. Bald eagle, deer, and elk habitat management areas



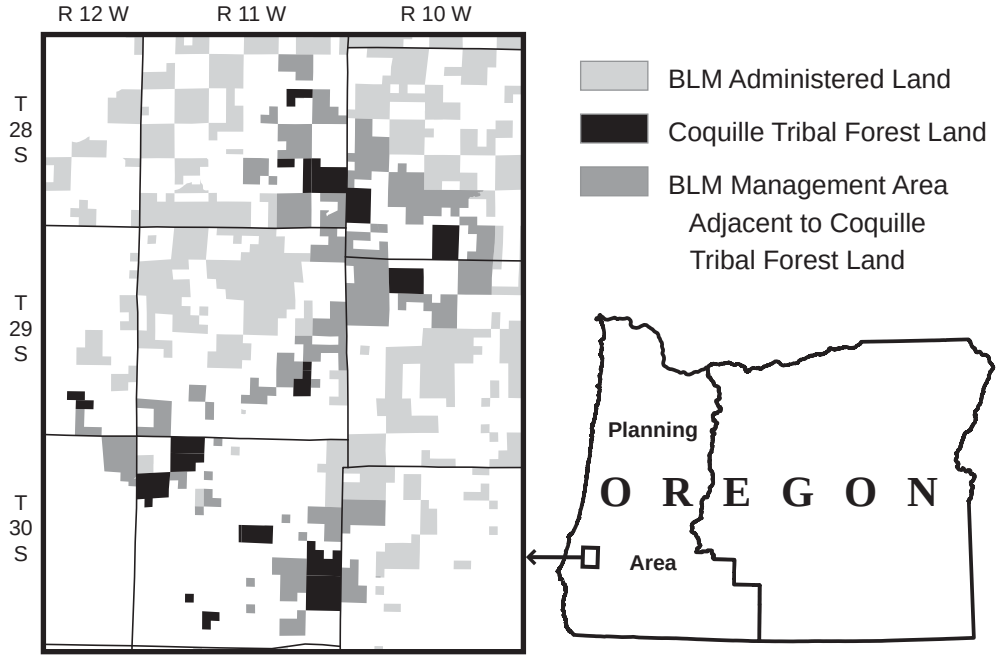
Map 14. Forest vegetation series



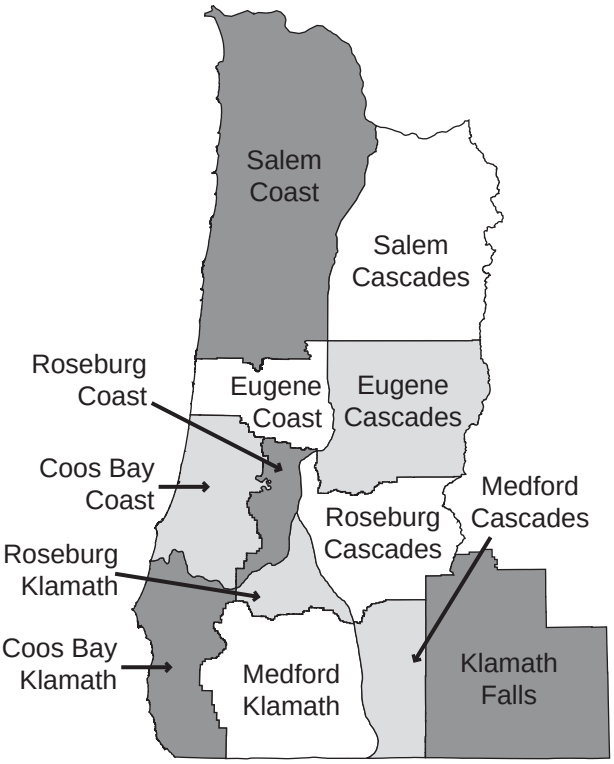
Map 15. Areas of critical environmental concern within the planning area



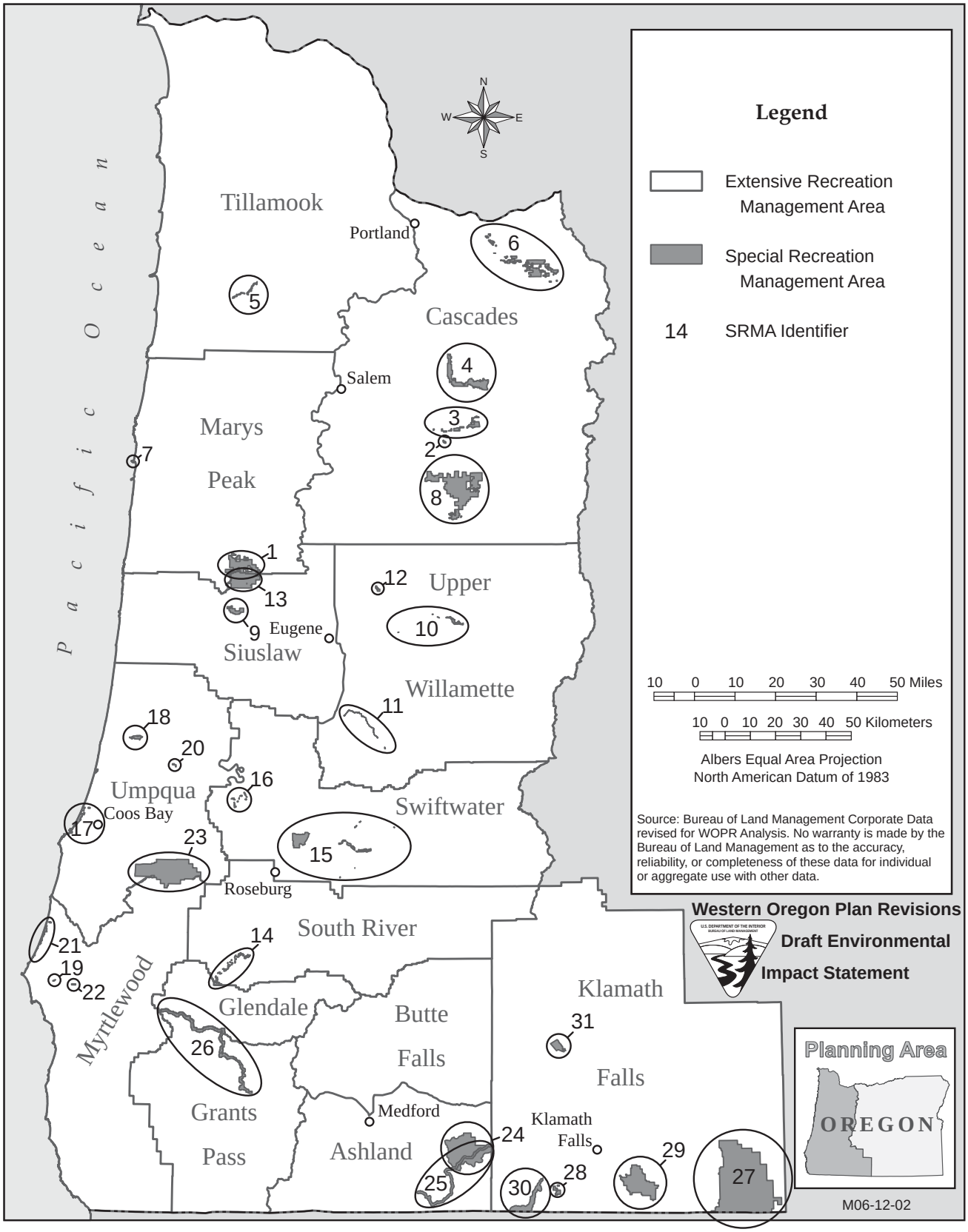
Map 16. BLM management area adjacent to the Coquille Forest



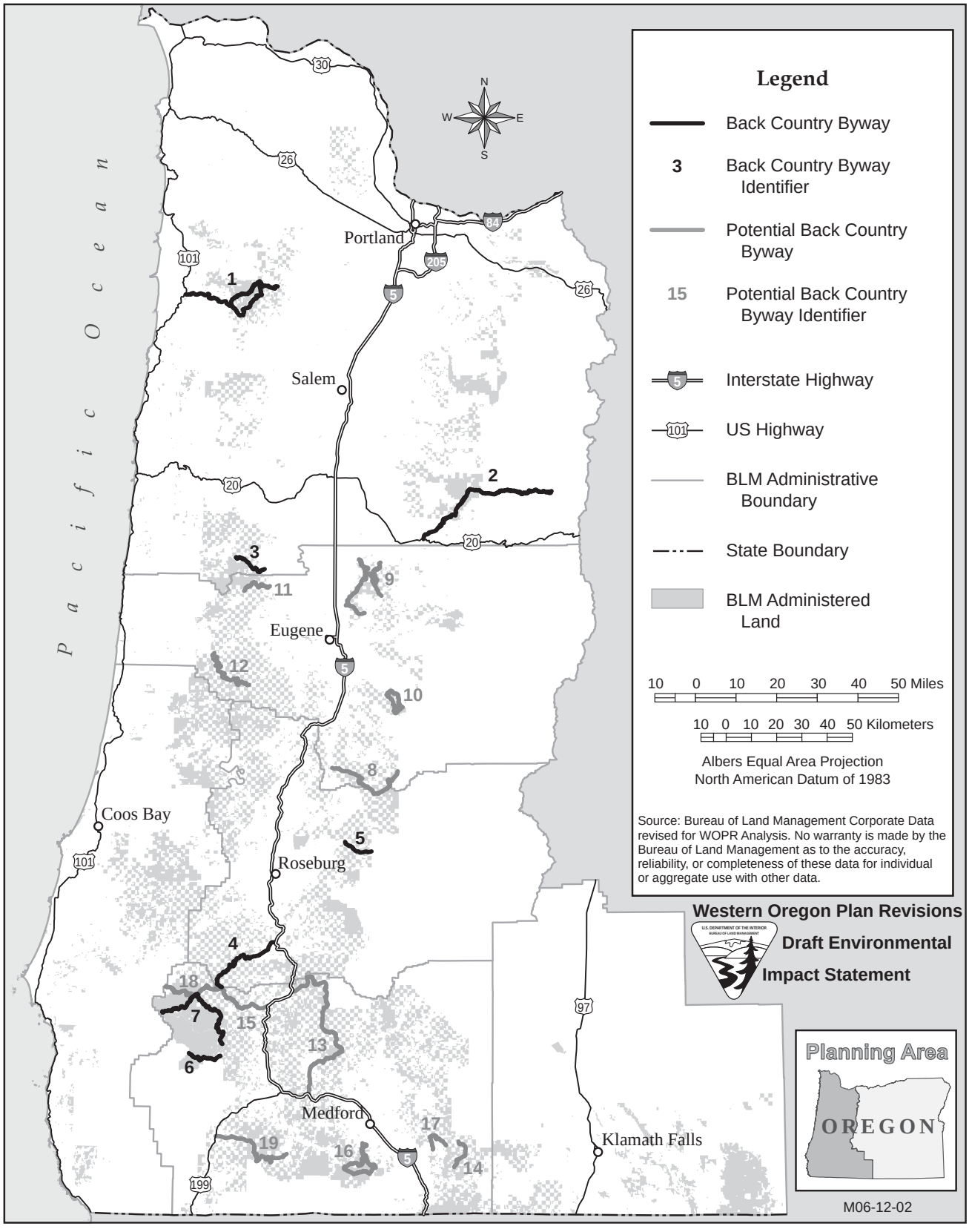
Map 17. Location of assessment areas (physiographic provinces within sustained yield units) under Alternative 3



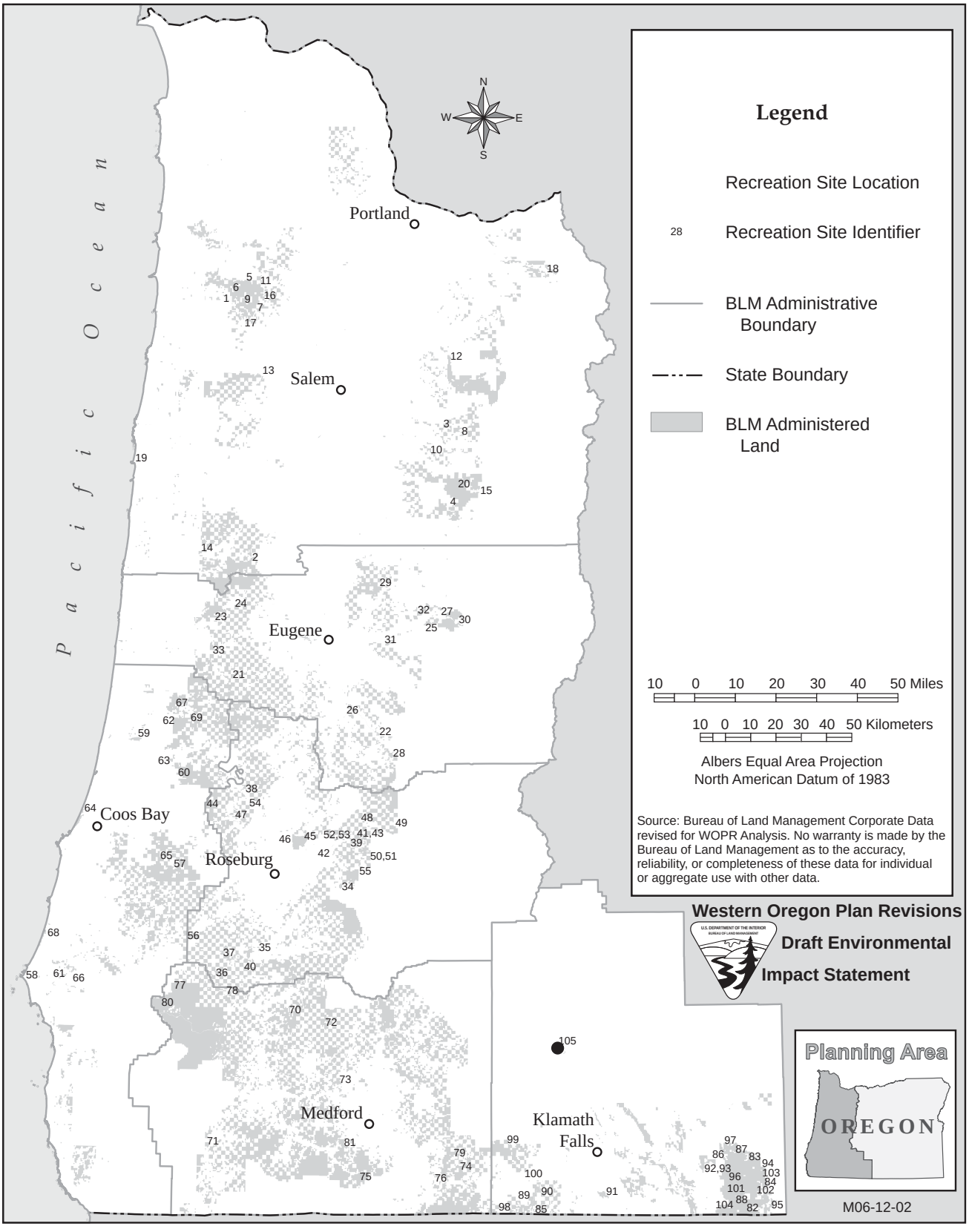
Map 18. Recreation management areas



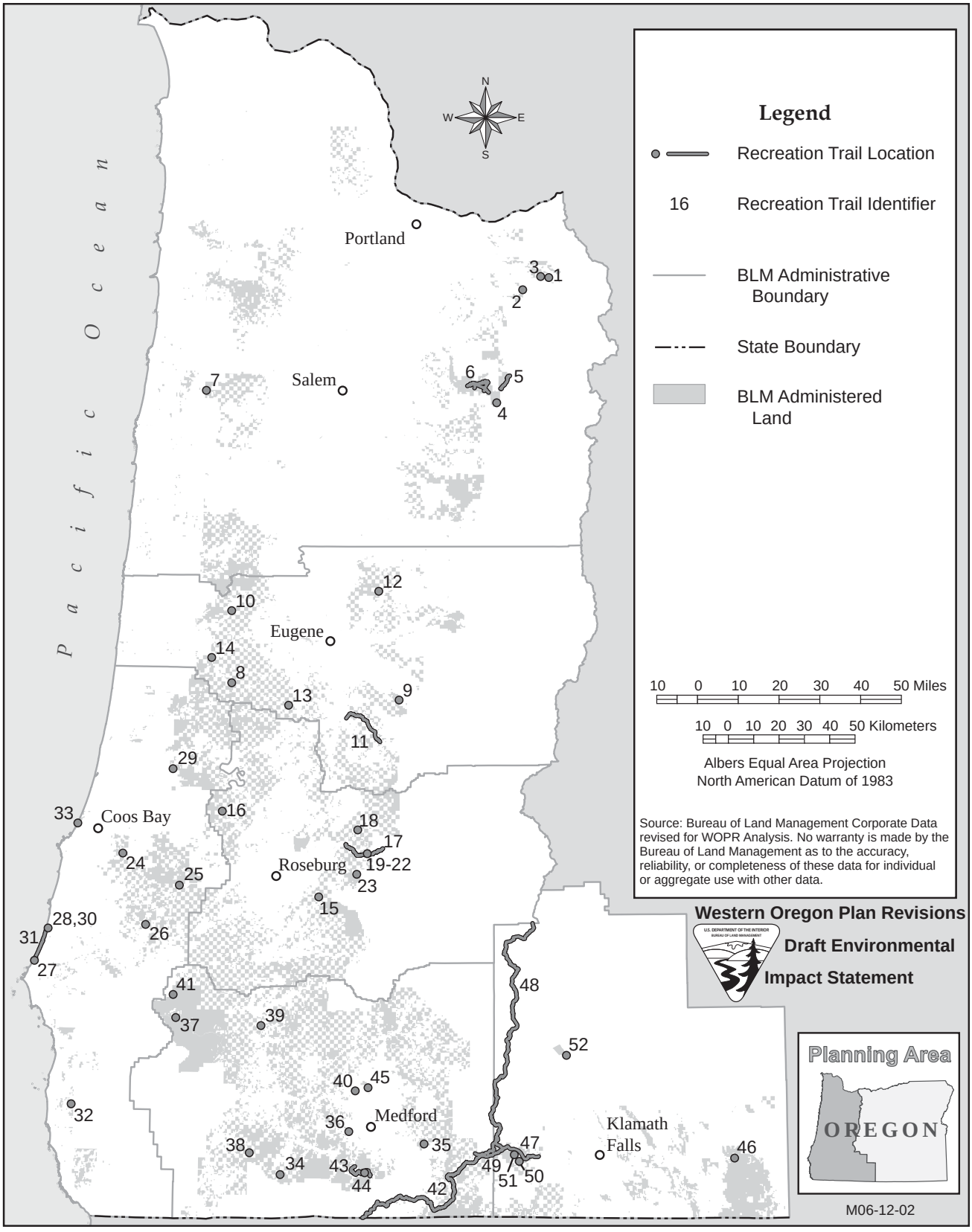
Map 19. Backcountry byways



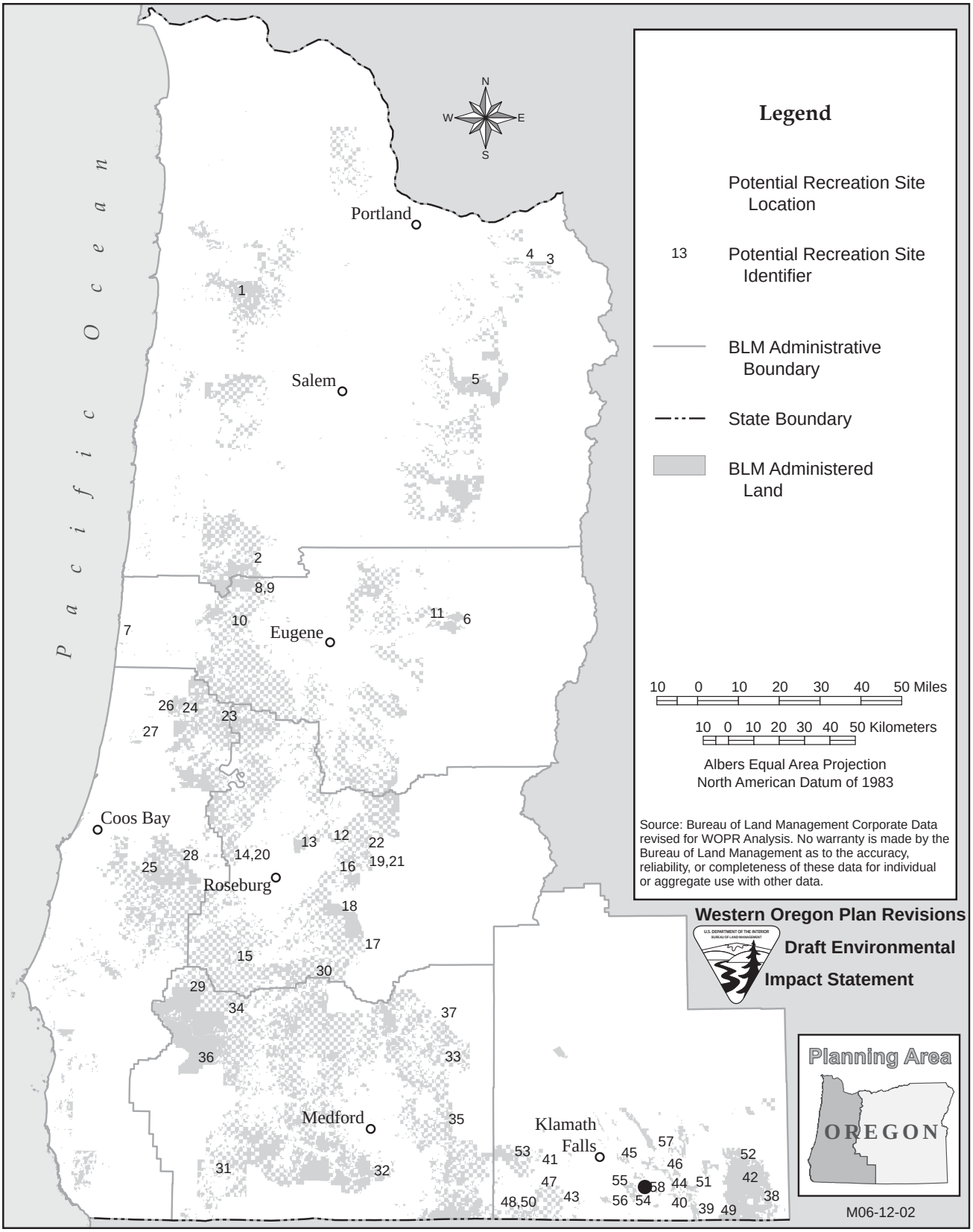
Map 20. Designated recreation sites



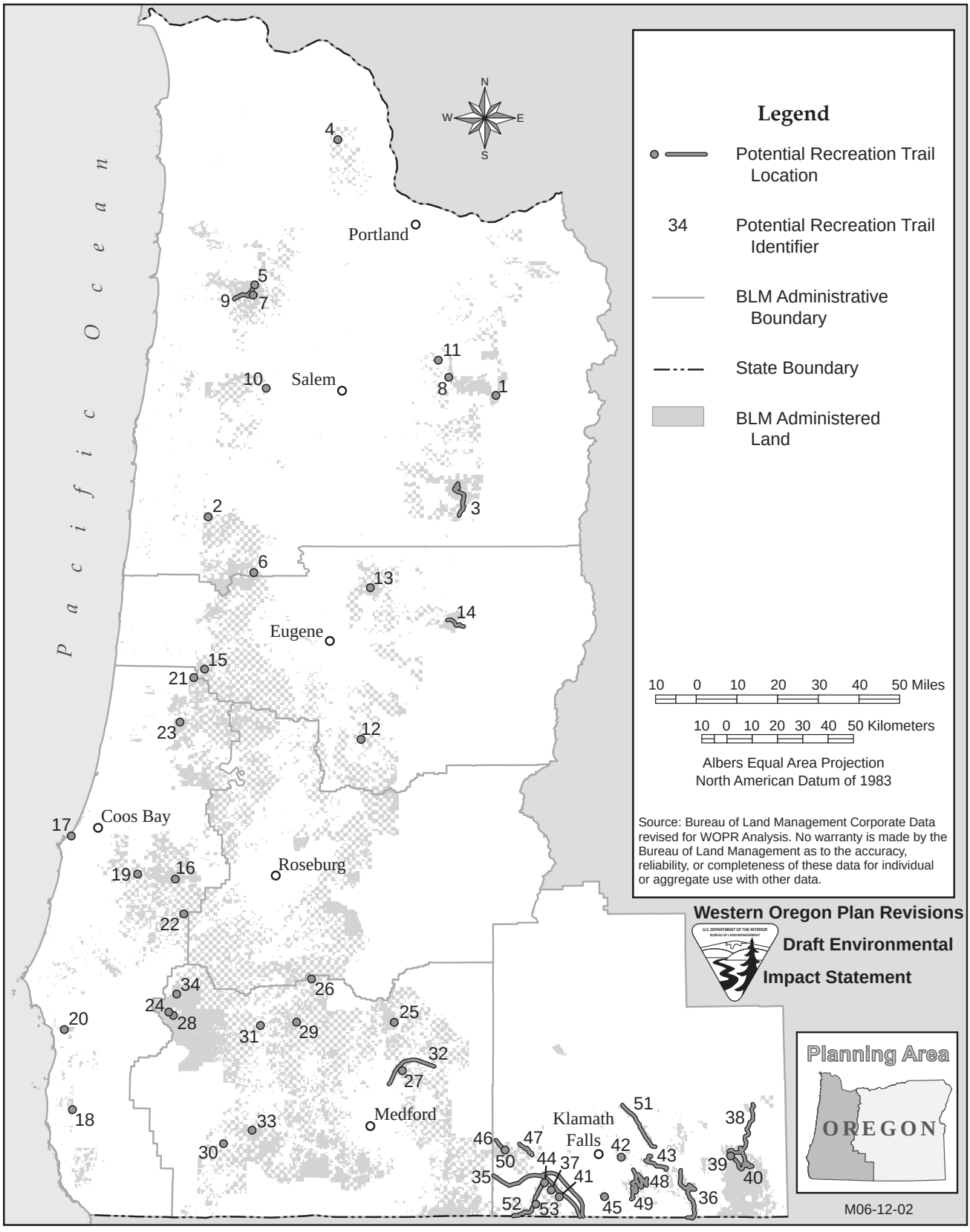
Map 21. Designated recreation trails



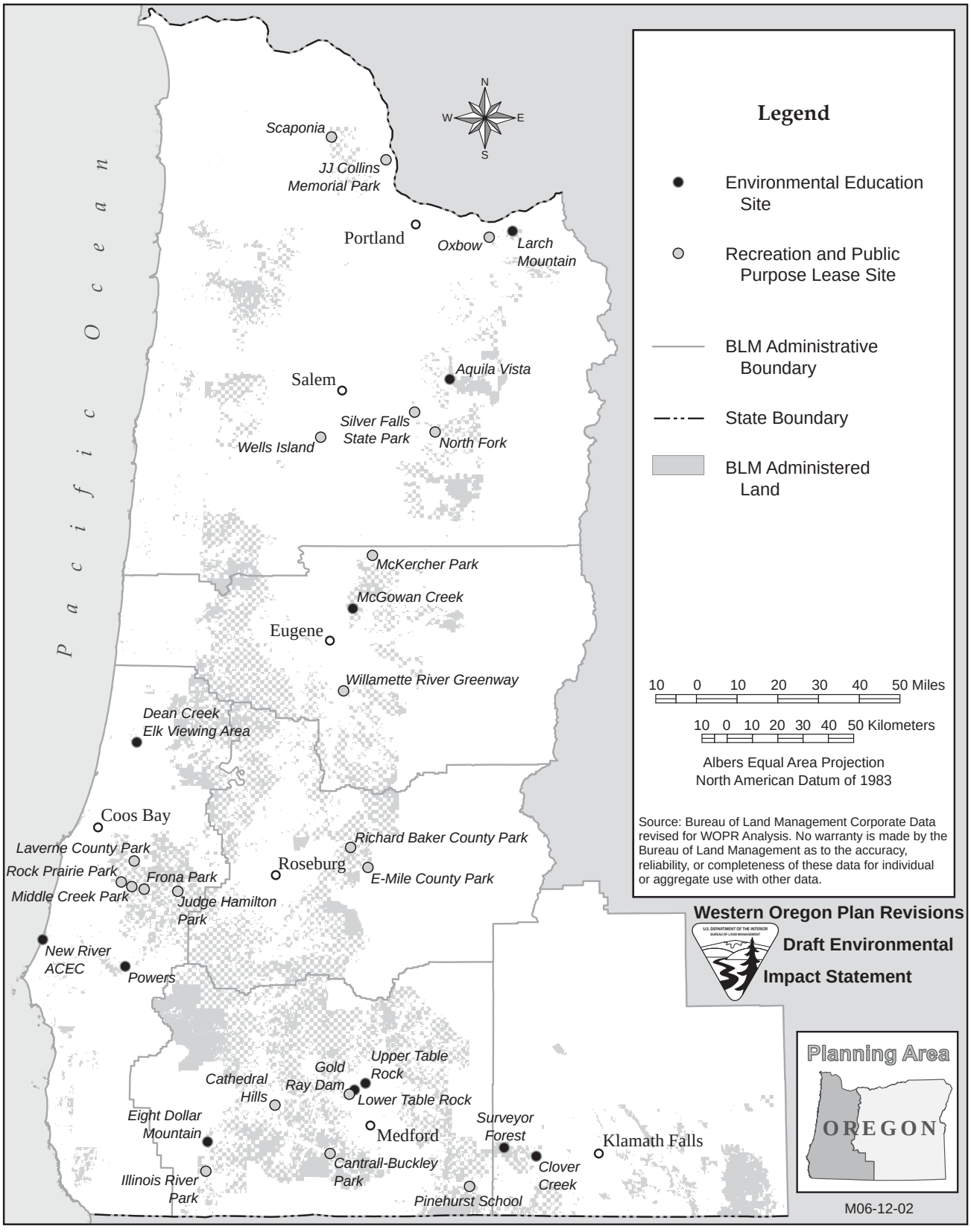
Map 22. Potential recreation sites



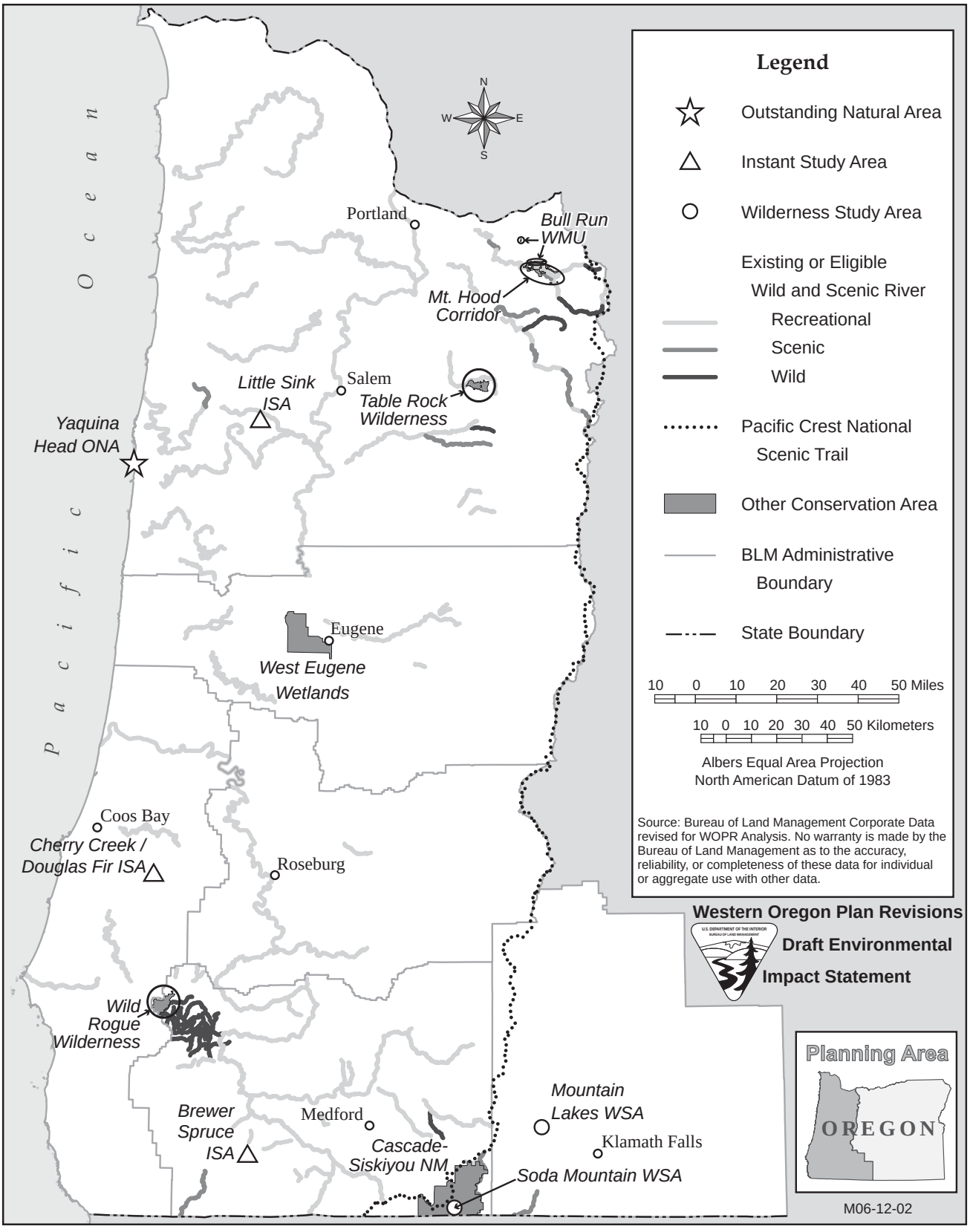
Map 23. Potential recreation trails



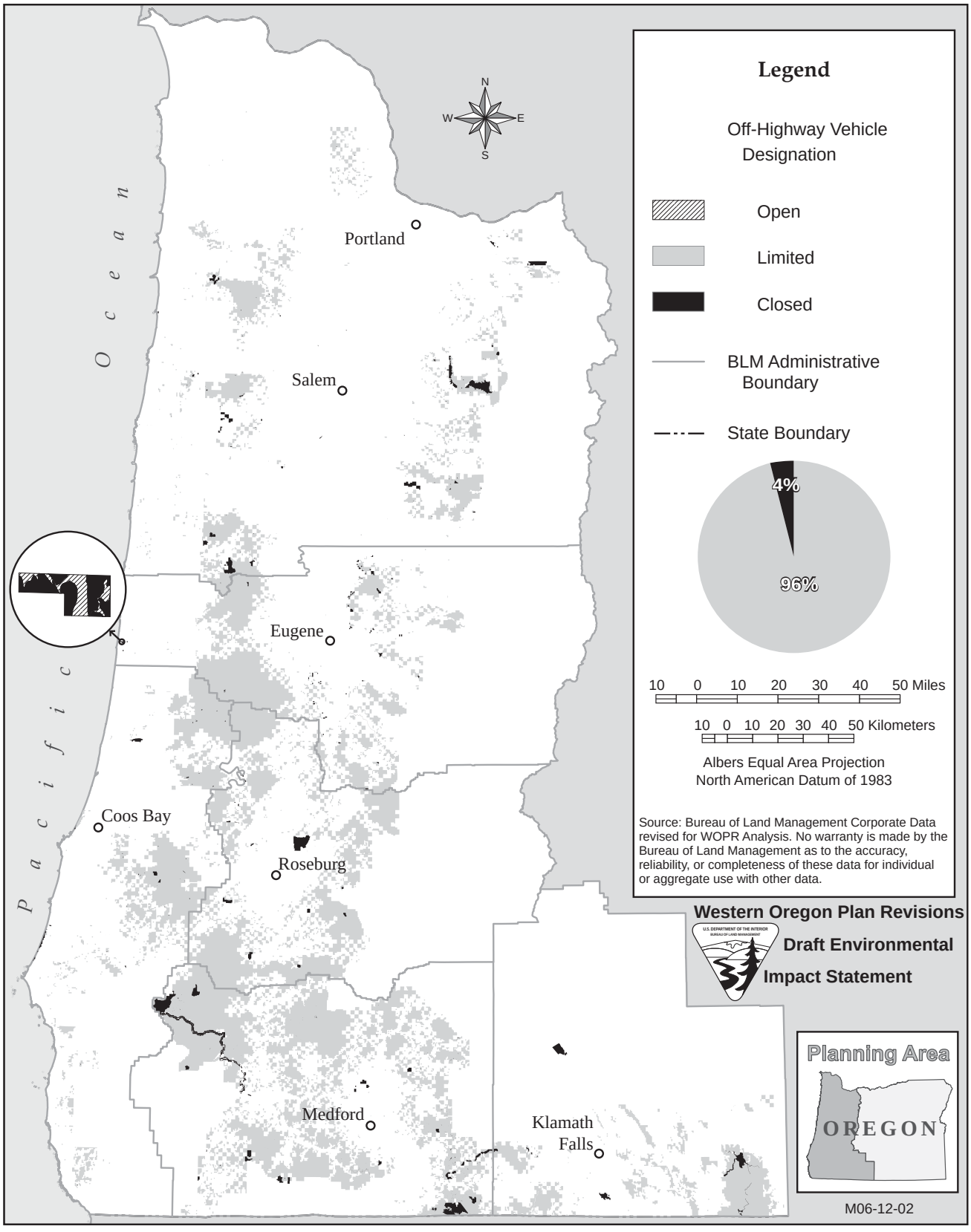
Map 24. Environmental education sites along with recreation and public purpose lease sites



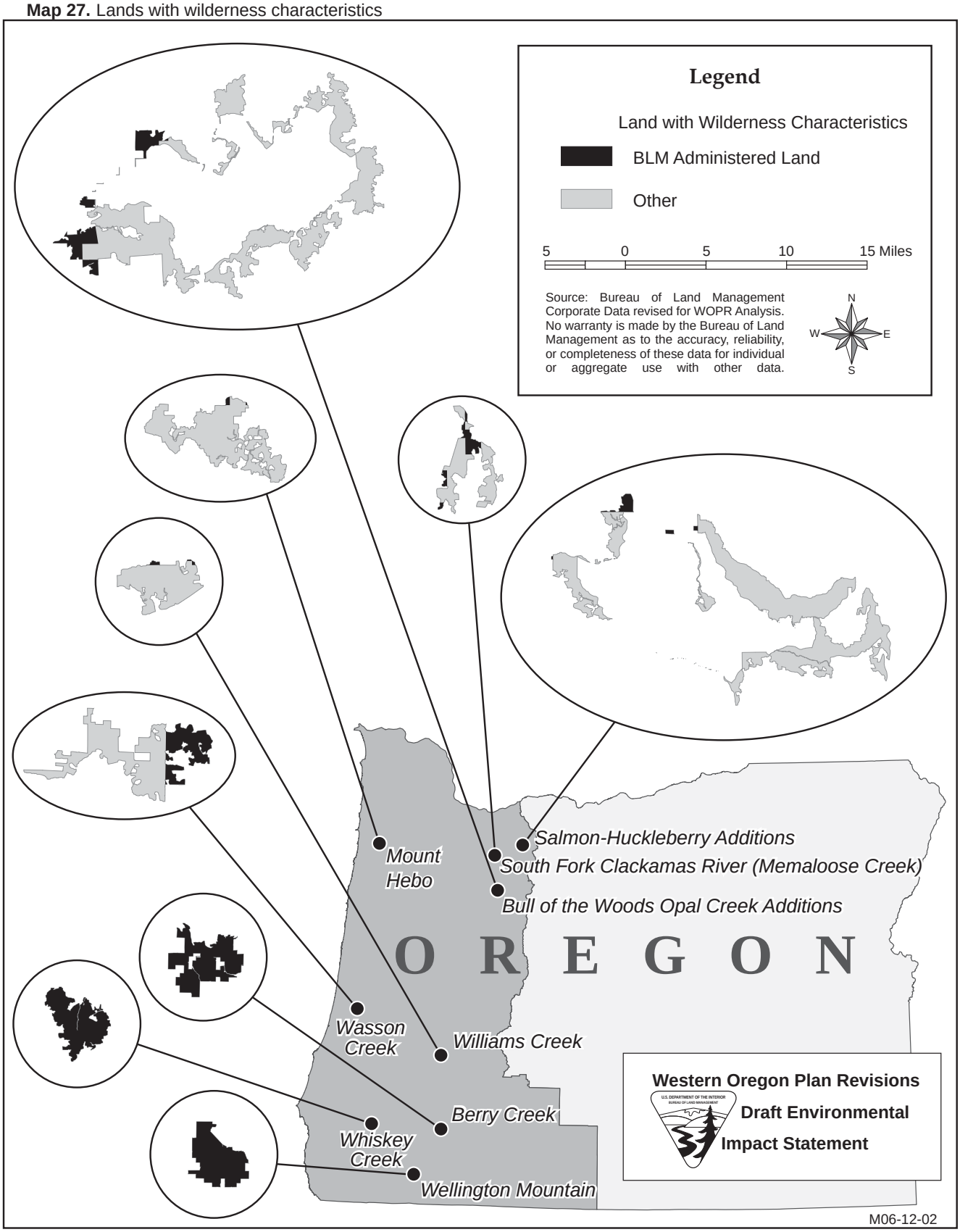
Map 25. National Landscape Conservation System designated lands



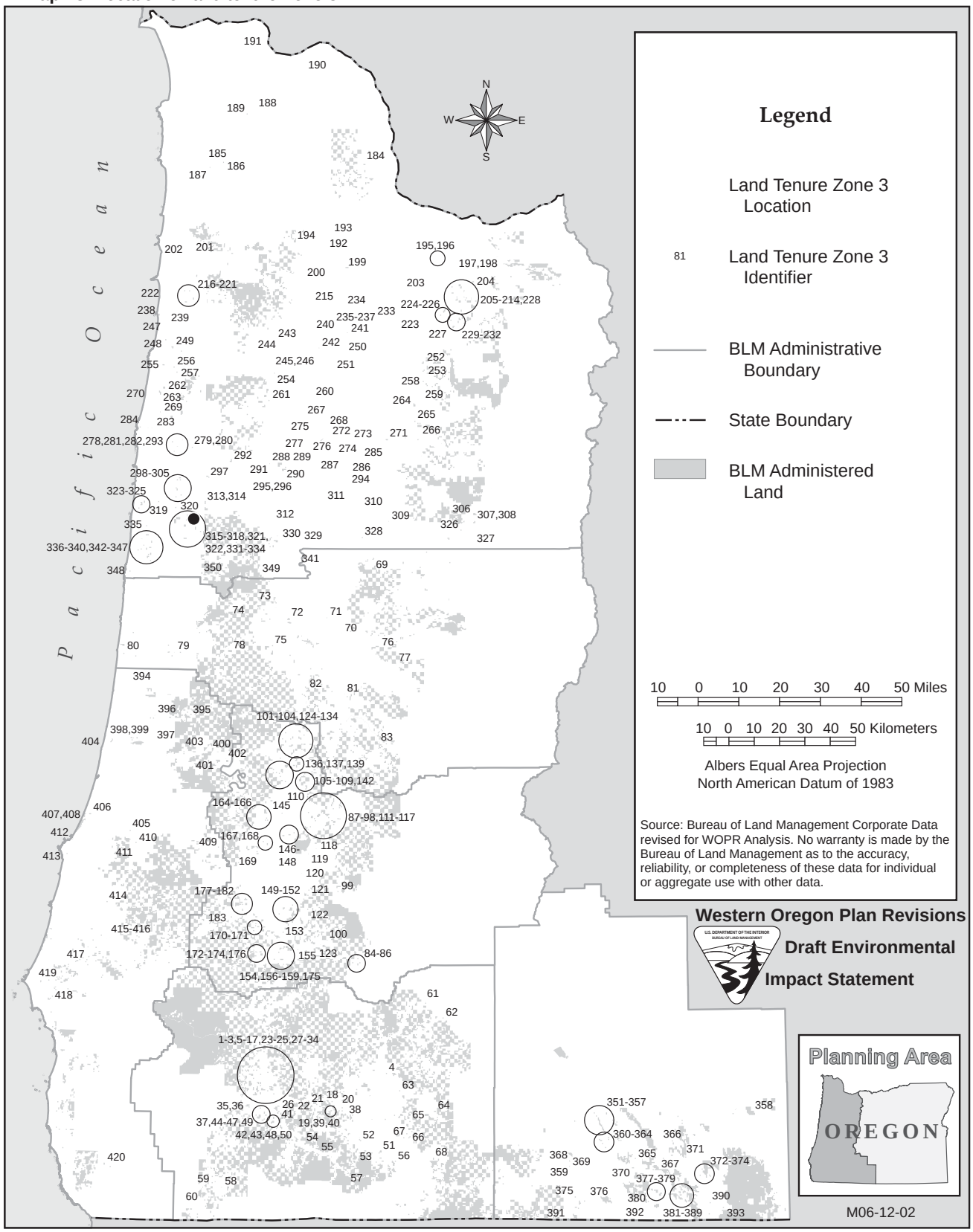
Map 26. Proposed off-highway vehicle designations



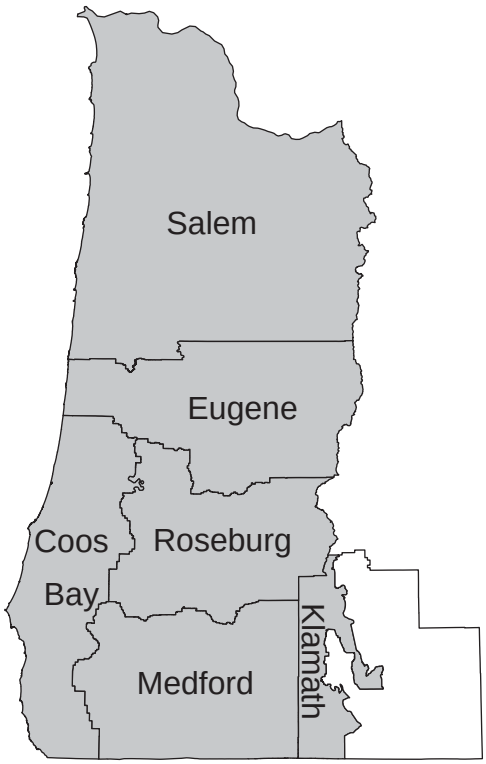
Map 27. Lands with wilderness characteristics



Map 28. Location of land tenure Zone 3



Map 29. Sustained yield units



Chapter 3 – Affected Environment

Chapter 3 of this draft environmental impact statement describes the affected environment for the six resource management plans of the planning area that are being revised.

In this chapter:

Introduction **181**

Ecology **192**

Socioeconomics **216**

Timber **247**

Special Forest Products **251**

Botany **257**

Invasive Plants **268**

Wildlife **282**

Fish **335**

Water **359**

Fire and Fuels **392**

Air **401**

Recreation **405**
Wilderness Characteristics **417**
Visual Resources **420**
National Landscape Conservation System **422**
Soils **425**
Grazing **428**
Wild Horses **433**
Areas of Critical Environmental Concern and Research Natural Areas **435**
Cultural Resources **439**
Lands, Realty, Access, and Transportation **445**
Energy and Minerals **454**

Introduction

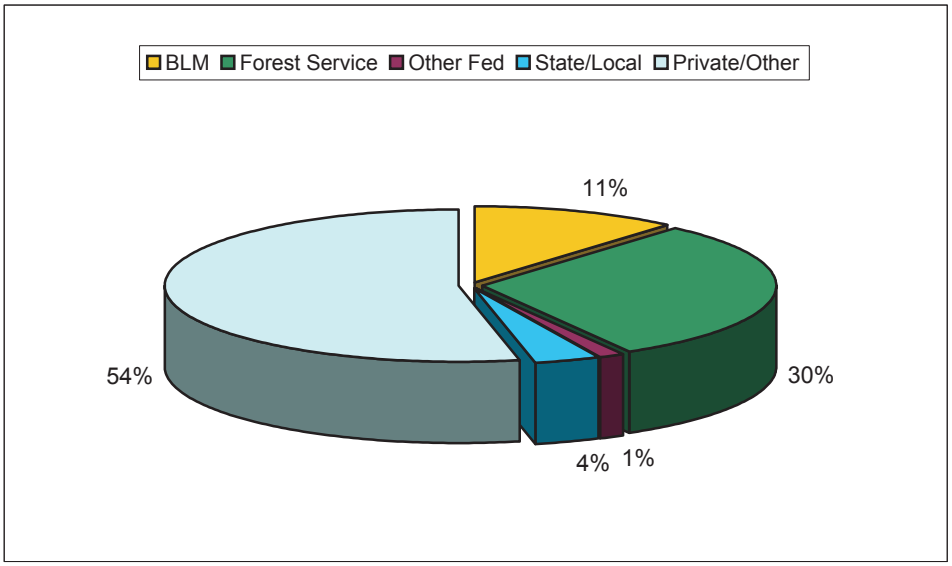
Chapter 3 describes the affected environment. The description of the affected environment is designed to support and facilitate the understanding of the analysis of the environmental consequences that are presented in *Chapter 4*. The amount of information provided in this chapter is proportionate to the importance, scope, and sensitivity of the environmental consequences and is no longer than necessary to understand the analysis.

Planning Area

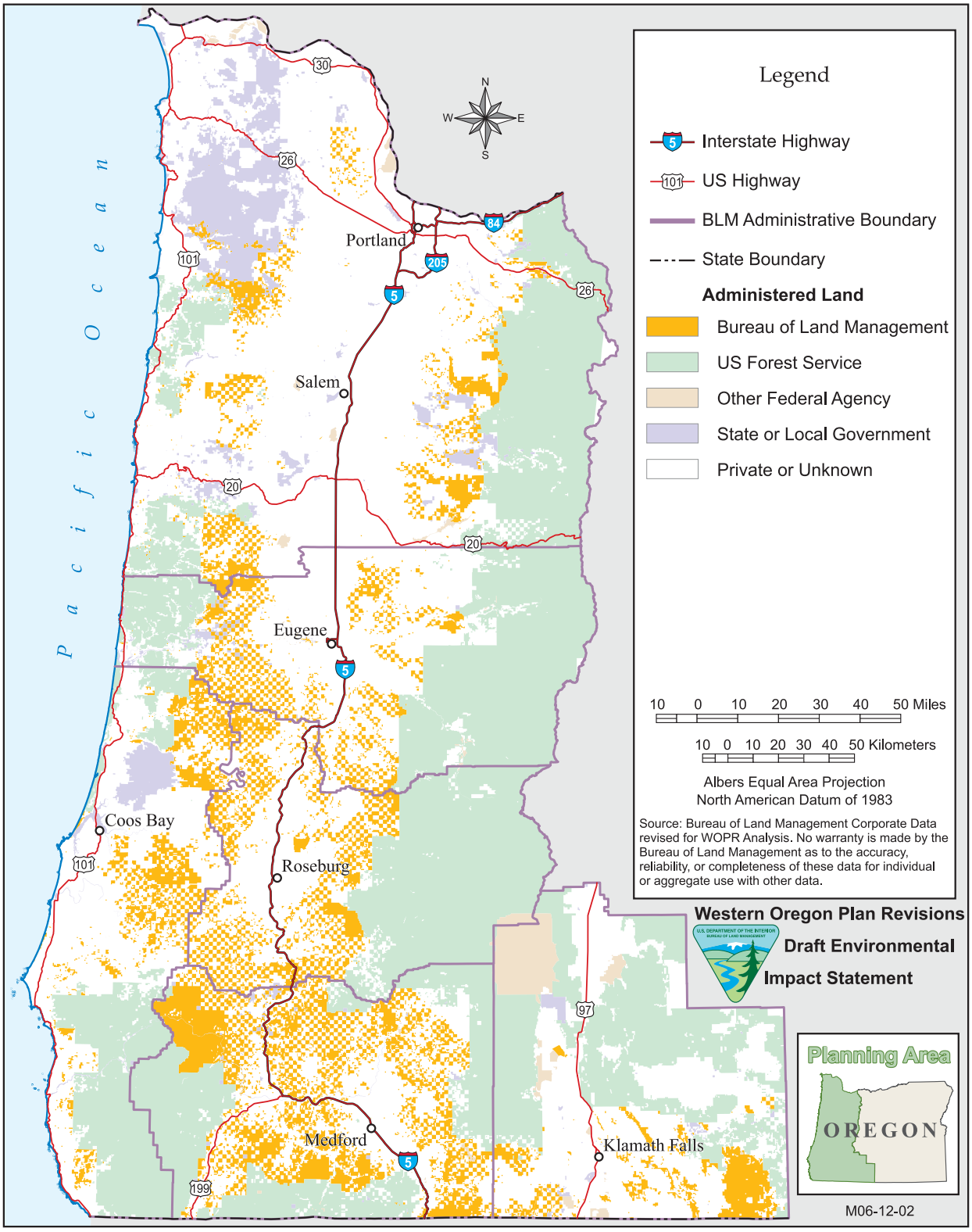
The planning area for the six resource management plans that are being revised includes the public lands and resources that are administered by the Salem, Eugene, Roseburg, Coos Bay, and Medford districts, and the Klamath Falls Resource Area of the Lakeview District. See *Map 30 (BLM lands within the planning area)*.

The entire planning area includes approximately 22 million acres, but only approximately 2.5 million acres are public lands that are administered by the BLM. The BLM-administered lands, therefore, represent only about 11% of the planning area. The majority of the lands within the planning area are owned and managed by private landowners and other government agencies. See *Figure 9 (Major ownerships within the planning area)*.

Figure 9. Major ownerships within the planning area

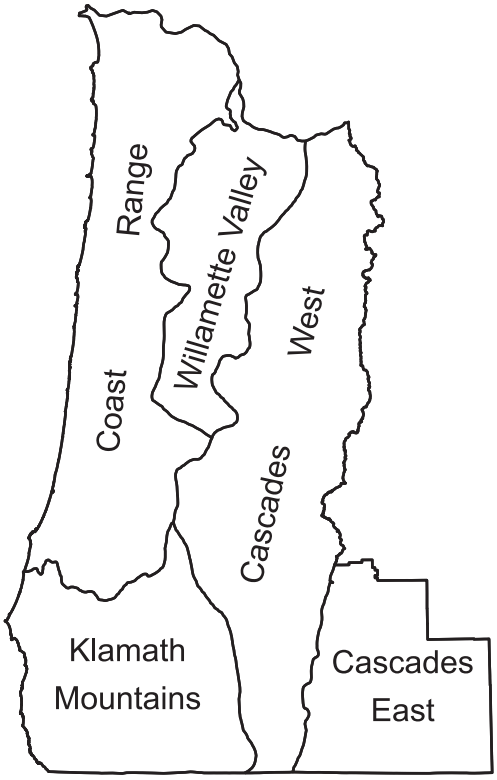


Map 30. BLM lands within the planning area



There are five physiographic provinces within the planning area. See *Figure 10 (Physiographic provinces within the planning area)*. Physiographic provinces vary by the type and structure of their vegetation and the differences in their hydrology, geology, and other processes (e.g., fire-return intervals) (FEMAT 1993).

Figure 10. Physiographic provinces within the planning area



Land Ownerships within the planning area

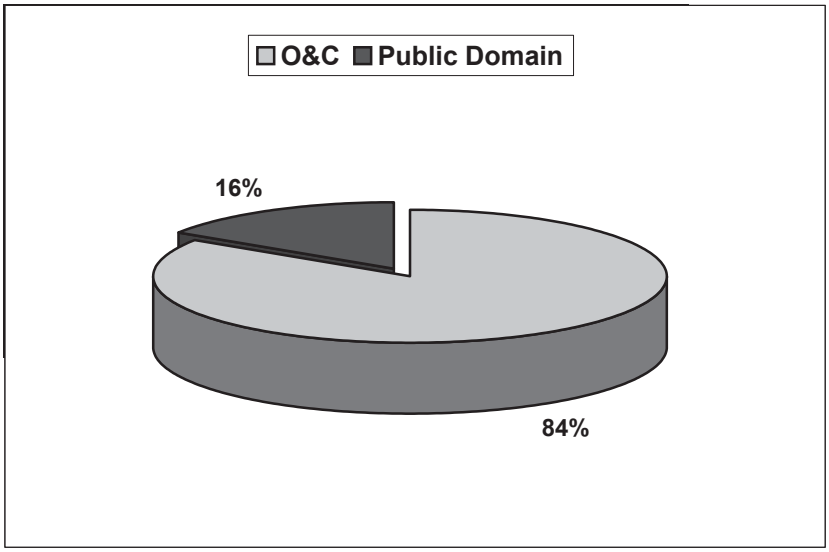
The public lands in Oregon include the O&C lands, public domain lands, and other public lands. See *Table 64 (Legal status of the lands administered by the BLM within planning area)*. The O&C lands in western Oregon are managed differently than the other public and public domain lands of Oregon, which are located mostly in eastern Oregon. The O&C lands are mostly scattered and intermingled with private, industrial forest lands. The public domain lands are about half scattered and intermingled with O&C lands and about half existing as larger blocks in the Salem, Coos Bay, and Lakeview districts (with the majority being concentrated in the Klamath Falls Resource Area of the Lakeview District). See *Figure 11 (BLM surface ownership by legal authority within the planning area)* for the amount of BLM surface ownership by source of administrative authority within the planning area.

Table 64. Legal status of the lands administered by the BLM within the planning area

BLM Districts	O&C Lands (acres)	Public Domain Lands (acres)	Other Public Lands* (acres)	Total (acres)
Salem	349,300	51,600	2,100	403,000
Eugene	304,200	10,500	400	315,100
Roseburg	406,500	19,800	0	426,300
Coos Bay	279,400	41,800	1,500	322,700
Medford	764,900	96,100	4,800	865,800
Klamath Falls Resource Area (Lakeview District)	46,900	174,800	3,200	224,900
Total	**2,151,200**	**394,600**	**12,000**	**2,557,800**

*Federal lands acquired by purchase or donation under an authorization other than the Federal Land Policy and Management Act.

Figure 11. BLM surface ownership by legal authority within the planning area



The O&C land pattern has a checkerboard character that results from the grid of the Public Land Survey System. O&C land is generally located in the odd-numbered sections with the intermingled private lands being located in the even-numbered sections. A section in the checkerboard is normally one mile on a side and encloses approximately 640 acres. The BLM administers approximately 2.5 million acres of these checkerboard parcels of public land within the approximately 22 million acres that comprise the planning area. The management of the intermingled private lands usually differs from that of the BLM-administered lands. See *Figure 12 (Sample portion of the intermingled checkerboard of private and BLM-administered lands).*

Public Land Survey System

For details about this system of subdividing and identifying public domain lands, see http://nationalatlas.gov/articles/boundaries/a_plss.html.

Figure 12. Sample portion of the intermingled checkerboard of private and BLM-administered lands

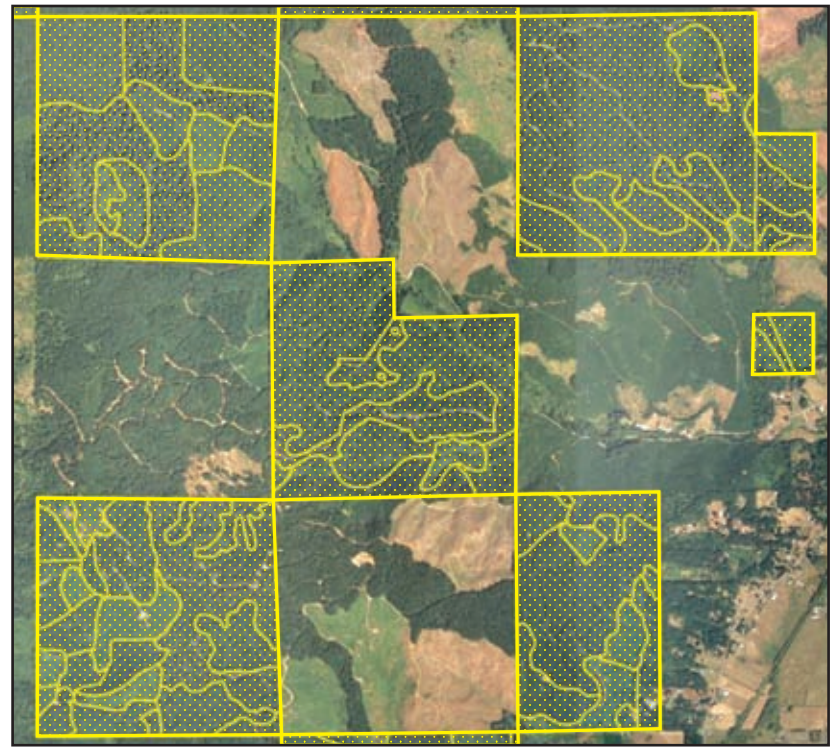


Figure 12 illustrates the intermingled checkerboard pattern of the BLM and private land ownerships. The BLM-administered lands in the figure are within the squares that contain the small polygons. Note that many parcels of BLM-administered lands are smaller than a square mile and are disconnected and isolated from other BLM-administered lands. The dark green areas in the image are older forests while the brown areas are recently harvested units.

Land Management

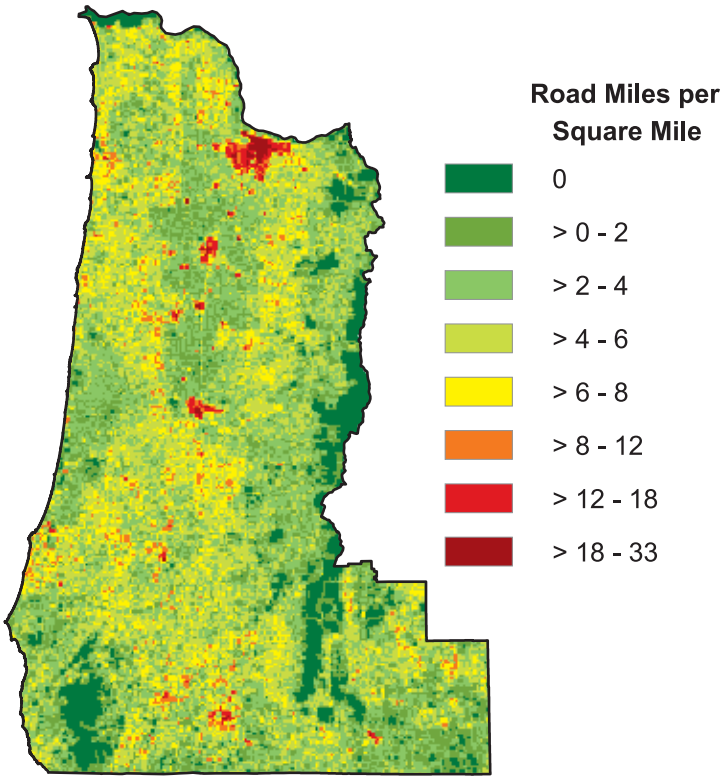
The existing land management plans for the individual national forests and BLM districts (including the six districts within the planning area) that are west of the Cascade Range in Washington, Oregon, and northern California have incorporated the management direction that is contained in the Northwest Forest Plan. Most, but not all, of the planning area falls within the Northwest Forest Plan area. See *Figure 13 (Areas of the Northwest Forest Plan and the planning area).*

Figure 13. Areas of the Northwest Forest Plan and the planning area

The current vegetation condition of the private, state, and federal lands within the planning area has been calculated using the 1996 satellite data from the Interagency Vegetation Mapping Project. This data includes the major fire and regeneration harvesting data that is available as of 2002. The vegetative condition of non-BLM lands varies from nonforest to the four forest structural stage classifications (stand establishment, young (or recently harvested), mature, and structurally complex).

The intensity of the land management activities across all ownerships within the planning area is partly indicated by the number of miles of roads that exist per square mile (i.e., road density). See *Figure 14 (Road density across all land ownerships within the planning area).*

Figure 14. Road density across all land ownerships within the planning area



The BLM has also developed a geospatial database of the lands and resources it administers. This geographic information system contains data regarding various resources, such as forests, streams, roads, recreation, and wildlife. This information was captured from on-the-ground surveys and aerial and satellite photography. See *Figure 15 (Example of geospatial data from the Forest Operations Inventory database)*.

Figure 15. Example of geospatial data from the Forest Operations Inventory database

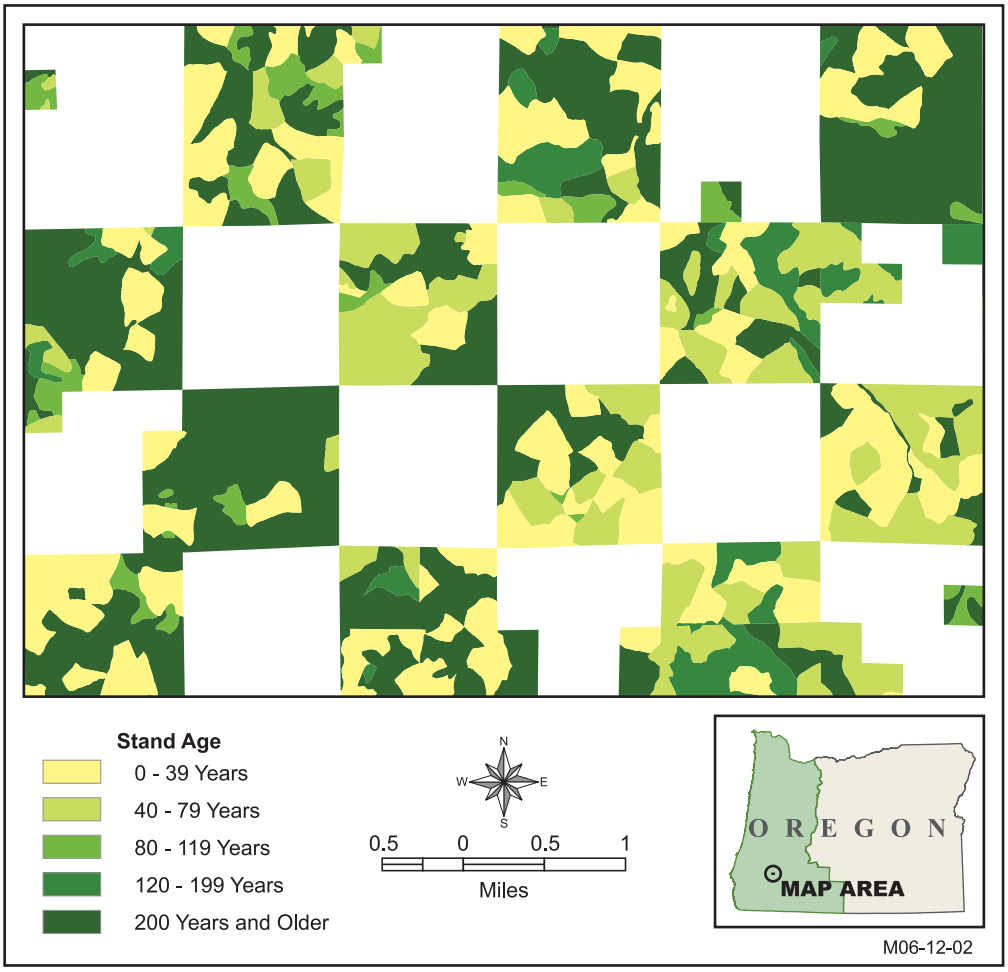


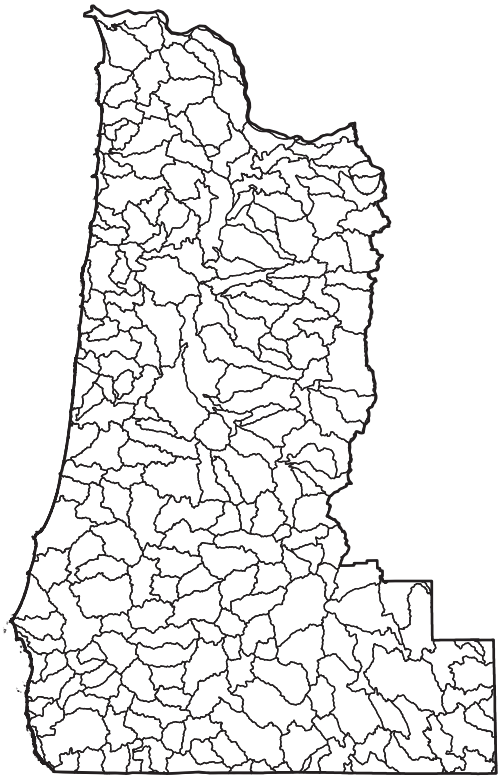
Figure 15 shows aggregated sections within individual forest stands. Non-BLM lands are not mapped. The areas mapped in the figure represent a somewhat typical BLM landscape, which is a mixture of older stands and younger stands that that have been harvested and replanted. These stands are intermixed on a larger landscape of private timber management, agriculture, and urbanization. The BLM manages over 80,000 mapped individual stands.

Watersheds are also useful as a unit of measure for summarizing certain natural resources. There are 260 fifth-field watersheds, which average 87,000 acres in size, located all or partially within the planning area. For a discussion of watersheds, see *Water* in *Chapter 3*. See *Figure 16 (Fifth-field watersheds within the planning area)* for the size and distribution of these watersheds within the planning area.

Watersheds

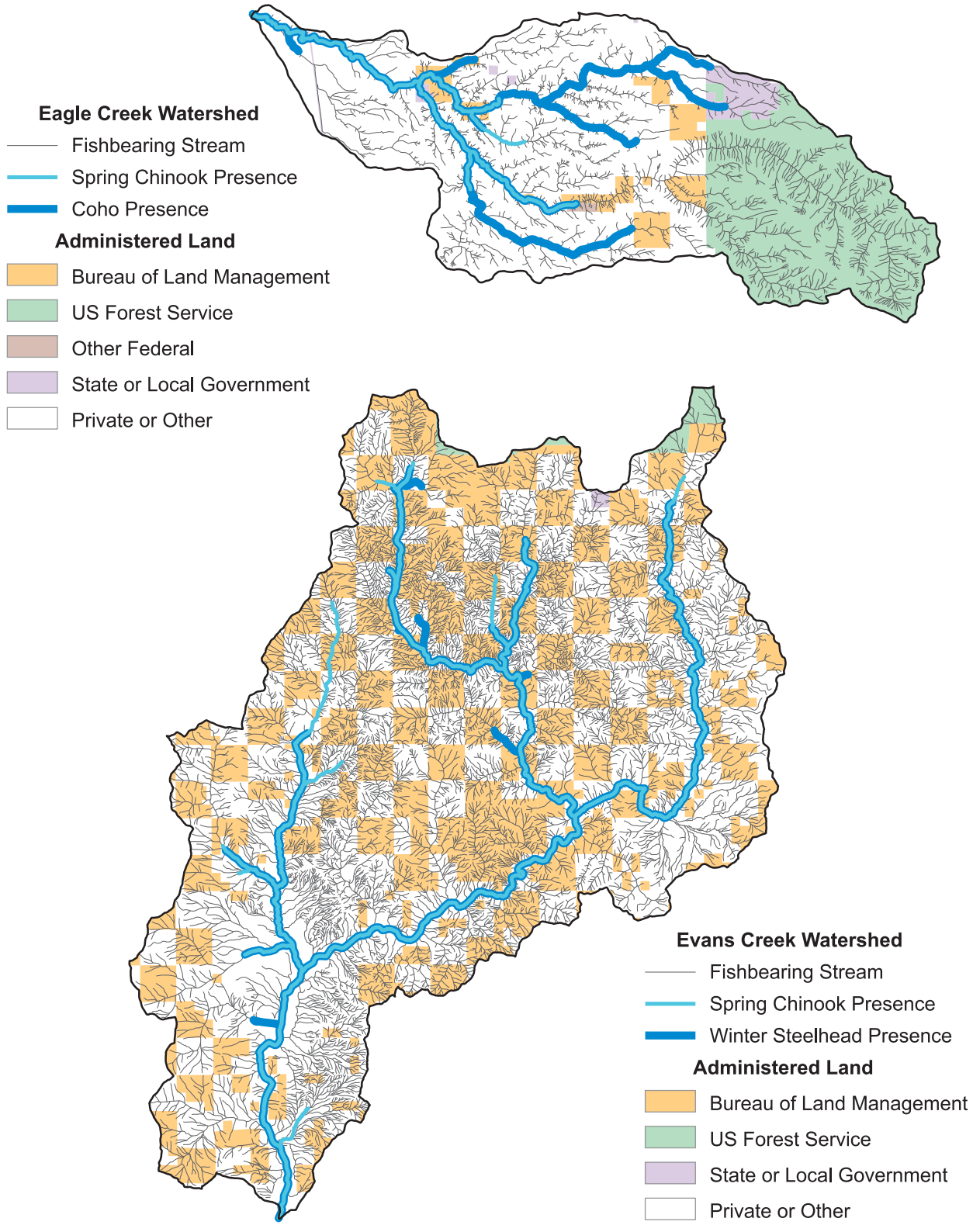
To learn more about watersheds in our area, see http://www.epa.gov/owow/watershed/whatis.html and http://cfpub.epa.gov/surf/

Figure 16. Fifth-field watersheds within the planning area



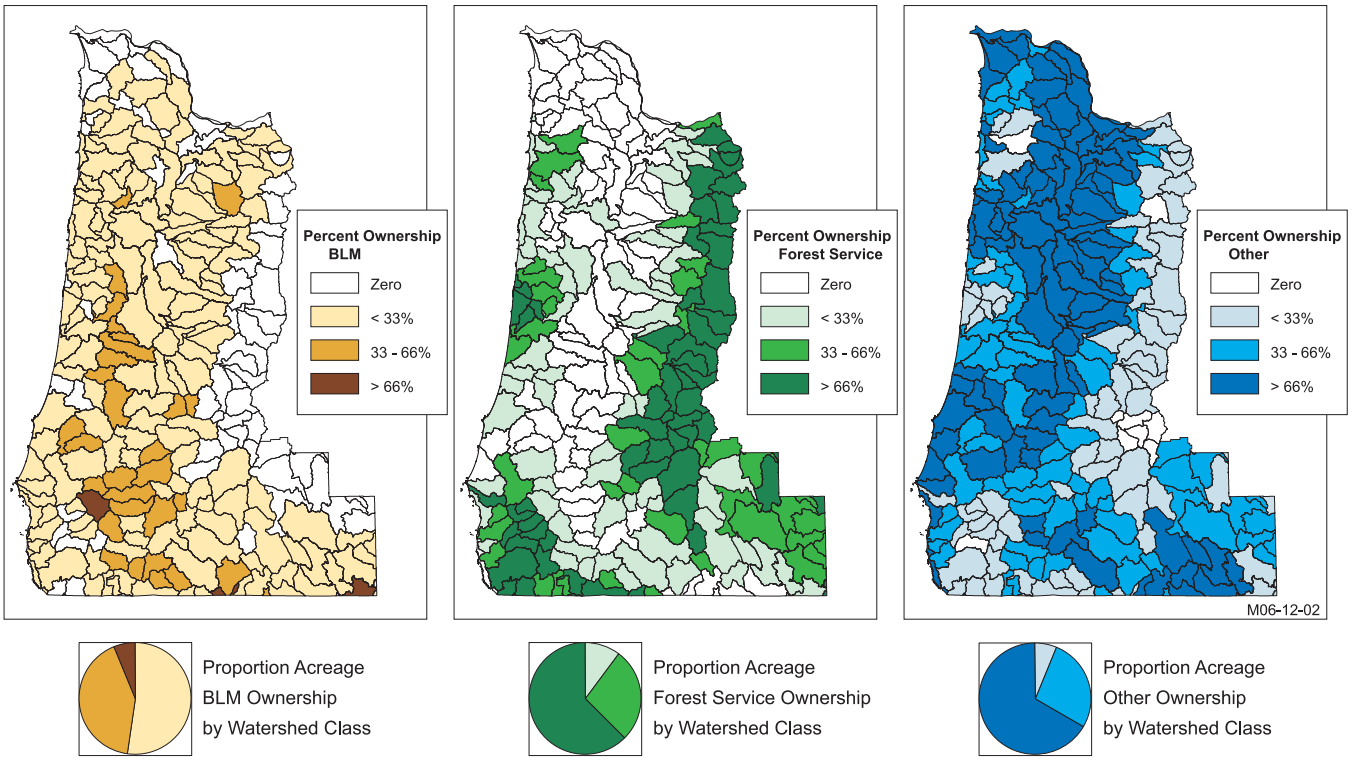
The BLM in western Oregon is rarely the predominant landowner within a fifth-field watershed. See *Figure 17 (Two example watersheds showing various BLM ownership patterns)*. *Figure 17* shows that BLM ownership at the fifth-field watershed level ranges from a few scattered parcels to large areas. Therefore, activities on adjacent lands have implications for the management of BLM lands. The BLM's ability to influence resource outcomes often depends upon the amount and location of its land ownership in relation to a particular resource.

Figure 17. Two example watersheds showing various BLM ownership patterns



Over half of BLM lands are located within fifth-field watersheds where the BLM-administered lands comprise less than one-third of the watershed. By contrast, most of the lands managed by the Forest Service are in large, contiguous blocks. See *Figure 18 (BLM, Forest Service, and private ownership as a percent of the fifth-field watersheds within the planning area)*, which illustrates the comparative proportion of land ownership at the fifth-field watershed scale for the BLM, Forest Service, and private land owners. In only 8 of the 260 fifth-field watersheds within the planning area does the BLM-administrated lands comprise the majority of the watershed.

Figure 18. BLM, Forest Service, and private ownership as a percent of the fifth-field watersheds within the planning area



Ecology

Key Points

- The abundance of stand establishment forests is above the average for historic conditions.
- Stand establishment forests that are created by timber harvesting usually lack the habitat complexity and legacy components that are typical of stand establishment forests following natural disturbances.
- Stand establishment forests have declined on federally managed forests over the past decade and are becoming restricted to nonfederal lands.
- The abundance of young forests is above the average for historic conditions.
- Young forests on BLM-administered lands are predominately high-density, even-aged stands that are developing along a trajectory that is fundamentally different from that experienced by most of the existing structurally complex forests on BLM-administered lands.
- The abundance of mature and structurally complex forests within the planning area is below the average for historic conditions.
- The growth of forests into a mature and structurally complex forested condition has far outpaced the loss of mature and structurally complex forests from harvesting and wildfires within the planning area over the past 10 years.

This section of Chapter 3 analyzes the ecological condition of conifer forests. Forest stands can be described by their structure, composition, and function. This analysis will focus on forest structure, because structure is the most easily analyzed, responds most predictably and apparently to management actions, and is closely related to many of the issues for analysis.

The structural development of conifer stands in the Pacific Northwest is a complex and continuous process. Pacific Northwest conifer forests are notable for the potential longevity and massive size of live trees, and enormous accumulations of coarse woody debris. Forest structure in the Pacific Northwest continues to develop for tremendously long time spans, perhaps even a millennium in the absence of stand-replacing disturbances (Spies 2004; Franklin et al. 2002). Therefore, there is more complexity in classifying the later stages of structural development in the conifer forests of the Pacific Northwest than in most forested regions.

The report titled *Forest Ecosystem Management: An Ecological, Economic, and Social Assessment* (FEMAT 1993) described ecological conditions throughout the range of the northern spotted owl. The FEMAT report described the history of forest management in the region (p. II-2, II-3), the terrestrial forest ecosystems with an overview of biological communities and ownership patterns (p. IV-3 to IV-8), and the current forest conditions with an emphasis on the structure, composition, and processes of late-successional forests (p. IV-8 to IV-12, IV-27 to IV-31). Those descriptions are incorporated by reference and the following paragraphs summarize them.

FEMAT
(Forest Ecosystem Management Assessment Team)

The 1993 presidentially assigned team of scientists, researchers, and technicians from seven federal agencies that created the report that was used as the basis for the Northwest Forest Plan.

The final supplemental environmental impact statement (USDA, USDI 1994) for the Northwest Forest Plan FEIS also analyzed the ecological conditions within the range of the northern spotted owl. The Northwest Forest Plan FSEIS relied partly on the FEMAT report, which was included as an appendix to the Northwest Forest Plan FSEIS. The Northwest Forest Plan FSEIS provided some additional discussion within each of the descriptions incorporated below, and those analyses are incorporated by reference (p. 3&4-11 to 3&4-29).

The FEMAT report and the Northwest Forest Plan focused on "late-successional and old-growth forest" (FSEIS, I-4 to I-6). As defined in the FEMAT report and the Northwest Forest Plan, the concept of late-successional forest included both mature and old-growth forests (FEMAT, IX-19; FSEIS, Glossary 9). The FEMAT report and the Northwest Forest Plan developed a management plan that was "based on returning the federal landscape toward an extent of old-growth forest more in line with what was here before widespread logging on federal lands. The historical extent was assumed to be adequate to sustain the native biological diversity associated with older forest." (Spies 2006, 83).

Late-successional forests are heterogeneous in structure and diverse in composition and function (FEMAT, IV-28 to IV-31). Since the publication of the FEMAT report in 1993, research has continued to refine scientific understanding of the development of existing late-successional forests. There are multiple developmental pathways to late-successional forest structure and composition across the region (Franklin and Van Pelt 2004; Spies 2004; Franklin et al. 2002). Research reconstructing the stand development of late-successional forests on BLM-administered lands in western Oregon suggests that large, old-growth trees generally developed under low stand densities (Spies 2006; Poage and Tappeiner 2002; Sensenig 2002; Tappeiner et al. 1997). In contrast, research by Winter et al. (2002), reconstructing a late-successional stand in western Washington, concluded that the stand initiated under high-density conditions (Winter et al. 2002). Although the research by Winter et al. (2002) represents only a single stand, its contrasting finding to the above research suggests that there may be strong regional differences in the development of late-successional forest conditions. The large data set from BLM-administered lands within the planning area make the conclusions from Poage and Tappeiner and Tappeiner et al. more relevant to this analysis.

The FEMAT report and the Northwest Forest Plan FSEIS described the role of silviculture, including the use of stand thinning, to accelerate the development of late-successional forest structural characteristics and to reduce the risk of stand-replacing fire (FEMAT, IV-33 to IV-36; FSEIS, 3&4-45, 3&4-47, 3&4-49). The Northwest Forest Plan FSEIS observed that late-successional forest development in young, managed stands may be retarded, or not occur at all, without silvicultural treatment (FSEIS, 3&4-49). Research in the last decade has reinforced the potential roles of silviculture and has provided a more detailed understanding of the effects of thinning on forest resources (Franklin et al. 2006; Spies 2006; Hayes et al. 2003; Muir et al. 2002; Carey 2000). The monitoring report titled *Northwest Forest Plan–The First Ten Years (1994-2003): A Synthesis of Monitoring and Research Results* (commonly known as the *Monitoring Synthesis Report*) affirmed the conclusions in the FEMAT report and the Northwest Forest Plan that thinning would restore ecological diversity and reduce the potential for loss from high-severity fires (Spies 2006, 110-111).

Ecological Conditions at the Regional Scale

The analysis in this section of *Chapter 3* (*Ecology*) will not provide a new analysis of forest conditions at the scale of the Northwest Forest Plan, which is the range of the northern spotted owl. The discussions below will summarize previous analyses and monitoring results and provide the context for this analysis, which is conducted at the scale of the planning area and physiographic provinces. The discussions below at the regional scale use the forest stage terminology (e.g., late-successional forest) of the original analyses rather than the structural stage classification terminology that was developed in this analysis.

Physiographic province

A region of the landscape with distinctive geographical features. There are five within the planning area:

- Coast Range
- Eastern Cascades
- Klamath
- Western Cascades
- Willamette Valley

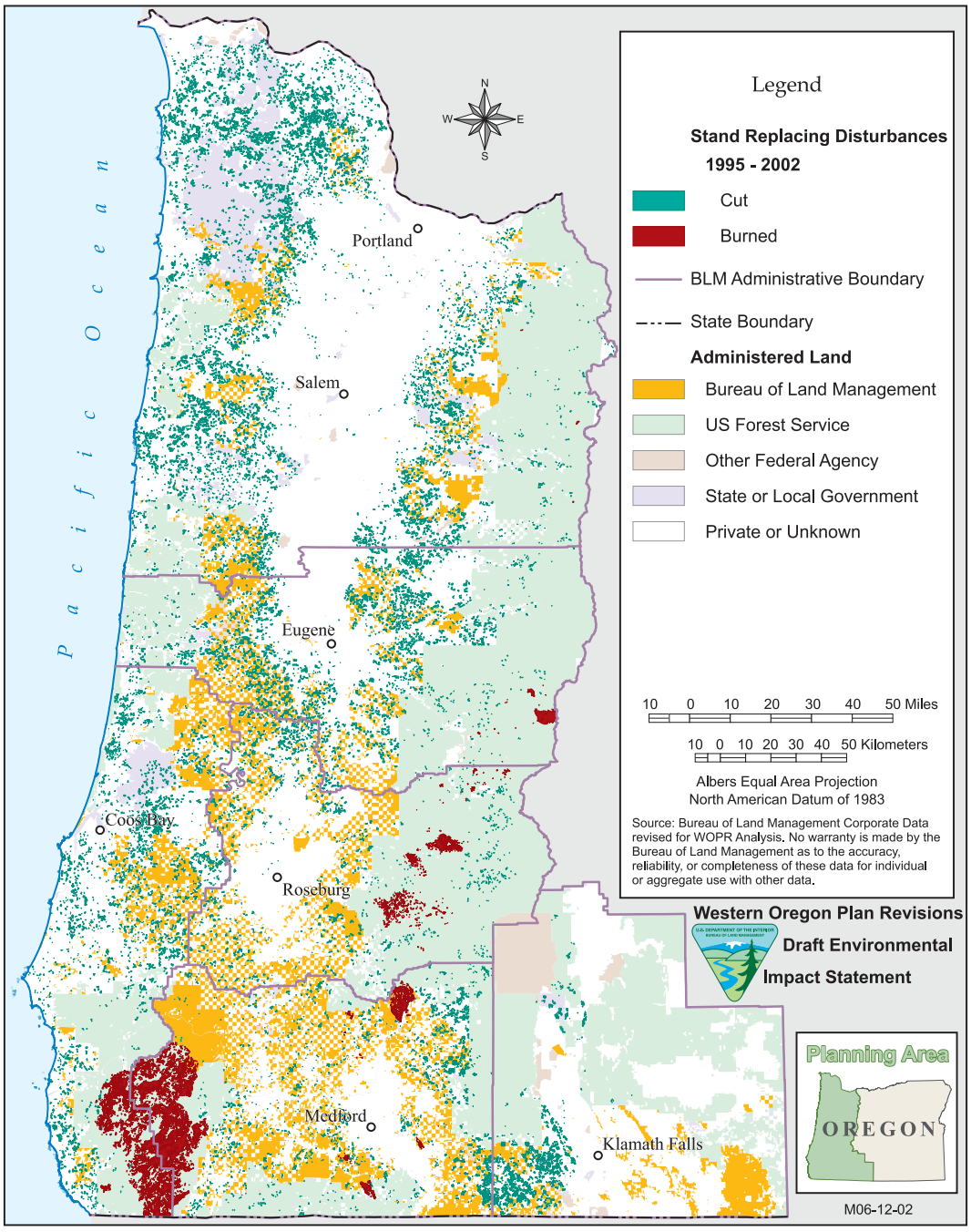
The Northwest Forest Plan FSEIS evaluated the abundance of late-successional forest by comparing abundance under each alternative to estimates of historic conditions (FSEIS, 3&4-36, 3&4-37):

- a "long-term average" of 65% of the region in late-successional forest, and
- a "long-term average low" of 40% of the region in late-successional forest.

The Northwest Forest Plan FSEIS estimated that there were 8.55 million acres of late-successional forest (described as medium and large conifer), which is approximately 35% of the 24.5 million acres of federally managed lands within the range of the northern spotted owl in 1994 (p. 3&4-27). The monitoring report titled *Northwest Forest Plan–The First Ten Years (1994-2003): Status and Trend of Late-Successional and Old-Growth Forest* (commonly known as the *Late-Successional Forest Monitoring Report*), using a similar definition but a remotely sensed data source, concluded that there were 7.87 million acres of late-successional forest on federally managed lands in 1994, and concluded that the plan was founded on valid assumptions about the extent of the remaining older forests (Moeur et al. 2005). The *Late-Successional Forest Monitoring Report* contains detailed descriptions of the abundance and distribution of late-successional forest by different measures, and those descriptions are incorporated by reference (Moeur et al. 2005, 44-110).

Since 1994, there has been a net increase of late-successional forest approximately twice the increase anticipated in the Northwest Forest Plan FSEIS. Growth of forests into the lower size range of late-successional forests has far outpaced losses of late-successional forest from harvesting and wildfire. Harvesting of late-successional forest has been far below the amount anticipated in the Northwest Forest Plan FSEIS. Loss of late-successional forest from wildfire in total has been approximately consistent with the amount anticipated in the Northwest Forest Plan FSEIS, though losses have been higher in the fire-prone forests of the Klamath province. See *Figure 19 (Disturbance map from the Northwest Forest Plan's Late-Successional Forest Monitoring Report)* (Spies 2006; Moeur et al. 2005, 39, 85-100, 104-106; FSEIS, 3&4-42).

Figure 19. Disturbance map from the Northwest Forest Plan's *Late-Successional Forest Monitoring Report*



At least 1.7 million acres of existing late-successional forests are in fire-adapted vegetation types that are characterized by high fire frequency and low fire severity in the Eastern Cascades and Klamath provinces, and up to 1 million acres are in dry mixed conifer types in the Western Cascades province. The *Late-Successional Forest Monitoring Report* and the *Monitoring Synthesis Report* identified that this large acreage of late-successional forest that is susceptible to catastrophic wildfire may be a concern,

and concluded that the possibility of major losses of late-successional forest in fire-prone ecosystems cannot be ignored (Spies 2006; Moeur et al. 2005, 100-102, 107-108).

Nonfederal forests within the range of the northern spotted owl are predominately young, even-aged, managed stands, and provide mostly early and mid-successional forest habitat. The Northwest Forest Plan FSEIS characterized typical management on nonfederal forest lands as including timber harvesting in a stand's fifth or sixth decade (FSEIS, 3&4-5 to 3&4-8). Since 1994, harvest rotations on forest industry lands have generally shortened (Nonaka and Spies 2005; Kennedy 2005, 110-117; Alig et al. 2000, 9). The Northwest Forest Plan assumed that nonfederal forests would contribute little to late-successional goals, but the *Monitoring Synthesis Report* acknowledged that this assumption may not have been correct, and that nonfederal lands, especially state lands, provide substantial late-successional forest (Spies 2006, 108).

The implementation of the Northwest Forest Plan reduced harvest levels on federally managed forests from recent historic levels. The vast majority of harvests and subsequent creation of early successional habitat is now occurring on nonfederal lands. The *Monitoring Synthesis Report* acknowledged that the Northwest Forest Plan did not explicitly provide for the biological diversity that is associated with early successional habitats. The *Monitoring Synthesis Report* observed that nonfederal lands cannot be assumed to provide for these elements of biological diversity because of the lack of diverse, early successional habitat with structural legacies on nonfederal lands (Spies 2006, 109).

The FEMAT report and the Northwest Forest Plan FSEIS provided a brief, qualitative evaluation of the existing spatial patterns of late-successional forests. Those analyses stated that what little late-successional forest remained on private and state lands occurred in small, isolated patches, and that most late-successional forests on federal forests are highly fragmented by harvested areas and young stands (FEMAT, IV-12; FSEIS, 3&4-29). The Northwest Forest Plan FSEIS evaluated the spatial patterns of alternatives by the connectivity of late-successional forest—measuring the distances between late-successional forested patches (FSEIS, 3&4-38 to 3&4-40). The Northwest Forest Plan FSEIS concluded that implementation of the Northwest Forest Plan would likely result in "moderate to strong" connectivity among late-successional forests (Spies 2006; FSEIS, 3&4-44, 3&4-46). However, that analysis did not project the retention or development of late-successional forests within the harvest land base unless explicitly reserved through the standards and guidelines (FSEIS, 3&4-42, 3&4-43).

Ecological Conditions at the Planning Area Scale

The ecological conditions at the scale of the planning area are discussed in terms of the structural stages of forests and physiographic provinces. See *Figure 20 (Percent of BLM-administered land within each of the physiographic provinces within the planning area)* and *Figure 21 (Physiographic provinces and BLM lands within the planning area)*.

Figure 20. Percent of BLM-administered land within each of the physiographic provinces within the planning area

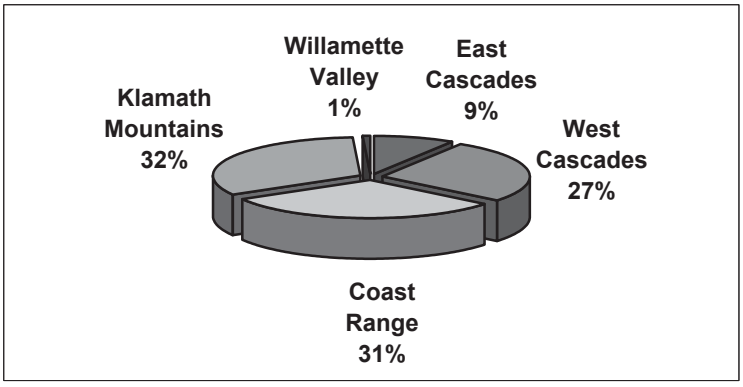
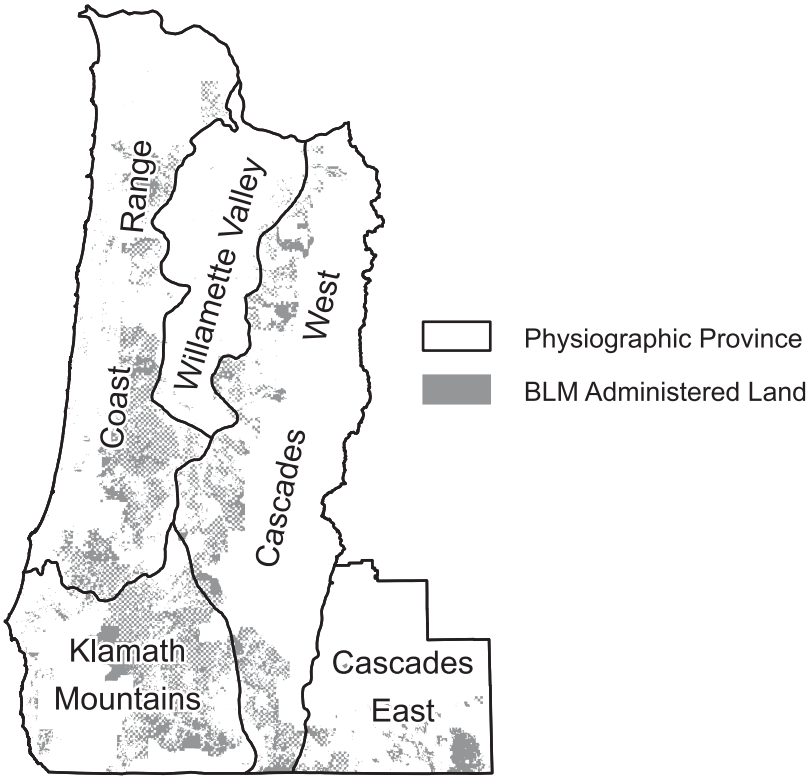


Figure 21. Physiographic provinces and BLM lands within the planning area



Forests are classified in this analysis by four structural stage classifications:

- stand establishment
- young
- mature
- structurally complex.

These four structural classes are further subdivided by additional structural descriptors See *Table 65 (Structural stage subdivisions)*. Most discussions in this section will only use the four classes described above. The subdivisions are applied only to BLM-administered lands and are used in this section only where needed to address specific analytical questions. A detailed description of the structural classifications is provided in *Appendix B. Ecology*.

Table 65. structural stage subdivisions

Structural Stages	Subdivisions	Descriptions
Stand Establishment	Stand Establishment without Structural Legacies	Very young forest (< 50 ft. tall) without larger trees
	Stand Establishment with Structural Legacies	Very young forest (< 50 ft. tall) with some larger trees
Young	Young without Structural Legacies	Taller than stand establishment, but still small (< 20 in. dbh) and without larger trees
	Young with Structural Legacies	Taller than stand establishment, but still small (< 20 in. dbh) and with some larger trees
Mature	Mature with Single-Layered Canopy	Larger trees (> 20 in. dbh) with little variation in tree size
	Mature with Multilayered Canopy	Larger trees (> 20 in. dbh) with more than one canopy layer
Structurally Complex	Existing Old Forest[ab]	Stands currently 200 years or older
	Developed Structurally Complex[c]	Larger trees (> 20 in. dbh) with some very large trees (> 40 in. dbh) and more than one canopy layer

Notes:

[a]Stands identified in the current inventory as 200 years or older remain in this subdivision in the future unless harvested.

[b]A subset of this subdivision (Existing Very Old Forest, which represents stands that are 400 years or older) is also identified based on current inventory. The assignment of ages to these unmanaged stands is imprecise, but represents the only available data across BLM-administered lands within the planning area.

[c]Forests are classified in this subdivision if they have the structural attributes identified but are not 200 years or older in the current inventory. It includes stands that currently have the attributes of structurally complex stands and those stands that develop the attributes of structurally complex stands in the future.

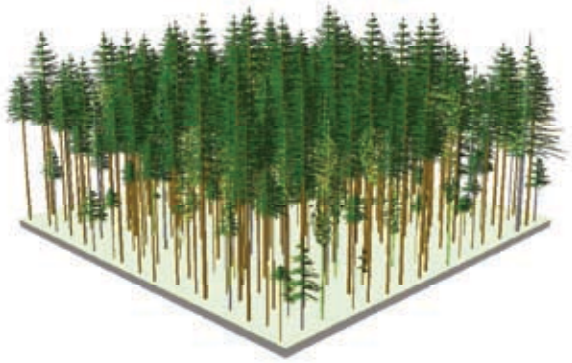
This classification uses only measures of live trees. The dynamics of coarse woody debris and snags are integral to ecological definitions of late-successional forests, and there is increasing understanding of the importance of dead wood in early-successional forests (Franklin et al. 2002; Spies and Franklin 1988). However, this classification does not include measures of dead wood because of inadequate inventory of dead wood (Spies 2006), the high variability of dead wood levels in unmanaged forests (Spies and Franklin 1991), and the difficulty in modeling future creation of dead wood from such disturbances as fire or wind (Kennedy 2005, 97-160).

The stand establishment structural stage describes the early-successional conditions of a forest following such disturbances as timber harvesting or wildfires. This classification is comparable to the cohort establishment stage in Franklin et al. (2002). This classification is subdivided based on whether the new forest includes trees from the previous forest (with or without structural legacies). See *Figure 22 (Stand establishment forest without structural legacies)*. Natural disturbances within the planning area typically do not kill all trees within a stand, and surviving trees have important influences on stand development (Franklin et al. 2002; Aber et al. 2000).

Figure 22. Stand establishment forest without structural legacies

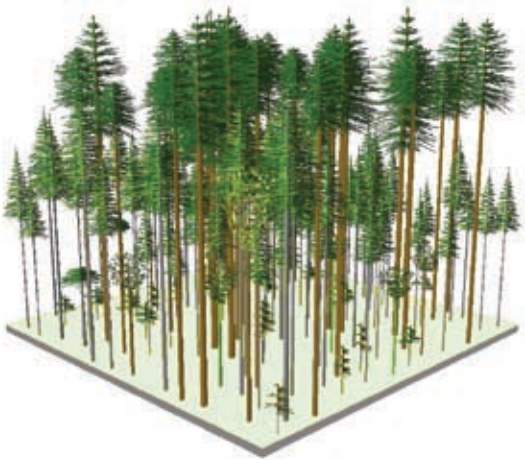
Young forests approximate small conifer forests as used in the FEMAT report and the Northwest Forest Plan. This classification is subdivided, like stand establishment, based on whether the young forest includes trees from the previous forest. See *Figure 23 (Young forest without structural legacies)*. Young forests with structural legacies develop from stand establishment forests that have structural legacies. Young forests with structural legacies typically develop directly into mature forests with multilayered canopies, whereas young forests without structural legacies typically develop into mature forests with a single-layered canopy.

Figure 23. Young forest without structural legacies



Mature forests are defined similarly to mature forests as described in the FEMAT report and the Northwest Forest Plan (although the definition in this analysis uses a lower threshold for the density of large trees in the southern portion of the planning area to reflect the generally lower site quality). This classification is subdivided based on whether the forest has a single-layered or multilayered canopy. See *Figure 24 (Mature forest with multilayered canopies)*. The development of multiple canopy layers may arise from the development of a new cohort of shade-tolerant trees below an older overstory or from prolonged or continuous tree regeneration in open young forests. This classification uses the diversity of tree diameters as a surrogate for direct modeling of tree crowns. (Development of continuous tree canopies may also arise from canopy trees re-establishing lower branches as the stand becomes more open. This process would not be detected by the subdivision in this classification. However, this process is typically associated with later stages of stand development, and therefore is part of the structurally complex structural stage in this classification scheme).

Figure 24. Mature forest with multilayered canopies



Mature forests with single-layered canopies typically must develop into mature forests with multilayered canopies first, before developing into structurally complex forests. This is because one of the defining characteristics of structurally complex forests is multiple canopy layers. Mature forests with multilayered canopies provide the precursors

to structurally complex forests, ensuring a replacement of structurally complex forests that are removed by timber harvesting or natural disturbances. Mature forests with multilayered canopies would provide more of the functions that are associated with structural complex forests, such as habitat for species that are associated with late-successional forests, than would mature forests with single-layered canopies (Spies 2006, 93; Washington State Department of Natural Resources 2005, 9-10).

Together, mature and structurally complex forests approximate what is termed late-successional forest in the FEMAT report, the Northwest Forest Plan, and the district resource management plans.

Structurally complex forests approximate what is termed:

- old-growth forests in many analyses (e.g., district resource management plans and environmental impact statements);
- medium and large conifer multistory forests in the FEMAT report; and
- large, multistoried older forest in the *Late-Successional Forest Monitoring Report* (Moeur et al. 2005).

See *Figure 25 (Structurally complex forest)*.

Figure 25. Structurally complex forest

The structural development of structurally complex forests is a continuous and variable process, and the structure and composition of very old stands is not equivalent to those of the younger, less developed forests that are classified as structurally complex (Spies 2006; Washington State Department of Natural Resources 2005; Franklin and Van Pelt 2004; Spies 2004; Franklin et al. 2002). The structural complexity of forests continues to develop for many centuries after meeting the minimum criteria for a structurally complex forest (Franklin et al. 2002). The older, more complex forests provide superior habitat for some species, such as *Nephroma occultum* and *Pseudocyphellaria*

rainierensis, that are slow to colonize habitats, are highly sensitive to disturbance, or prefer highly complex canopy structure (USDA, USDI 2004a). However, there is inadequate information to evaluate whether older structurally complex forests would provide superior habitat to younger structurally complex forests for most species that are related to late-successional forests.

This analysis does not classify forests by age alone (though some parts of the analysis use stand age), because stand age alone does not reliably describe the structural conditions of stands (Franklin et al. 2006; Spies 2006; Moeur et al. 2005; Spies and Franklin 1991; Spies and Franklin 1988). The rate of development of several forest structural characteristics that are relevant to the issues in this analysis, such as large individual trees and multiple canopy layers, is dependent partly on the forest management actions that would differ among the alternatives. This differential rate of structural development would be masked by classifying the forest solely by age. Furthermore, classifying stands by age is problematic in mixed-aged stands. Stand age is used here to distinguish between existing old forest and existing very old forest within the broader classification of structurally complex forests.

There is inadequate information on existing stands to distinguish among levels of complexity among structurally complex forests. Current structurally complex forests are mostly or exclusively unmanaged stands, and the BLM has less stand-level inventory information regarding these stands than for managed stands. Therefore, this classification describes a subdivision of structurally complex forest as existing old forest (stands identified in the current inventory as 200 years or older), and a further subset of this subdivision of existing very old forest (stands identified in the current inventory as 400 years or older). The assignment of ages to these unmanaged stands is imprecise and was usually made based on qualitative and subjective evaluation, but this represents the only available data on stand age across the BLM-administered lands within the planning area. The existing old forest subdivision and existing very old forest subset labels do not directly describe structurally complex stands with the greatest structural complexity. However, without more detailed stand structural information, these forests are most likely to have the most developed structure and the longest time since a disturbance of the structurally complex forests.

Some analyses have evaluated forest structural complexity using an index approach rather than discrete thresholds for classifications (e.g., Washington State Department of Natural Resources 2005; Spies and Franklin 1991; Spies and Franklin 1988). An index approach can be effective and informative when used to classify existing conditions at the stand level, if there is an abundance of stand-level data (e.g., Spies and Franklin 1991). However, an index approach would produce an analysis of bewildering complexity if used to analyze multiple alternatives modeled into the future.

The structural stages for all lands other than the BLM-administered lands are classified using data from the Interagency Vegetation Mapping Project (IVMP), which uses satellite imagery to classify attributes of forest vegetation. See *Appendix B. Ecology*. Moeur et al. (2005) discuss the accuracy of mapping forest vegetation from IVMP data and conclude that it provides the best practice for classifying forest vegetation across all

ownerships in a region (Moeur et al. 2005, 18-30, 108-109, 123-128). Those discussions are incorporated by reference. The BLM-administered lands are classified for both the current and future conditions based on OPTIONS model outputs rather than IVMP data.

For analyses across all ownerships, the four classes of structural stages that are defined above are reduced to three classes—combining structurally complex and mature, which is equivalent to late-successional forest in other analyses. IVMP data cannot reliably distinguish between mature and structurally complex forests (Spies 2006; Moeur et al. 2005, 103-104). This analysis will refer to this combined class as mature&structurally complex forest.

Average Historic Conditions

This analysis compares the abundance and spatial patterns of the structural stages to average historical conditions, as did the FEMAT report and the Northwest Forest Plan FSEIS.

The FEMAT report estimated that 60 to 70% of the region was historically in mature&structurally complex forests (FEMAT, IV-51). At the scale of the physiographic provinces (e.g., the Coast Range), the amount of mature&structurally complex forests probably fluctuated between approximately 50 to 85% of the landscape (Spies 2006; Nonaka and Spies 2005; Wimberly 2002; Wimberly et al. 2000; Rasmussen and Ripple 1998).[1] The FEMAT report (with its focus on late-successional forest) did not characterize the abundance or spatial patterns of forest conditions other than for late-successional forests.

This analysis uses the descriptions of average historic conditions from Nonaka and Spies (2005) and the draft Rapid Assessment Reference Condition Model (USDA, USDI 2005a). Historic landscape conditions were dynamic, and the abundance of structural stages varied over time. Spies (2006) noted further that "no single point or short period can realistically be used to characterize this dynamic system." However, comparing effects over time under multiple alternatives to a range of conditions would have the following problems.

- There are no existing characterizations of the range of historic conditions that match the geographic scale of the planning area.
- The magnitude of the range of historic conditions is highly dependent upon the spatial scale of analysis, and the range is so wide at fine scales as to be uninformative (Wimberly et al. 2000).
- A comparison to a range of conditions would not provide for a clear comparison of the alternatives.

[1] Note that these studies modeled the historic range of variability for the Coast Range. Descriptions of the reference conditions vary for the other provinces (USDA, USDI 2005a), but these results are consistent with the region-wide estimates in the FEMAT report.

See *Appendix B. Ecology* for the average historical conditions and the historic range of variability). Therefore, this analysis uses average historic conditions rather than a historic range of variability as a benchmark for comparing the effects of the alternatives.

For the entire planning area, this analysis uses average structural stage abundance and spatial patterns from Nonaka and Spies (2005), which modeled historic conditions in the Coast Range. Although this research was conducted on only a portion of the planning area, it presents the only available description of historic spatial patterns at a broad scale, and the abundance results are consistent with the region-wide estimates of late-successional forest in the FEMAT report. The age classes in Nonaka and Spies were combined for comparison to the structural stages in this analysis. Average historic conditions adapted from Nonaka and Spies approximately correlate to 5% stand establishment, 15% young, 25% mature, and 55% structurally complex.

Wimberly (2002) also modeled historical ranges of variability in the Coast Range and found slightly different median average values, which would correlate to 17% stand establishment; 21% young; 16% mature; 42% structurally complex. Forest classes were defined differently in Wimberly. Notably, Wimberly defined the early successional forests, which correlate to stand establishment forests here, more broadly than Nonaka and Spies. Also, Wimberly assumed that both high-severity and moderate-severity fires reestablished early successional forests, whereas Nonaka and Spies assumed that only high-severity fires reestablished early successional forests (Nonaka and Spies 2005, 1737). Finally, comparison of mean averages from one model to median averages from another model is inherently problematic. Neither of these characterizations of average historic conditions is definitive, and the analysis here is attempting to make use of average values rather than a range describing the variability of a dynamic system. Using the average historic conditions from Wimberly as a benchmark for the comparison of alternatives would necessarily yield different conclusions about the absolute relationship of the effects of a specific alternative to average historic conditions. However, using a different benchmark for average historic conditions would not alter conclusions about the relative effects of the alternatives.

For individual physiographic provinces, this analysis uses the description of structural stage abundance from the draft Rapid Assessment Reference Condition Model (USDA, USDI 2005a). These models derive historic abundances by modeling disturbance probabilities that are generated from mean fire-return intervals combined with the probabilities of other disturbances (such as wind, insect, and pathogens). These models describe the average amount of the landscape that would be expected in each of the broad vegetation classes, which are roughly equivalent to the structural stages used in this analysis. The Coast Range and Western Cascades provinces are compared to

the Douglas fir hemlock wet-mesic model.[2] The Klamath province is compared to the mixed conifer-southwest Oregon model. The Eastern Cascades province is compared to the dry ponderosa pine-mesic model. These reference condition models provide representative descriptions of common conditions in each province. However, the provinces include other models, some of which describe other patterns of abundance. For example, the Coast Range and Western Cascades provinces include the Douglas fir Willamette Valley foothills model, which describes more stand establishment and young forest (15% and 25%, respectively). The Klamath province includes the Oregon coastal tanoak model, which describes more young forest (60%).

Abundance of Structural Stages

Stand establishment forests currently comprise 48% of the forested lands within the planning area across all ownerships. See *Table 66 (Current structural stage abundance on forested lands)*.[3] Stand establishment forests have declined on BLM-administered and Forest Service lands and are becoming restricted to nonfederal lands. Despite the decline on federal forests, stand establishment forests across all ownerships are still above average historical conditions.

Intensive forest management practices on forest industry lands (including site preparation, rapid and dense replanting, and herbicide application) simplify the structure and composition of stand establishment habitat and shorten the time until canopy closure. As a result, stand establishment forests created by timber harvesting lack the habitat complexity and legacy components typical of stand establishment forests following natural disturbances (Spies 2006; Ohmann et al. 2005; Cohen et al. 2002; Franklin et al. 2002; Aber et al. 2000; Perry 1998).

On BLM-administered lands, stand establishment forests currently comprise 7% of forest-capable lands, which is close to average historical conditions. These forests are predominately (79%) stand establishment forests without structural legacies, resulting from regeneration harvesting before the Northwest Forest Plan.

Young forests currently comprise 17% of the forested lands within the planning area across all ownerships. See *Table 66 (Current structural stage abundance on forested lands)*, which is above average historical conditions. Young forests on BLM-administered lands are predominately high-density, even-aged managed

[2] Analysis of structural stage abundance by physiographic province splits the small acreage of BLM-administered lands in the Willamette Valley province at Interstate 5 and combines the resultant portions with the Coast Range and West Cascades provinces.

[3] Current condition structural stage abundance differs slightly among the alternatives because of differences in how the inventory information is assembled for modeling under each alternative. The structural stage classification is made based on the Organon growth and yield curve attributes. The assignment of groupings of stands to specific yield curves varies among the alternatives, which results in slightly different current conditions. In addition, the classification for Alternatives 2 and 3 improved the identification of open water as non forest. Therefore, the following descriptions of current conditions use the 2006 data from Alternative 3.

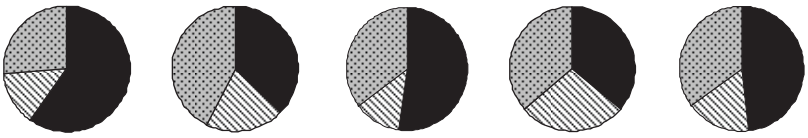
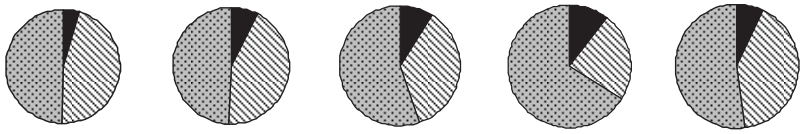
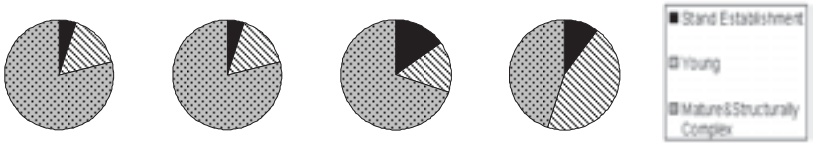
stands. Most of these stands were established following timber harvesting and intensive site preparation practices. This management history has created stands with a homogeneous structure, uniform tree composition, and high tree density. These young forests are developing along a trajectory that is fundamentally different from that experienced by most of the existing structurally complex forests on BLM-administered lands (Muir et al. 2002; Poage and Tappeiner 2002; Sensenig 2002; Tappeiner et al. 1997).

On BLM-administered lands, young forests currently comprise 42% of forest-capable lands. These are predominately (78%) young forests without structural legacies.

Mature&structurally complex forests currently comprise 35% of forested lands within the planning area across all ownerships. See *Table 66 (Current structural stage abundance on forested lands)*. The abundance of mature&structurally complex forests within the planning area is well below the average historical condition of 80%.

On BLM-administered lands, mature&structurally complex forests together currently comprise 51% of forest-capable lands. Mature forests comprise 28% and structurally complex forests comprise 23% of forest-capable lands. Mature forests are predominately (82%) mature forests with multilayered canopies. Structurally complex forests are predominately existing old forest (60%) with a smaller amount of developed structurally complex (37%) (i.e., stands that meet the defining attributes of structurally complex but are identified as less than 200 years old in the current inventory), and only a very small amount of existing very old forest (3%). While establishing accurate stand ages for unmanaged stands is problematic, as described above, structurally complex forests on BLM-administered lands are dominated by stands that are less than 400 years old. This is in contrast to the extensive acreage of structurally complex forest in national forests in the Western Cascades province (most of which is 400 to 500 years old) (Weisberg and Swanson 2003).

Table 66. Current structural stage abundance on forested lands

Structural Stage Abundance	Acres	Physiographic Provinces				Totals per Stage
		Coast Range	Western Cascades	Klamath	Eastern Cascades	
Stand Establishment	All ownerships	3,393,000	2,362,000	1,812,000	209,000	**7,776,000**
	BLM only	34,000	48,000	68,000	5,000	**155,000**
Young	All ownerships	790,000	1,295,000	441,000	159,000	**2,685,000**
	BLM only	340,000	274,000	278,000	11,000	**902,000**
Mature&Structurally Complex	All ownerships	1,487,000	2,694,000	1,225,000	211,000	**5,617,000**
	BLM only	370,000	311,000	427,000	32,000	**1,140,000**
Totals per Province	**All ownerships**	**5,670,000**	**6,352,000**	**3,478,000**	**578,000**	**16,078,000**
	BLM only	**743,000**	**633,000**	**773,000**	**49,000**	**2,197,000**
Current Condition	All ownerships					
	BLM only					
Historical Average Condition of Forested Lands (USDA, USDI 2005a)						

Hardwood stands are typically dominated by red alder or big leaf maple in the Coast Range and Western Cascades provinces, by madrone and oaks in the Klamath province, and by tanoak in the coastal portion of the Klamath province. Hardwood stands provide many ecological functions that are distinct from conifer stands and are hotspots for biological diversity (Kennedy and Spies 2005). Red alder stands are particularly noted for nitrogen fixation and high-nitrogen litter (Harrington 2006; Compton et al. 2003). The nitrogen levels in alder stands generally contribute to high growth rates for trees, but nitrogen inputs by alder stands on sites that are already nitrogen rich may lead to nutrient imbalances, which may predispose coastal Douglas fir stands to intensification of Swiss needle cast disease (Perakis et al. 2006; Compton et al. 2003; Maguire et al. 2000). Other hardwood stands, especially dry upland sites dominated by oaks, madrone, or tanoak, are characterized by a lower soil fertility and have nitrogen levels that are more limited.

It is not possible to quantify the abundance or map the location of hardwood stands at this scale of analysis. Hardwood stands are often interspersed with conifer stands throughout the planning area. For example, red alder-dominated riparian stands are typically classified together with the adjacent upland conifer stand. In southwestern Oregon, oak, madrone, or tanoak stands are typically finely interspersed with conifer stands without discrete boundaries. Both cases generally result in classifying the stand as mixed or conifer-dominated in forest inventories. In the Coast Range province, Ohmann et al. (2005) modeled hardwood stand abundance as approximately 7% of the landscape across all ownerships. Hardwood abundance is likely lower in the Western Cascades and Eastern Cascades provinces, and higher in the Klamath province.

Spatial Patterns of Structural Stages

The spatial arrangement of forest structural stages influences fundamental ecosystem processes, such as the flows of energy, materials, and organisms (Nonaka and Spies 2005; Forman 1995). In addition to the abundance of structural stages, this analysis describes the spatial patterns of structural stages to evaluate forest fragmentation and connectivity.

Fragmentation is the breaking up of large habitat areas into smaller patches. Fragmentation is often coupled with habitat loss. The two processes together have a cumulative effect that can result in an overall reduction in biological diversity. The populations of species that are associated with mature&structurally complex forests are more likely to decline in a fragmented landscape because of the smaller patches of suitable habitat and the greater isolation from neighboring populations (Jules 1998; Forman 1995; FSEIS, 3&4-29 to 3&4-31). As habitat is fragmented, the connectivity of the habitat decreases. Beyond some threshold, fragmentation disrupts connectivity of the habitat and contributes to population declines. Such thresholds are poorly understood for most species and depend on the scale at which a species interacts with its habitat (With and Crist 1995).

Larger habitat patches can support greater species diversity. For many species that are associated with mature&structurally complex forests, patches below a certain size are no longer suitable habitat. However, these minimum patch sizes are highly species-specific (to the limited extent they have been quantified). For example, Carey et al. (1992) suggest that a breeding pair of northern spotted owls requires a mature&structurally complex forest patch of about 2,000 acres in mixed conifer forests, whereas marbled murrelets use much smaller patches for nesting (ranging from 7 to 368 acres) (Ralph et al. 1995). Smaller patch size leads to increased amounts of edge habitat and decreased amounts of interior forest habitat. Edge habitats are created where contrasting habitat types abut. Edges between mature&structurally complex forests and stand establishment or young forests are characterized by altered microclimate and altered biological interactions (Forman 1995, 412-415). The depth of edge habitat varies for specific biophysical characteristics and ecological processes, and is strongly

influenced by the degree of contrast between habitat types and such physical conditions as slope and aspect.

This analysis examines spatial patterns of the forested landscape using FRAGSTATS, a spatial patterns analysis program for categorical maps. See *Appendix B. Ecology*. FRAGSTATS quantifies the aerial extent and spatial configuration of patches within a landscape. The user defines and scales the landscape (including the extent and grain of the landscape) and the scheme upon which patches are classified and delineated. For a given landscape mosaic, FRAGSTATS computes several metrics for:

- each patch in the mosaic;
- each patch type (class) in the mosaic; and
- the landscape mosaic as a whole.

For this analysis, patches are delineated as stand establishment, young, or mature&structurally complex forest. As noted above, the IVMP data used to classify non-BLM-administered lands cannot reliably distinguish between mature and structurally complex forest, and therefore these structural stages are combined for this portion of the analysis. Additionally, the contrast between mature and structurally complex forest patches is too low to constitute an edge for many important ecological processes (such as the habitat for the northern spotted owls). Nonforest is not included in the spatial analysis.

FRAGSTATS produces a wealth of metrics, many of which are highly correlated. For any given analysis of spatial patterns, many of the metrics do not reveal clear patterns. The analysis here uses the following metrics:

- mean patch size (mean average of the distribution of patch sizes); and
- connectance index (number of functional joinings between patches of the same structural stage; this analysis defines patches as functionally joined if they are within 1,969 feet (600 m)).

Results for additional metrics are included in the *Appendix B. Ecology*.

Spatial patterns are analyzed by province for BLM-administered lands, because the entire planning area comprises too large a database for computing many of the metrics. For all ownerships, even the province comprises too large a database for computing most metrics, including connectance. Therefore, only mean patch size is computed for all ownerships at the province scale. See *Table 67 (Current mean patch size by structural stage by province)*.

Table 67. Current mean patch size by structural stage by province

Structural Stages	Current Mean Patch Size (acres)	Physiographic Provinces			
		Coast Range	Western Cascades	Klamath	Eastern Cascades
Stand Establishment	All ownerships	25.5	29.2	30.2	44.4
	BLM only	44.3	21.5	41.9	14.5
Young	All ownerships	104.4	82.1	65.0	49.3
	BLM only	5.8	8.0	6.2	11.1
Mature&Structurally Complex	All ownerships	110.8	106.6	137.3	182.8
	BLM only	15.3	28.4	28.8	28.2

Note: Because the 2006 data differs slightly for the alternatives (as explained above), the spatial configuration differs among the alternatives. As with the abundance data above, the spatial pattern results for 2006 use data from Alternative 3.

The changes in spatial patterns over time from this analysis can be compared to the measures of spatial patterns from other studies or estimates of average historic conditions of spatial patterns to provide a qualitative evaluation of overall trends. However, a direct comparison of the absolute values of the spatial pattern measures should be made with caution. Measures of spatial patterns are highly dependent on the spatial extent of the analysis, the resolution of the data (i.e., the grain size), and the classification scheme (in this analysis, the structural stage classification). As these factors differ, the absolute values in the results will differ. For example, connectance is higher in the Eastern Cascades province than in other provinces for all structural stages partly because the spatial extent of this province is much smaller than the other provinces. See *Table 68 (Current connectance on BLM-administered lands by structural stage by province)*. The spatial extent, grain size, and classification scheme in this analysis differ from studies of historic spatial patterns within the planning area (Nonaka and Spies 2005; Wimberly 2002). Therefore, the results here should be compared to the results from those studies only to evaluate relative trends in spatial patterns, not to make a direct comparison of the absolute values of the specific spatial pattern measures.

Table 68. Current connectance on BLM-administered lands by structural stage by province

Structural Stages	Physiographic Provinces			
	Coast Range	Western Cascades	Klamath	Eastern Cascades
Stand Establishment	0.13	0.13	0.10	2.42
Young	0.09	0.10	0.08	1.22
Mature & Structurally Complex	0.09	0.11	0.10	1.64

Ecological Conditions at the Province Scale

The FEMAT report and the Northwest Forest Plan FSEIS provide general descriptions of the existing conditions at the province scale (FEMAT, IV-6 to IV-11; FSEIS, 3&4-16 to 3&4-28), but did not explicitly analyze the effects of the alternatives at the province scale. The six resource management plans and environmental impact statements (RMPs/EISs) for the six districts within the planning area described the vegetation communities, the characteristics of the stages of forest development, and the biological diversity and ecological health of the forest ecosystems within each BLM district. Each district analysis concluded, consistent with the FEMAT report and Northwest Forest Plan FSEIS, that late-successional forests have been reduced in abundance and highly fragmented by past timber harvesting and other land management activities (USDI, BLM 1994a, 3-23 to 3-39; USDI, BLM 1994b, 3-34 to 3-46; USDI, BLM 1994c, 3-18 to 3-45; USDI, BLM 1994d, 3-30 to 3-57; USDI, BLM 1994e, 3-17 to 3-42; USDI, BLM 1994f, 3-21 to 3-41, 3-63 to 3-66, 3-79 to 3-82). Those analyses are incorporated by reference.

Current conditions across in the Coast Range, Western Cascades, and Klamath provinces generally reflect the structural stage abundance and spatial patterns described for the planning area as a whole. The Eastern Cascades province differs from the other provinces in many measures of structural stage abundance and spatial patterns partly because of its differing ecological conditions and management history. However, these different patterns have little effect on the overall pattern for the planning area, because the Eastern Cascades province makes up only 2% of the BLM-administered forest lands modeled within the planning area.

Coast Range

The natural disturbance regime in much of the Coast Range province is characterized by infrequent, high-intensity fires and windstorms. Average historic forest conditions were 79% mature&structurally complex forests, 16% young forests, and 5% stand establishment forests (USDA, USDI 2005a).

Currently, the Coast Range province has more stand establishment forests and less mature&structurally complex forests than it did historically. The Coast Range province has little remaining mature&structurally complex forests, most of which are mature forests with highly fragmented patches of structurally complex forests, primarily on BLM-administered lands (FSEIS, 3&4-21, 3&4-25, 3&4-27). The mature&structurally complex forests currently comprise 26% of all forest lands in the province (50% of BLM-administered lands). Stand establishment forests currently comprise 60% of all forest lands in the province (5% of BLM-administered lands). See *Table 66 (Current structural stage abundance on forested lands).*

The spatial patterns of structural stages in the Coast Range province has been strongly altered from historic conditions (Nonaka and Spies 2005; Wimberly 2002). Current spatial patterns in the Coast Range are characterized by small, scattered patches of mature&structurally complex forest set in a matrix of young and stand establishment forests. Mean patch size and connectance of mature&structurally complex forest is lower than average historic conditions (Nonaka and Spies 2005).

On BLM-administered lands, stand establishment forests are in fewer and smaller patches than young or mature&structurally complex forest, which is consistent with the overall abundance of structural stages.

Red alder stands in the Coast Range have increased in abundance since the 1930s (Wimberly and Ohmann 2004), but it is unknown how current hardwood abundance compares with the historical range of variability (Ohmann et al. 2005; Long et al.1998). The current distribution and abundance of red alder stands in the Coast Range has been considered by some to be an unnatural artifact of past timber harvesting practices (FEMAT, V-25). The increase in red alder stands is not continuing throughout the Coast Range. The abundance of red alder stands in the central Coast Range has been declining in recent decades, in contrast to the southern Coast Range (Kennedy and Spies 2005; Wimberley and Ohmann 2004). Forest management practices will likely reduce the abundance of red alder stands within the planning area (Spies 2006; Alig et al. 2000).

Swiss needle cast, caused by the native fungus, *Phaeocryptopus gaeumannii,* has recently caused substantial growth loss of Douglas fir, primarily in young plantations within 30 miles of the coast (Kanaskie et al. 2005; Maguire et al. 2000; USDI, BLM 1994a, 3-27). Possible reasons for the increased effects of Swiss needle cast include shifting plantation composition to pure Douglas fir on sites that previously supported Sitka spruce, western red-cedar, and western hemlock; past planting of off-site Douglas fir; climate changes; and soil nutrition changes (Perakis et al. 2006; Campbell and Liegel 1996).

Western Cascades

The natural disturbance regime in the Western Cascades is complex with moderate or highly variable fire frequencies and intensities. Average historical conditions are similar to the Coast Range (USDA, USDI 2005a).

Like the Coast Range and Klamath provinces, the Western Cascades province currently has more stand establishment forest and less mature&structurally complex forest than average historical conditions. Nevertheless, the Western Cascades province currently has greater amounts of mature&structurally complex forests than other provinces, especially on Forest Service lands (FSEIS, 3&4-19, 3&4-20, 3&4-25, 3&4-27). Mature&structurally complex forests currently comprise 43% of all forest lands in the province (49% of BLM-administered lands). Stand establishment forests currently comprise 37% of all forest lands in

the province (8% of BLM-administered lands). See *Table 66 (Current structural stage abundance on forested lands)*.

There are no studies modeling the historic spatial patterns in the Western Cascades comparable to those done in the Coast Range, which approximated a range of historic patch sizes (Cissel et al. 1999). The overall comparison to current conditions is likely similar to the Coast Range with a current mean patch size and connectance of mature&structurally complex forest that is lower than average historic conditions.

As in the Coast Range, stand establishment forests on BLM-administered lands are in fewer and smaller patches than young or mature&structurally complex forest, which is consistent with the overall abundance of structural stages.

Klamath

The natural disturbance regime in much of the Klamath province is characterized by frequent, low-intensity fires. Forests in the Klamath province are highly fragmented by natural factors, and past cutting has resulted in many mixed-age stands (FSEIS, 3&4-22, 3&4-25, 3&4-27). Average historic forest conditions in most of the province were 70% mature&structurally complex forests, 15% young forests, and 15% stand establishment forests (mixed conifer southwest Oregon reference condition model; USDA, USDI 2005a). Other reference condition models are applicable in smaller portions of the province. For example, the Oregon coastal tanoak model, applicable to the coastal portions of the province, describes average historical forest conditions as 30% mature&structurally complex forests, 60% young forests, and 10% stand establishment forests (USDA, USDI 2005a). The dry ponderosa pine-mesic model, applicable to the dry sites in the eastern portion of the province, describes average historical forest conditions as 45% mature&structurally complex forests, 45% Young forests, and 10% Stand Establishment forests (USDA, USDI 2005a).

Like the Coast Range and Western Cascades, the Klamath province currently has more stand establishment forests and less mature&structurally complex forests than it did historically. Mature&structurally complex forests currently comprise 35% of all forest lands in the province (55% of BLM-administered lands). Stand establishment forests currently comprise 52% of all forest lands in the Klamath province (9% of BLM-administered lands). See *Table 66 (Current structural stage abundance on forested lands)*.

There are no studies modeling the historic spatial patterns in the Klamath province comparable to those done in the Coast Range. Historic spatial patterns were likely more variable and difficult to characterize, because of the complex interaction of highly variable geology and climate with the highly variable disturbance regimes. Therefore, comparisons to the historic spatial patterns for the province would be speculative.

As in the Coast Range and Western Cascades provinces, stand establishment forests on BLM-administered lands are in fewer and smaller patches than young or mature&structurally complex forests. The disparity in the patch size between stand establishment forests and young forests is less. The patch size of mature&structurally complex forests is larger than in the Coast Range or Western Cascades, which is consistent with the overall abundance of structural stages.

In the coastal Klamath province, Port-Orford cedar root rot, caused by the introduced pathogen, *Phytophthora lateralis*, has been killing Port-Orford cedar (*Chamaecyparis lawsoniana*). The supplemental environmental impact statement for management of Port-Orford cedar in southwest Oregon (USDA, USDI 2004b) described the ecological role of Port-Orford cedar, the spread of the disease, and the effects of different management actions to control the disease. That analysis concluded that the rate of the spread of the disease is decreasing, and that Port-Orford-cedar is not in danger of extirpation (USDA, USDI 2004b, 3&4-19 to 3&4-52). That analysis is incorporated by reference.

In the Klamath province, fire suppression has shifted fuel loads and tree species composition, which has made these stands more susceptible to drought-induced mortality, insect and disease mortality, and high-intensity, stand-replacing fires (Taylor and Skinner 2003; Frost and Sweeney 2000; FSEIS, 3&4-22; USDI, BLM 1994e, 3-24 to 3-26).

Eastern Cascades

Forests in the Eastern Cascades are highly fragmented by natural factors. The natural disturbance regime in much of the region is characterized by frequent, low-intensity fires. (FSEIS, 3&4-20, 3&4-21, 3&4-25, 3&4-27). The average historic forest conditions in the province were 45% mature&structurally complex forests, 45% young forests, and 10% stand establishment forests (USDA, USDI 2005a).

The Eastern Cascades province currently has slightly less mature&structurally complex forests, less young forests, and more stand establishment forests than it did historically. The mature&structurally complex forests currently comprise 36% of all forest lands in the province (66% of BLM-administered lands). Young forests currently comprise 27% of all forest lands in the province (23% of BLM-administered lands). Stand establishment forests currently comprise 37% of all forest lands in the province (11% of BLM-administered lands). See *Table 66 (Current structural stage abundance on forested lands)*.

The classification of structural stages in the Eastern Cascades province and the characterization of average historic conditions is more challenging than in any other province. The prevailing frequent, low-intensity fire regime produced stands that are difficult to classify. Most descriptions of the average historic abundance, including the estimates used above, would estimate greater abundance of stand establishment forest if all stands that were partially disturbed (such as by moderate- or low-severity fires) were classified as stand establishment forest.

There are no studies that are modeling the historic spatial patterns in the Eastern Cascades province comparable to those that were done in the Coast Range. The historic spatial patterns were likely very different from the Coast Range, because the frequent, low-intensity fire regime in the Eastern Cascades province would have produced a more fine-grained mosaic of structural stages.

The total acreage of the Eastern Cascades province within the planning area is far less than in the other provinces, which complicates the direct comparison of the measures of spatial patterns with other provinces. The extent of the landscape analyzed alters the absolute values of spatial pattern metrics, as explained above. As in the other provinces, stand establishment forests on BLM-administered lands in the Eastern Cascades province are in fewer and smaller patches than mature&structurally complex forests. However, unlike other provinces, the spatial patterns of young forests are similar to stand establishment forests, which is consistent with overall abundance. The Eastern Cascades has the lowest percentage of Young forest on BLM-administered lands of all the provinces within the planning area.

In the Eastern Cascades province, as in the Klamath province, fire suppression has shifted fuel loads and tree species composition, which has made these stands more susceptible to drought-induced mortality, insect and disease mortality, and high-intensity, stand-replacing fires (FSEIS, 3&4-20, 3&4-21; USDI, BLM 1994f, 3-24, 3-63 to 3-66, 3-79 to 3-82).

Socioeconomics

Key Points

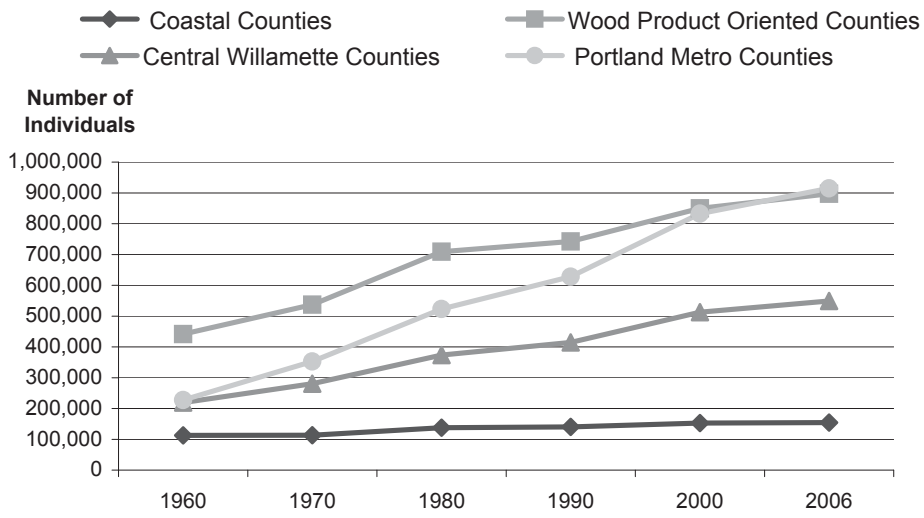
- A comprehensive measure of community health and resiliency does not exist.
- The Oregon primary wood products sector employs 51,900 workers that earn $1.9 billion annually, which is about 3.2% of Oregon's total wages.
- In total, the counties rely on BLM-associated revenues for about 2.7% of their budgets. BLM revenues, however, account for 9.2% of their discretionary revenue ranging from less than 1% for larger metropolitan counties to up to 70% for rural counties.
- Without funding under the Secure Rural Schools Act, BLM payments to counties would fall about 90%.
- There is currently a strong market for wood products in western Oregon. There is adequate capacity to process larger logs that would come from BLM lands.

The management of BLM-administered lands contributes to the economic activity in western Oregon communities and can be measured. For example, timber harvesting and manufacture of wood products creates jobs and income in these sectors, which in turn stimulates economic activity in other sectors of local and regional economies. BLM employees, and BLM management expenditures also contribute to local economies. Approximately 50% of revenues received from timber harvesting on O&C lands, furthermore, flow directly to the county governments and is used to fund a variety of social services and investments.

Receipts from such nontimber sources as special forest products (approximately $300,000 annually) and grazing receipts ($30,000 to $40,000 annually) is relatively minor and would not vary between the alternatives. The nonmarket values (e.g., wildlife, recreation, and water quality) are not included in this analysis.

Oregon is a growth state with a history of relatively steady in-migration. The 2006 state population of 3.7 million has slightly more than doubled (109%) since 1960. In western Oregon, population growth is spatially concentrated and rates vary considerably by the nature of the economic base. See *Figure 26 (Oregon population growth by county group)*. Portland's metro counties (Clackamas, Columbia, and Washington, excluding Multnomah) started from a relatively low base but grew three times more rapidly (302%) during the same era. The central Willamette Valley counties (Benton, Marion, Polk, and Yamhill) grew 151%. Counties that are focused on wood products (Douglas, Jackson, Josephine, Klamath, Lane, and Linn) kept pace with state growth (103%). Only the coastal county group (Coos, Curry, Lincoln, and Tillamook) had significantly below average population growth (37%).

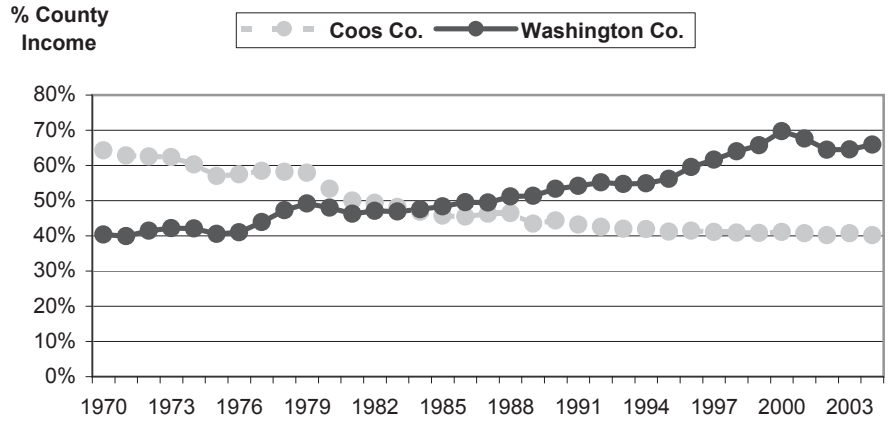
Figure 26. Oregon population growth by county group



County economies typically had a resource-based history (agriculture and wood products). A dominance of public land ownership gave federal forest policy shifts large influences over the evolution of those economies. Through most of the twentieth century, increasing federal harvests expanded local wood products industries. Since World War II, technological progress gradually decreased worker/output ratios. During the 1990s, federal harvest reductions under the Northwest Forest Plan led to a reduction in wood products sector jobs, wages, and salaries in most of the county economies.

Changes in county economies vary by county. There are differences in timber substitution capacity, contemporary economic diversity, and opportunities for alternative economic development. See *Figure 27 (Coos and Washington county wage and salary income as a percent of total income)*. Both counties experienced declining wage and salary income from the wood products sector but differed in the nature of income replacement. In Coos County, the percentage of income attributable to wages and salaries declined continuously due to decreasing wood products manufacturing and an increasing share of unearned income derived from retirement. Growth in the diversified Washington County economy, on the other hand, replaced resource sector incomes with increased wages in other developing sectors. The figure's comparison is in proportional terms to normalize the fact that the Washington County economy is 25 times larger.

Figure 27. Coos and Washington county wage and salary income as a percent of total income



In most cases, these new trajectories become permanent redirections. As returning these economies to their historic structures is unlikely, this analysis considers the 2005 base year structure as a stable reference point for evaluating any new economic changes.

The economies of the O&C counties vary in the magnitude, type, and diversity of economic activity. These differences affect the patterns of how each economy might be changed by new external effects. The initial size of each county economy can be profiled with three primary indicators. These are industrial output, total employment, and earnings. See *Table 69 (2005 county economy indicators)*.

These measures show a wide range of differences between the county economies. Curry County is a small economy with the region's lowest output, employment, and earnings. Washington County, on the other hand, has 49 times more industrial output, 25 times more employment, and 45 times more earnings. More detailed indicators (not shown) reveal quality-of-life implications as well. Curry County's average annual wage is $26,200 compared to $46,400 for Washington County.

Table 69. 2005 county economy indicators

County	Industrial Output ($1,000)	Employment (total jobs)	Earnings ($1,000)
Benton	4,208,367	37,603	1,416,139
Clackamas	19,046,826	197,405	6,994,767
Columbia	1,708,099	14,182	390,413
Coos	2,171,795	28,792	797,151
Curry	762,355	10,726	281,937
Douglas	4,732,462	52,770	1,469,009
Jackson	8,364,619	103,612	3,247,024
Josephine	2,676,289	37,253	1,033,446
Klamath	2,719,816	34,179	1,024,239
Lane	15,445,518	178,924	5,729,986
Lincoln	1,797,597	21,560	606,118
Linn	5,010,081	50,568	1,619,544
Marion	14,249,826	157,199	5,782,895
Polk	1,682,760	22,499	624,709
Tillamook	1,170,965	10,985	306,070
Washington	37,563,913	272,210	12,626,678
Yamhill	3,492,580	37,928	1,129,303
Region Total	**126,803,868**	**1,268,395**	**45,079,428**

The economic impact analysis (see *Chapter 4*) estimates the implications of three large external effects on each county economy between the base reference year of 2005 and the impact year of 2009.

These large external effects on each county are (Adams and Latta 2007):

- loss of Secure Rural School payments to counties,
- BLM's selection and implementation of one of the management alternatives in the plan revision, and
- structural changes in the plywood industry projected by the WOR model.

By artificially isolating the first two policy-driven effects, the county-level input-output models can estimate the roles of each effect in these county economies. *Table 70 (2005 county economy dependence on Secure Rural Schools and BLM effects)* shows the relative influence of combined Secure Rural School payments and current BLM harvest levels as of 2005. Using current employment as an indicator of impact, *Table 70 also* shows that the Secure Rural School funding and BLM expenditures account for a very small portion of the jobs in Washington County and up to 4.18% of the jobs in Douglas County. Counties with small portions of their economies dependent on Secure Rural School and BLM activities (less than 0.5%) would likely experience little overall impact from projected changes.

Table 70. 2005 county economy dependence on Secure Rural Schools and BLM effects

County	Industrial Output (%)	Employment (%)	Earnings (%)
Benton	0.23%	0.31%	0.28%
Clackamas	0.18%	0.13%	0.16%
Columbia	0.29%	0.37%	0.46%
Coos	1.63%	1.42%	1.80%
Curry	1.83%	2.19%	2.39%
Douglas	4.33%	4.18%	4.70%
Jackson	1.69%	1.56%	1.70%
Josephine	1.40%	1.26%	1.57%
Klamath	2.12%	1.67%	2.13%
Lane	1.18%	1.11%	1.35%
Lincoln	0.50%	0.66%	0.70%
Linn	0.84%	0.78%	0.99%
Marion	0.20%	0.17%	0.23%
Polk	0.24%	0.24%	0.30%
Tillamook	0.49%	0.72%	0.81%
Washington	0.01%	0.01%	0.01%
Yamhill	0.23%	0.16%	0.21%
Region Total	**0.65%**	**0.71%**	**0.71%**

Higher percentages in *Table 70* typically reflect a higher dependence on Secure Rural Schools funding, an economic concentration in woods products industries, and the location of BLM administrative units. Even though influence percentages appear small, their effects would be concentrated in specific sectors, which could concentrate the effects of any changes.

Together, the three external effects are expected to cause somewhat countervailing impacts spread to different sectors. The loss of the Secure Rural School payments would reduce jobs and income in county government. Increased BLM timber harvesting would increase wood products employment, but industrial contractions in the plywood sector would reduce jobs there. As a result, the economic response in any county depends as much on the internal economic structure of the county as well as its overall size. *Table 71 (2005 county economy grouped income patterns)* classifies each county into one of four indicative types defined by their general economic structure and diversity. Each type would react to changes differently.

Table 71. 2005 county economy grouped income patterns

Counties by Indicative Type	Sources of Income					
	Wage and Salary	Business Profits	Unearned DIR	Unearned Transfers	Commuting	Seasonal Homes
Coastal Counties						
Coos	46%	13%	16%	22%	1%	2%
Curry	26%	9%	31%	27%	5%	3%
Lincoln	31%	11%	17%	30%	2%	10%
Tillamook	38%	13%	16%	16%	3%	14%
Wood Products						
Douglas	49%	17%	7%	22%	4%	1%
Jackson	53%	13%	16%	16%	2%	0%
Josephine	45%	13%	14%	22%	5%	1%
Klamath	39%	10%	19%	28%	2%	2%
Lane	53%	16%	14%	15%	3%	1%
Linn	44%	13%	10%	16%	17%	0%
Central Willamette						
Benton	47%	17%	18%	8%	8%	0%
Marion	53%	13%	11%	13%	10%	0%
Polk	30%	7%	16%	13%	33%	0%
Yamhill	40%	12%	12%	12%	23%	0%
Portland Metro						
Clackamas	41%	14%	12%	8%	25%	0%
Columbia	22%	10%	19%	23%	25%	0%
Washington	48%	26%	8%	6%	11%	0%

The indicative types that the counties fit into are described as follows:

- **Coastal.** Counties on the coast have a relatively small percent of income derived from wage and salary employment. Seasonal home spending is proportionately larger than the rest of Oregon, particularly nearer Portland on the northern coast. Curry County has relatively larger property income (DIR) and transfers indicating retirees with higher incomes.[4]
- **Wood Products.** Counties that are based on wood products combine the highest proportions of wage and salary income with lower property incomes. Linn County is a bit of anomaly because of its high commuting rates--presumably to high wage jobs in Salem, Corvallis, and Eugene.

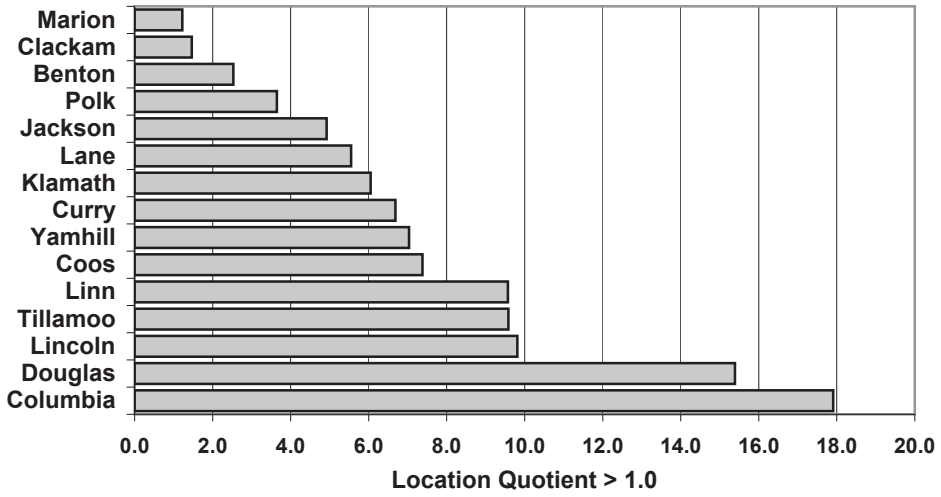
[4] DIR is the aggregate total of a category of unearned (or property) income "dividend, interest and rents". High DIR is typically associated with a retirement services economy.

- **Central.** Counties in the central Willamette Valley have significantly more commuting and earned income proportions (wage and salary income plus commuting). Earned income accounts for more than 60% of total income in these counties. These counties have the lowest overall percent of retirees and the lowest proportion of social security income.
- **Portland Metro.** Counties surrounding the Portland metropolitan area have very high commuting. Washington County has the lowest commuting, because its high tech jobs cluster is itself a job magnet. Retirement income (transfers) tends to be low except for Columbia County which contains a significant retiree population.

Another way of describing the county economic structures is through location quotients. This index measures how the economic concentration for one economic sector in a county compares to the national average concentration for that same sector. A location quotient much larger than 1.0 in the wood products sector, for example, indicates that the county has a higher than average concentration in that sector, and may reflect a relatively specialized economic base that is more sensitive to changes.

Location quotients reveal that western Oregon is still a wood products region. County wood products cluster location quotients are very large for 15 of the 17 counties. See *Figure 28 (County economies with high wood products sector location quotients (LQ))*. The large number of high location quotients indicate how sensitive those county economies might be to BLM harvest changes.

Figure 28. County economies with high wood products sector location quotients (LQ)



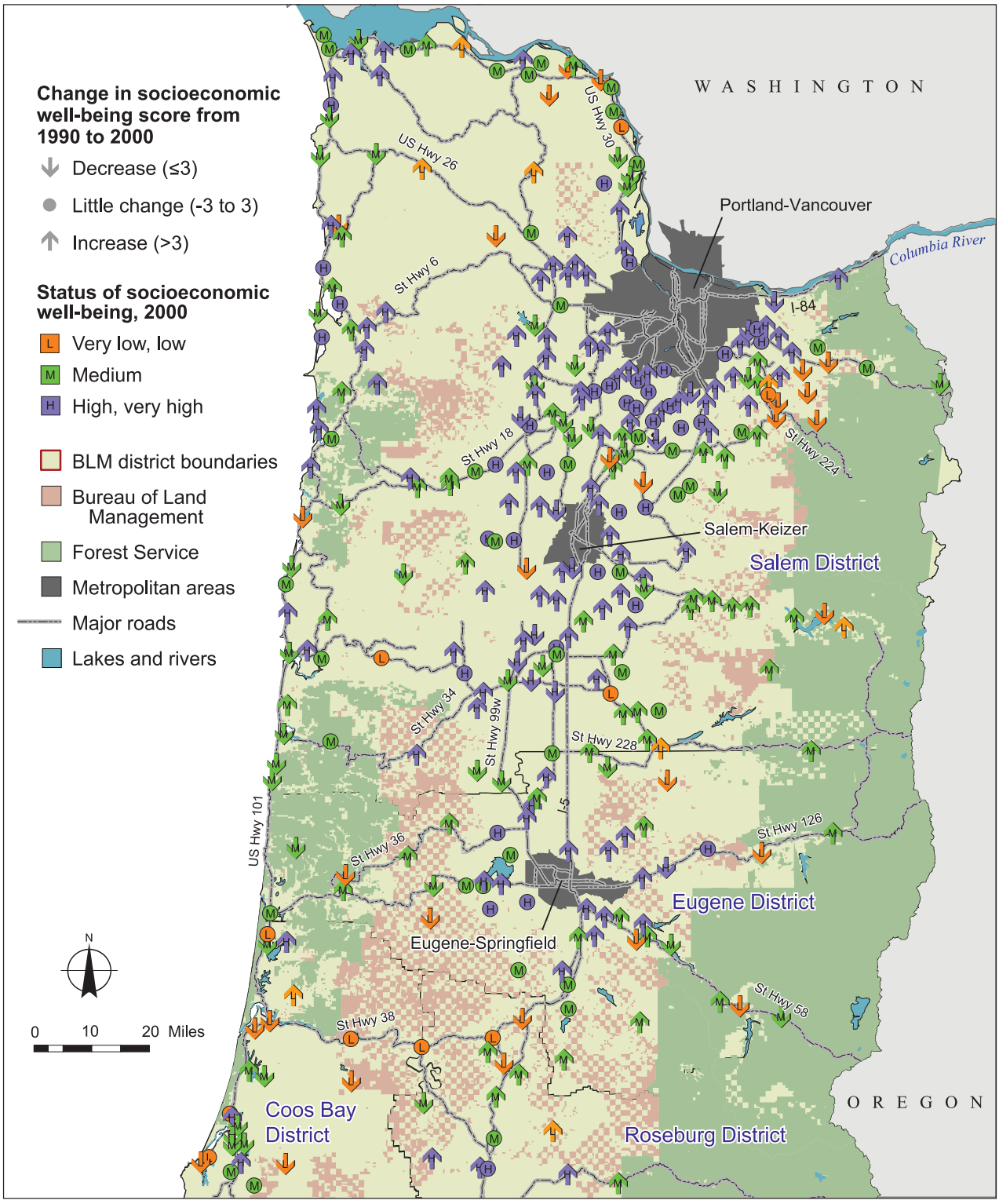
Although several measures of socioeconomic well-being, community capacity, and community resiliency have been developed, no universally accepted measures exist. Community capacity and community resiliency are fundamentally about dynamic processes that involve the actions of community leaders and residents. Leadership, social cohesion, and decision making are important to how a community adapts to change and betters the lives of its residents, but they are not attributes that can be easily measured.

Causality between changes in forest management policy and some community socioeconomic conditions is difficult to demonstrate. The social and economic well-being index and scores for western Oregon communities were developed as part of the Northwest Forest Plan Socioeconomic Economic Monitoring report (USDA, U.S. Forest Service 2006a). The index consists of six indicators:

- diversity of employment by industry
- percentage of population that is 25 years and older with a bachelor's degree or higher
- percentage unemployed
- percentage of persons living below the poverty level
- household income inequality
- average travel time to work

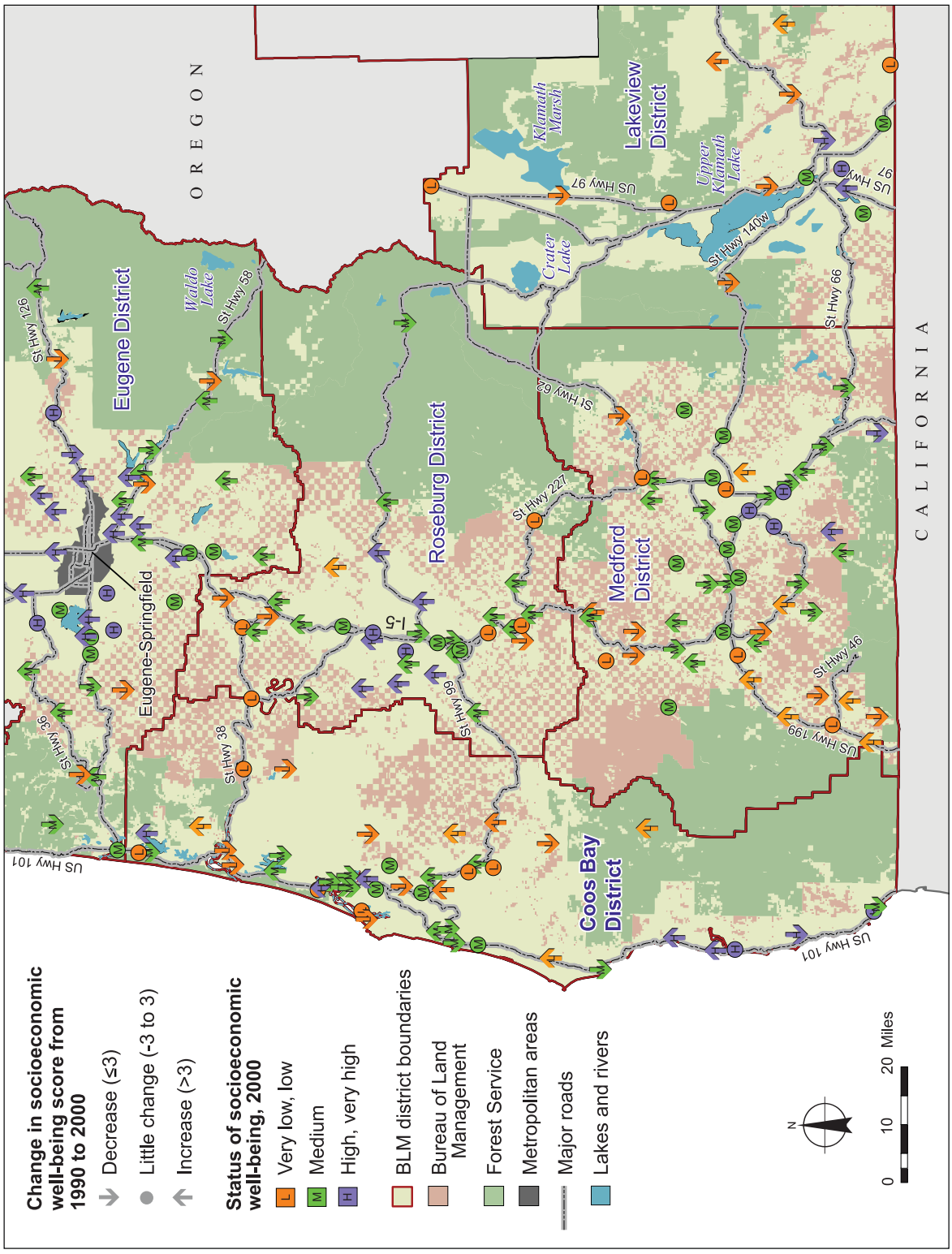
Many communities in western Oregon either increased or decreased in their social and economic well-being score between 1990 and 2000. See *Figure 29 (Change in socioeconomic well-being scores from 1990 to 2000 in the northern portion of the planning area)* and Figure 30 *(Change in the socioeconomic well-being scores from 1990 to 2000 in the southern portion of the planning area)* for a summary of the direction and magnitude of change in this index. The communities were examined by population size class; small, medium, and large communities. The smaller community size classes of 501 to 2,000 people had proportionately more communities with relatively lower social and economic well-being scores, whereas the larger population size classes of 2,001 to 5,000 people and 5,001 to 50,000 people had proportionately more communities with higher scores. Recent regional social assessments suggested that the higher the population in a rural community, the greater the infrastructure and the higher the socioeconomic resilience (Harris et al. 2000).

Figure 29. Change in the socioeconomic well-being scores from 1990 to 2000 in the northern portion of the planning area



Source: USDA 2006

Figure 30. Change in the socioeconomic well-being scores from 1990 to 2000 in the southern portion of the planning area



Source: USDA 2006

O&C Revenues and County Budgets

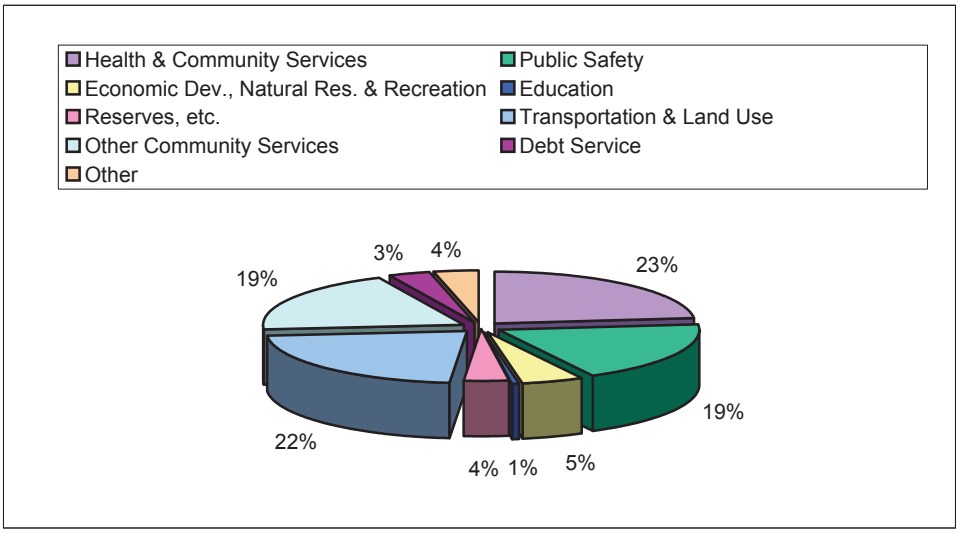
The O&C Act specifies that counties with O&C lands will receive 75% of the revenue generated from these lands. In 1953, the O&C counties agreed to receive 50% of the revenue and that the other 25% would be used by the BLM for roads, reforestation and silvicultural treatments, recreation sites, fire protection, and other forest management. Historically, the bulk of the revenue generated from the BLM has been and continues to be associated with timber harvesting and is the focus of this discussion.

County governments provide a variety of public services. A survey of the O&C counties was conducted to understand the source and use of county revenues. See *Appendix C. Socioeconomics*. See *Table 72 (Public services that county revenues support)* for a list of service categories and the services within each category. Also see *Figure 31 (Fiscal year 2005 county expenditures)* for a summary of the $3.9 billion spent in fiscal year 2005 by the O&C counties.

Table 72. Public services that county revenues support

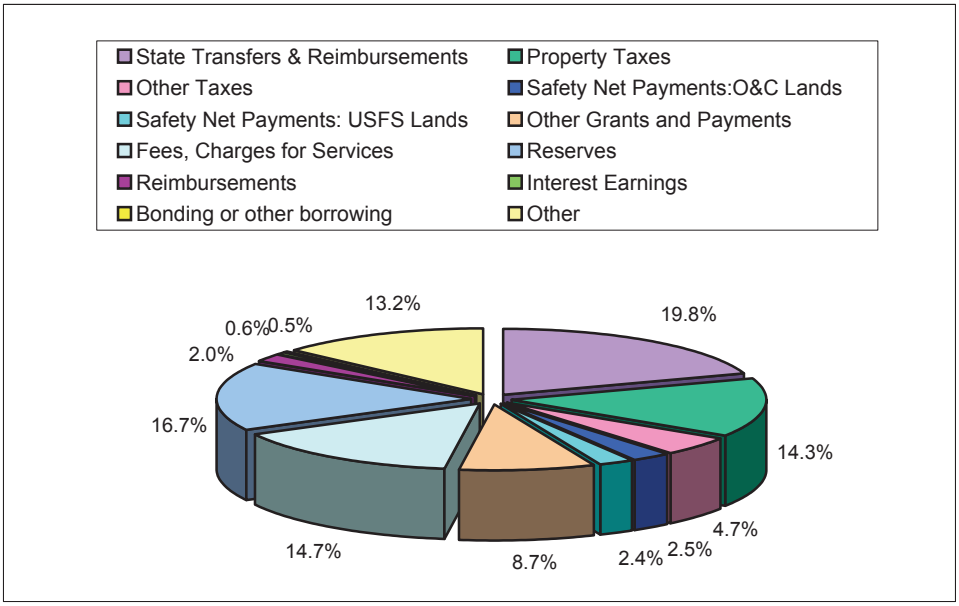
Service Categories	Types of Services	
Health and Community Services	Aging services	Veterans services
	Alcohol and drug addiction services	Public health services
	Services for children and families	Environmental health services
	Developmentally disabled	Housing services
	Mental health services	Medical examiner
	Oregon health plan services	Solid waste disposal/recycling
Public Safety	Trial courts	Community corrections
	District attorney	Court security
	County jail	Juvenile services
	911/emergency communications	County law library
	Emergency management	Sheriff patrol
	Homeland security	Animal control
Economic Development, Natural Resources and Recreation	Oregon plan implementation	Watermaster
	State forest management	County forests
	Federal land policy	County library
	Extension services	County parks
	Telecommunications	County museums
	County fair	
Transportation and Land Use	Highway and road systems	Engineering
	Land use planning and coordination	Building permitting and inspections
	Senior and disabled transportation	Surveying
	Development services	Capital projects
Other Community Services	Management and administration	Property and facilities management
	Elections	Procurement
	Assessment and taxation	Recording public documents
	Human resources and employee relations	

Figure 31. Fiscal year 2005 county expenditures



County governments are funded from sources such as local taxes, transfers from federal and state governments, and fees and charges for services. In addition, the O&C counties receive 50% of the revenue generated by the sale of timber and other goods and services produced from the O&C lands. See *Figure 32 (Fiscal year 2005 revenues for the O&C counties)* for the source of the $4.2 billion in revenues received by the O&C counties in the 2005 fiscal year.

Figure 32. Fiscal year 2005 revenues for the O&C counties



In fiscal year 2005, O&C-related revenues accounted for about $114 million (or about 2.7% of the total funds available to the O&C counties[5]).The importance of O&C revenues varies by county. See *Table 73 (Total revenue, discretionary revenue, and O&C funding).* O&C revenues account for more than 20% of the Douglas County revenue but only 0.1% of the metropolitan Multnomah and Washington county revenues.

The counties also reported receiving about $99 million of Secure Rural Schools funding that was associated with land that is managed by the U.S. Forest Service. The U.S. Forest Service reports a distribution of $123.3 million for western Oregon counties. (The difference could be related to the fact that U.S. Forest Service funding is distributed through the state rather than directly to the counties.) The U.S. Forest Service funds are typically not considered discretionary in that they are earmarked for schools and roads.

Table 73. Total revenue, discretionary revenue, and O&C funding for fiscal year 2005

County	Revenue			O&C Revenue as % of	
	All Sources		BLM		
	Total	Discretionary	Total O&C	Total (%)	Discretionary (%)
Rural Counties					
Benton	72,288,316	24,114,009	2,920,490	4.0	12.1
Columbia	47,303,696	9,881,991	2,250,622	4.8	22.8
Coos	45,315,118	13,113,030	6,537,510	14.4	49.9
Curry	54,959,478	6,920,829	3,424,000	6.2	49.5
Douglas	136,784,970	39,942,546	28,105,526	20.5	70.4
Jackson	290,614,408	77,040,445	15,145,237	5.2	19.7
Josephine	109,802,550	29,278,099	12,092,595	11.0	41.3
Klamath	160,315,525	15,522,030	2,206,000	1.4	14.2
Lane	466,328,935	56,786,868	14,583,629	3.1	25.7
Lincoln	74,031,888	32,218,773	388,968	0.5	1.2
Linn	83,070,524	25,287,488	2,518,846	3.0	10.0
Marion	314,833,911	70,333,962	1,360,000	0.4	1.9
Polk	60,207,240	13,956,261	2,385,000	4.0	17.1
Tillamook	57,560,514	14,622,039	730,820	1.3	5.0
Yamhill	82,504,377	13,211,916	807,500	1.0	6.1
Rural Subtotals	**2,055,921,450**	**442,230,286**	**95,456,743**	**4.6**	**21.6**
Metropolitan Counties					
Clackamas	406,647,713	82,829,267	5,890,071	1.4	7.1
Multnomah	1,092,793,083	409,015,566	1,000,000	0.1	0.2
Washington	607,731,836	121,402,176	707,861	0.1	0.6
Metro Subtotals	**2,107,172,632**	**613,247,009**	**7,597,932**	**0.4**	**1.2**
Totals (all counties)	**4,163,094,082**	**1,055,477,295**	**103,054,675**	**2.5**	**9.8**

[5] In the survey, the counties reported receiving $103 million from the BLM, whereas the BLM reports total payments of $114 million. Most of that difference is accounted for as Title II funds, which are expended by the agency under the direction of the county-level resource advisory committees but do not go directly through the county budgets.

Much of the funding received by county governments is directed to specific programs. For fiscal year 2005, the O&C Counties reported that only about 25% of total revenue received was discretionary—the rest of the revenue received by the county governments is earmarked for specific programs. Counties consider most the BLM revenue as discretionary in that it can be used for whatever purpose the county commissioners deem suitable.

See *Figure 33 (Fiscal year 2005 discretionary spending for the O&C counties)* for how the O&C counties spent the funds considered discretionary. About 43% of the discretionary budget is spent on public safety. The next largest category is for other community services, which includes such services as management, administration, and elections.

Figure 33. Fiscal year 2005 discretionary spending for the O&C counties

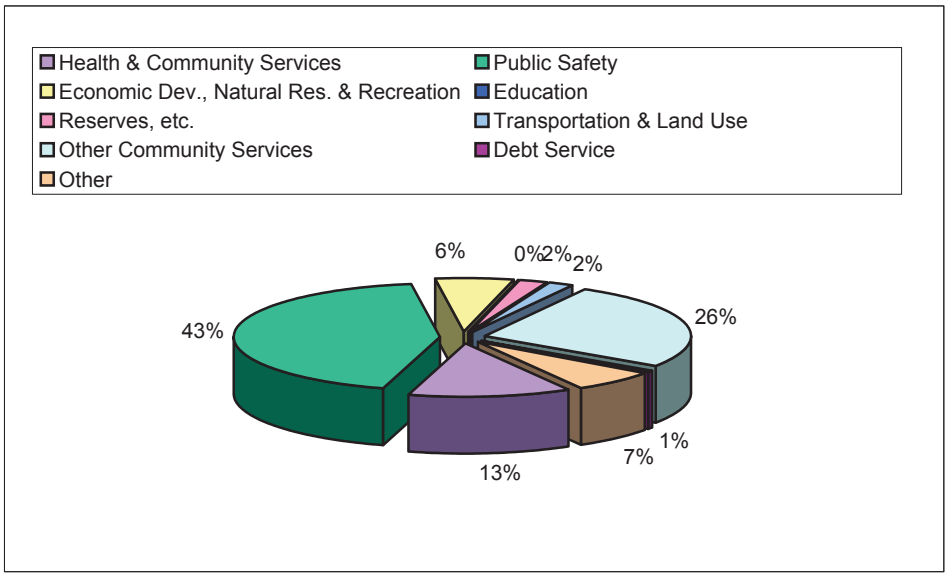


Table 73 (Total revenue, discretionary revenue, and O&C funding for fiscal year 2005) shows that across the O&C counties, O&C revenues accounted for 9.8% of the discretionary funding. Some counties, however, rely on O&C revenues much more to fund discretionary programs than others. Over 70% of the discretionary funding in Douglas County, for example, is based on O&C revenues. A number of counties rely on O&C revenues for more than 20% of discretionary funding. O&C revenues make up only a small portion of the discretionary funding for the larger metropolitan counties.

Timber harvesting from O&C lands began dropping in the 1990s as a result of the listing of the northern spotted owl and the adoption of the Northwest Forest Plan. In response, Congress established safety net payments for 72 counties in Oregon, Washington, and California through the Omnibus Budget Reconciliation Act of 1993. This provided a stabilized income flow to timber-dependent communities through the remainder of the 1990s.

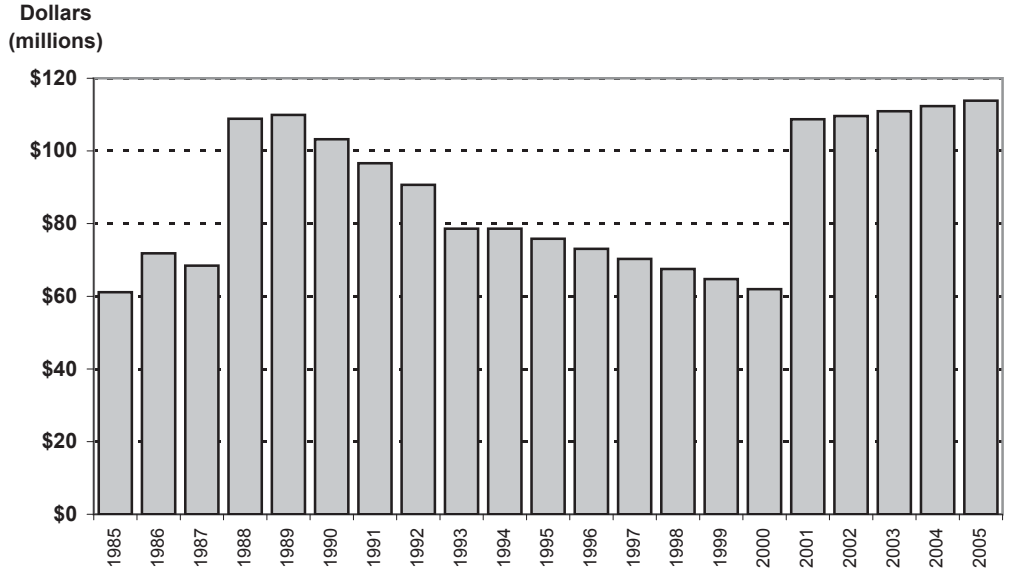
In 2000, Congress repealed the safety net payments and passed the Secure Rural School and Community Self Determination Act (P.L. 106-393). This law established a stable level of payments to counties at an amount equal to the average of their three highest

timber receipts from 1986 through 1999. Under the Act, counties elect the percentage of payment (80 to 85%) to be distributed directly to the county (Title I), and the percentage (15 to 20%) to be allocated between Title II projects and Title III projects.

- **Title I.** These are funds that are distributed to the county and may be used for any purpose the previous 50% revenue sharing funds were used for, as a supplement to other county funds. Typically, these revenues go to county general fund budgets.
- **Title II.** These are funds that are used to support cooperative projects under the guidance of a resource advisory committee to restore healthy conditions on public lands or on private lands for the benefit of public land resources. Such projects include wildfire hazard reduction, stream and watershed restoration, forest road maintenance, road decommissioning or obliteration, control of noxious weeds, and improvement of fish and wildlife habitat.
- **Title III.** Under Title III of the Act, counties may use funds for search, rescue, and emergency services; community service work camps; purchase of easements for recreation or conservation; forest related educational programs; and fire prevention activities.

See *Figure 34 (BLM payments to counties for fiscal years 1985 to 2005)* for the trend in BLM payments to counties since 1985. In fiscal year 2005, BLM payments to counties totaled about $115 million.

Figure 34. BLM payments to counties for fiscal years 1985 to 2005



Historically, payments authorized under the O&C Act account for the bulk of the total BLM payments to counties. Counties do, however, receive revenue associated with other BLM funding sources. Douglas and Coos Counties receive payments from the Coos Bay Wagon Road grant fund. There are 15 counties that receive payments in lieu of taxes (PILT) from public domain lands that are located within their county. A few counties also

receive grazing and mineral lease income. Altogether, these other sources of payments averaged just over $1.0 million annually over the last five years.

Table 74 (BLM payments to counties within the planning area for selected years ($million)) summarizes the total payments to counties from western Oregon BLM lands including timber receipts, safety net payments, and Secure Rural Schools Self Determination Act payments under Title I, II and III, Coos Bay Wagon Road grants, payments in lieu of taxes, and mineral and grazing income. The average annual BLM payment to all counties since implementation of the Secure Rural Schools legislation has been $112 million.

Table 74. BLM payments to counties within the planning area for selected years ($million)

County	1985	1990	1995	2000	2001	2002	2003	2004	2005
Benton	1.7	2.9	2.1	1.7	3.1	3.1	3.1	3.2	3.2
Clackamas	3.4	5.8	4.2	3.4	6.0	6.1	6.2	6.2	6.3
Columbia	1.3	2.1	1.6	1.3	2.2	2.3	2.3	2.3	2.3
Coos	4.0	6.8	5.0	4.1	7.2	7.3	7.4	7.5	7.6
Curry	2.2	3.8	2.8	2.3	4.0	4.0	4.1	4.1	4.2
Douglas	15.4	26.0	19.1	15.6	27.4	27.6	27.9	28.3	28.7
Jackson	9.6	16.2	11.9	9.7	17.0	17.2	17.4	17.6	17.8
Josephine	7.4	12.5	9.2	7.5	13.1	13.2	13.4	13.6	13.8
Klamath	1.5	2.4	1.8	1.5	2.6	2.6	2.6	2.7	2.7
Lane	9.3	15.8	11.6	9.5	16.6	16.7	16.9	17.2	17.4
Lincoln	0.2	0.4	0.3	0.2	0.4	0.4	0.4	0.4	0.4
Linn	1.6	2.7	2.0	1.6	2.9	2.9	2.9	3.0	3.0
Marion	0.9	1.5	1.1	0.9	1.6	1.6	1.6	1.6	1.7
Multnomah	0.7	1.1	0.8	0.7	1.2	1.2	1.2	1.2	1.2
Polk	1.3	2.2	1.6	1.3	2.3	2.4	2.4	2.4	2.5
Tillamook	0.3	0.6	0.4	0.3	0.6	0.6	0.6	0.6	0.6
Washington	0.4	0.7	0.5	0.4	0.7	0.7	0.7	0.7	0.7
Yamhill	0.4	0.7	0.5	0.4	0.8	0.8	0.8	0.8	0.8
Totals	**61.7**	**104.2**	**76.5**	**62.5**	**109.8**	**110.6**	**112.0**	**113.4**	**114.9**

The O&C revenue is allocated between counties based on an acre-weighted proration formula. The largest recipients of payments from western Oregon BLM lands are Douglas, Jackson, Lane, and Josephine counties, which together received 68% of total payments in 2005.

The Secure Rural Schools legislation was not reauthorized for 2007. Absent a reauthorization or new legislation, the size of the BLM payment to counties will be highly dependent on the amount and price of timber sold from O&C lands. For example, without the Secure Rural Schools legislation the fiscal year 2005 BLM payment to counties would have totaled about $12.2 million, which is a reduction of about 90% from the total with the legislation.

In addition, many of the O&C counties would also lose Secure Rural School funding attributable to land that is managed by the U.S. Forest Service. For fiscal year 2005, such funding totaled $123.3 million.

O&C counties have a limited ability to replace BLM revenues with other sources of revenue. Oregon income taxes are paid to the state, not the counties. As a result of several ballot measures, Oregon counties are not able to raise tax rates and the growth in taxable property value is capped at 3% a year. The federal government, furthermore, owns a large portion of the land in some of the O&C counties. See *Table 75 (Percent public land in O&C counties)*. These lands are not on the tax rolls. The O&C Counties believe that neither economic growth nor tourism can be reasonably expected to offset a shortfall in O&C-related revenues (Davis 2006). See *Appendix C. Socioeconomics*.

Table 75. Percent public land in O&C counties

O&C County	Total (acres)	BLM (acres)	BLM (%)	Government (acres)	Government (%)
Benton	433,500	58,100	13.4%	106,300	24.5%
Clackamas	1,205,000	75,400	6.3%	632,200	52.5%
Columbia	440,800	10,800	2.5%	32,100	7.3%
Coos	1,041,000	162,900	15.6%	261,100	25.1%
Curry	1,047,100	67,600	6.5%	688,700	65.8%
Douglas	3,244,500	655,100	20.2%	1,670,500	51.5%
Jackson	1,792,700	449,700	25.1%	914,200	51.0%
Josephine	1,050,200	299,800	28.5%	714,900	68.1%
Klamath	3,137,900	224,900	7.2%	1,651,300	52.6%
Lane	2,957,900	288,100	9.7%	1,740,400	58.8%
Lincoln	635,600	20,200	3.2%	216,800	34.1%
Linn	1,477,000	87,200	5.9%	581,400	39.4%
Marion	762,600	20,900	2.7%	258,800	33.9%
Multnomah	297,500	4,200	1.4%	88,400	29.7%
Polk	476,000	40,200	8.4%	53,100	11.2%
Tillamook	719,500	48,500	6.7%	450,200	62.6%
Washington	465,000	11,500	2.5%	67,700	14.6%
Yamhill	459,700	32,600	7.1%	65,100	14.2%
Totals	**21,643,500**	**2,557,700**	**11.8%**	**10,193,200**	**47.1%**

The economics of BLM timber harvesting are directly linked to western Oregon's timber economy and market.

The counties in western Oregon comprise the relevant market area for this analysis. Although some of the BLM timber may be shipped outside of this area for primary processing, the most recent information about log flow suggests that it is likely that the bulk of the BLM timber will be processed within the market area. As shown below, western Oregon is a net importer of logs—more timber is processed than harvested in the area.

There are 413 bbf of sawtimber on 16.3 million acres of timberland[6] within the planning area of western Oregon (Miles et al. 2006). See *Table 76 (2005 timberland area and inventory within the planning area)*. The BLM administers about 13% of the timberland and 16% of the sawtimber in western Oregon.

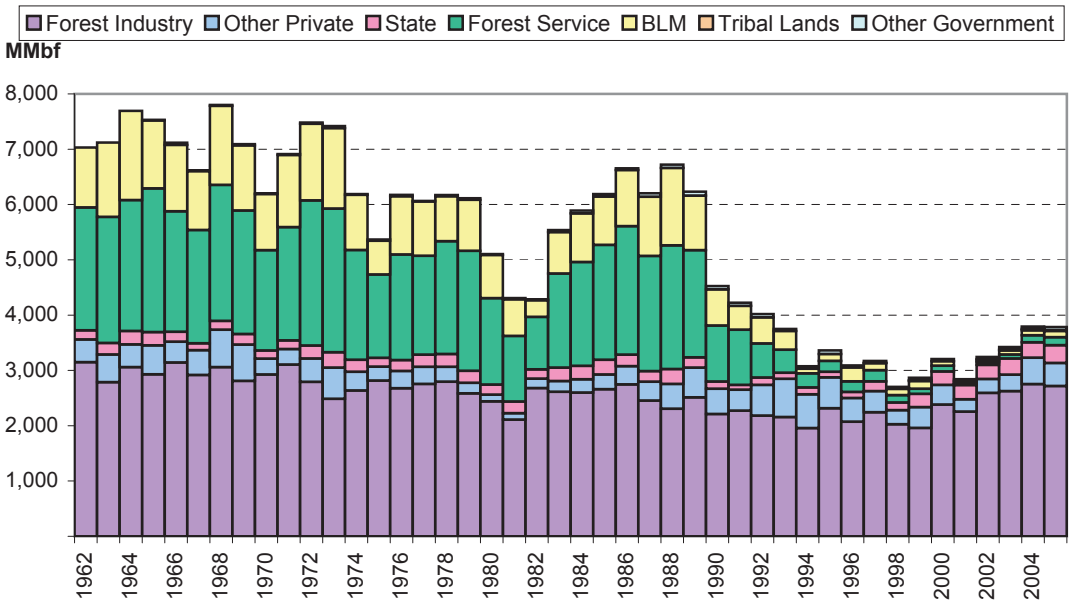
[6] Not all of the 2.5 million BLM acres within the planning area are classified as timberland.

Table 76. 2005 timberland area and inventory within the planning area

Ownership Class	Timberland Area (acres)	Sawtimber Inventory (bbf)
National Forest	5,937,000	210
Bureau of Land Mgmt	2,068,000	66
Other federal	27,000	1
State	839,000	29
County and Municipal	116,000	2
Other local government	10,000	-
Private	7,323,000	105
Totals	**16,320,000**	**413**

See *Figure 35 (Harvest by land owner within the planning area)* for the western Oregon harvest by owner. Since 2000, western Oregon harvests have averaged about 3.4 bbf[7]—a 47% reduction from the average 6.4 bbf average harvest prior to the 1990 listing of the northern spotted owl. Most of the reduction came from federal timberlands (U.S. Forest Service and BLM).

Figure 35. Harvest by land owner within the planning area



During the 1970s, BLM harvests averaged 1.05 bbf, which is about 16% of the total.[8] BLM harvests averaged 0.87 bbf in the 1980s, which is about 15% of the total. Under the Northwest Forest Plan (since 1994), BLM harvests have averaged about 0.11 bbf annually, which is about 3.4% of the total harvest.

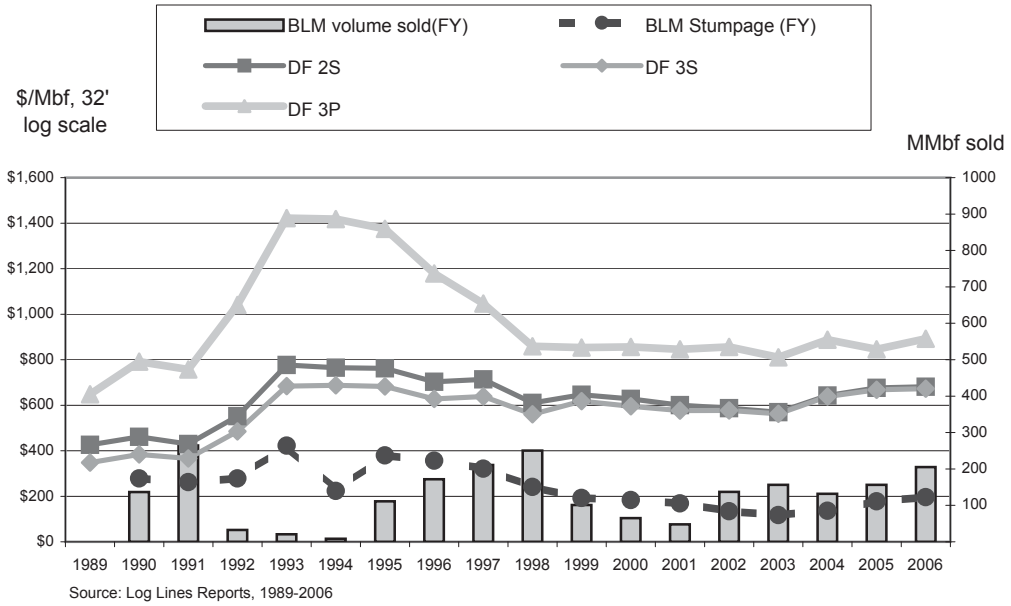
[7] bbf – billion board feet, Scribner log scale.

[8] In this discussion, BLM timber volumes have been converted from the 16 foot log scale used by the BLM, to the 32 foot log scale used by other western landowners. The conversion factor varies with timber species and log size. Generally, a factor of 0.80 can be used to convert BLM 16 foot log volumes to 32 foot log volumes.

Harvests from private lands trended down slightly through the 1990s (3.08 bbf in the 1970s, 2.79 bbf in the 1980s, and 2.61 bbf in the 1990s). Private harvests have been trending up since 1995 and have averaged 2.89 bbf since 2000. Currently, private lands provide about 85% of the harvest within the planning area.

See *Figure 36 (Willamette Valley Douglas fir delivered log prices and BLM volume and average stumpage)* for log price trends since 1989 (Log Lines 1989-2006)[9]. Log prices rose dramatically in the early 1990s, due primarily to a reduction in federal harvests during a time of strong demand for lumber and wood products. High log prices and increased penetration of U.S. markets by Canadian lumber manufacturers led to a reduction in mill capacity in western Oregon. Log prices declined through the 1990s. Log prices began trending up again in 2003 as housing markets strengthened. Western Oregon mills added capacity with the sawmills still operating in 2005 and producing about 37% more wood in 2005 than they did in 2001 (Ehinger 2006a). In Western Washington, mills have added about 1.0 bbf in net capacity over the last five years. This has further strengthened log prices (Ehinger 2006b.)

Figure 36. Willamette Valley Douglas fir delivered log prices and BLM volume and average stumpage



Source: Log Lines Log Price Reporting Service 2006

Figure 36 (Willamette Valley Douglas fir delivered log prices and BLM volume and average stumpage) also shows that the premium for higher grade logs has been shrinking (2S and 3S logs[10] sell for about the same price and 3P log margins are narrowing). This reflects recent investment in smaller log mills and the ongoing shift toward dimension lumber.

[9] Log Lines is a log price reporting service that began reporting log prices in 1988.
[10] 3P, 2S and 3S are log grades reflecting size and quality.

Figure 36 also shows the total volume and average stumpage price of the BLM timber sold in western Oregon.[11] Note that since 1995, when the BLM began selling smaller timber under the Northwest Forest Plan, stumpage prices have followed a trend similar to the current market for 2S and 3S logs.

Logs harvested in one area are often manufactured into wood products in another area. Understanding how logs flow helps to establish the geographic extent of the market area. Predicting future log flows, furthermore, is important to establishing impact at the county level.

See *Table 77 (2003 mill study log flows)* for a summary of log flows reported in the 2003 mill study (Brandt et al. 2003; USDA, U.S. Forest Service 2006a). About 3.757 bbf was consumed by western Oregon mills in 2003. About 8% of the total was imported into western Oregon from outside the state and another 4% was imported from eastern Oregon.

Table 77 (2003 mill study log flows) also suggests that the difference between local log supply and local log demand is greatest in southwest Oregon. These mills imported 412 mmbf from northwest Oregon, whereas only 58 mmbf went from southern Oregon to northwest Oregon.

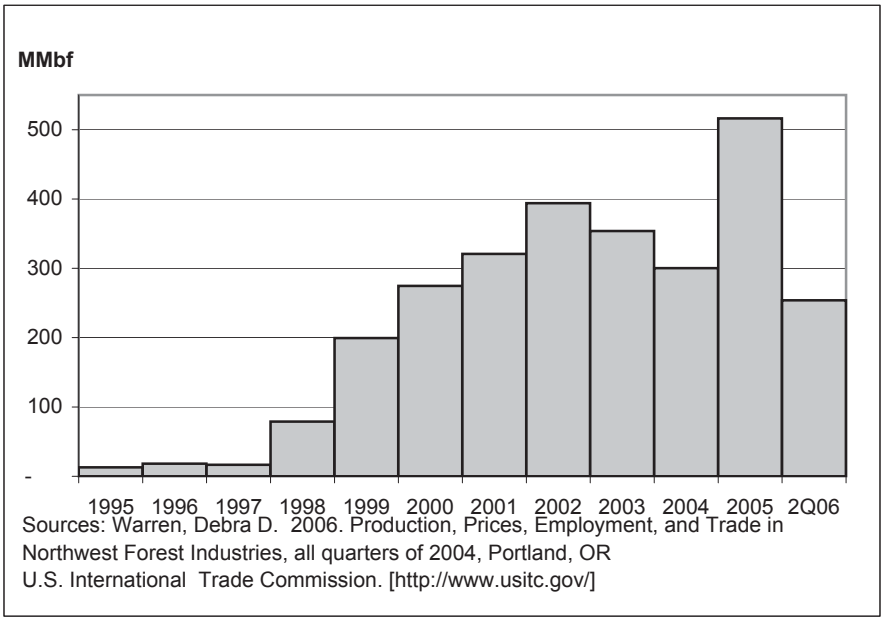
Table 77. 2003 mill study log flows

Destination	Log Volume (mmbf)				
	Total Utilization	Source			
		Northwest Oregon	Southwest Oregon	Eastern Oregon	Other States
Northwest Oregon	1,667	1,378	58	0	231
Southwest Oregon	2,090	412	1,460	158	60
Total Western Oregon	**3,757**	**1,790**	**1,518**	**158**	**291**

Current estimates are that log imports into western Oregon have increased since the 2003 mill study. *Figure 37 (Log imports from Canada to Washington and Oregon ports)* shows that Canadian logs imported into western ports exceeded 500 mmbf in 2005 and is on a similar track in 2006. Oregon log buyers expect that about 500 mmbf is currently flowing into Oregon from Washington and Canada. Many consider the Canadian volume to be subject to intense competition by more favorably located mills in Washington, or by new in ventures in Canada (Rasmussen, personal communication 25 August 2006).

[11] Stumpage is the price paid for timber on the stump. A BLM timber purchaser pays stumpage to the BLM and then incurs the costs of logging and hauling the logs to the mill.

Figure 37. Log imports from Canada to Washington and Oregon ports

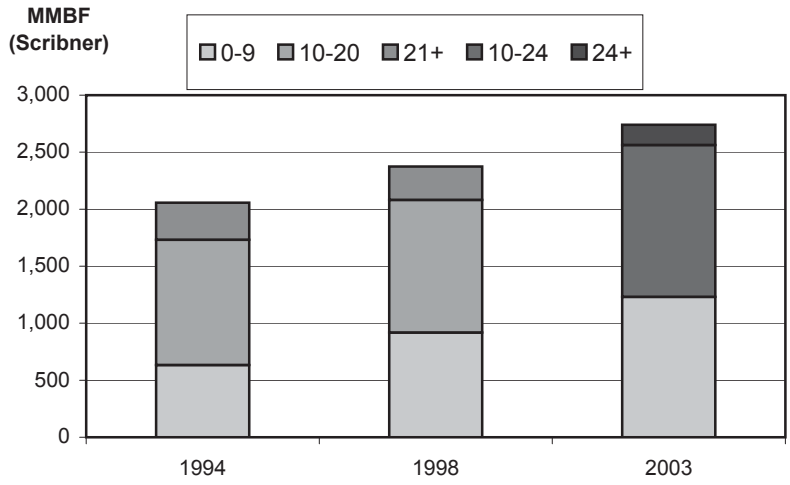


Source: Warren 2006

The log market in western Oregon is competitive. In 2005, for example, only 28% of the timber used by Oregon's sawmills was fee timber (timber owned by the manufacturing company). The rest of the timber harvested was purchased by manufacturers from timberland owners (Western Wood Products Association 2006). Much of this timber is sold in an open, competitive market to the highest bidder. BLM timber is appraised and sold at auction to the highest qualified bidder, which ensures that the agency receives fair market value.

Mills are typically optimized to process certain species and sizes of logs. The log market allocates logs to the mills that can most efficiently and effectively process particular types of logs. Prior to the Northwest Forest Plan, the U.S. Forest Service and the BLM were key suppliers of large, high-quality logs. Decisions made in the Northwest Forest Plan substantially reduced the volume of large logs available to Oregon mills. Much of the recent investment made in Oregon mills focused on more efficient processing of the smaller logs harvested from private lands. *Figure 38 (Oregon sawmill consumption by diameter class)* shows that logs that are less than 9 inches DIB (diameter inside the bark at the small end of the log) being processed by Oregon mills has doubled from 632 mmbf in 1994 to 1,230 mmbf in 2003.

Figure 38. Oregon sawmill consumption by diameter class



Even with the investment in smaller log processing, there remains in Oregon a sizeable capacity for the larger logs that could be harvested from BLM land.

- *Figure 38 (Oregon sawmill consumption by diameter class)* shows that about 300 mmbf of logs greater than 21 inches DIB were processed in 1994 and 1998. The 2003 study changed the classification—179 mmbf of logs greater than 24 inches DIB were processed in that year.
- Ehinger (2006) defines large logs as those over 48 inches DIB, lists eleven mills that process large logs, and reports that 10% of western Oregon mill capacity is capable of handling large logs (about 450 mmbf), and that more large log capacity is being added.
- An Oregon State University study defined large logs as those over 30 inches DIB and found 18 mills that handle large logs (Wagner et al. 2003).

The primary wood products manufacturing sector is a large contributor to the Oregon economy. In 2003, 249 firms used 4.3 billion board feet of wood to produce $6.7 billion of annual sales (Brandt et al. 2006). While this sector accounts for less than 0.1% of Oregon firms, it produces 14.6% of annual manufacturers' shipments (U.S. Census Bureau 2000-2004). This estimate does not include substantial secondary wood products sectors such as furniture and cabinetry.

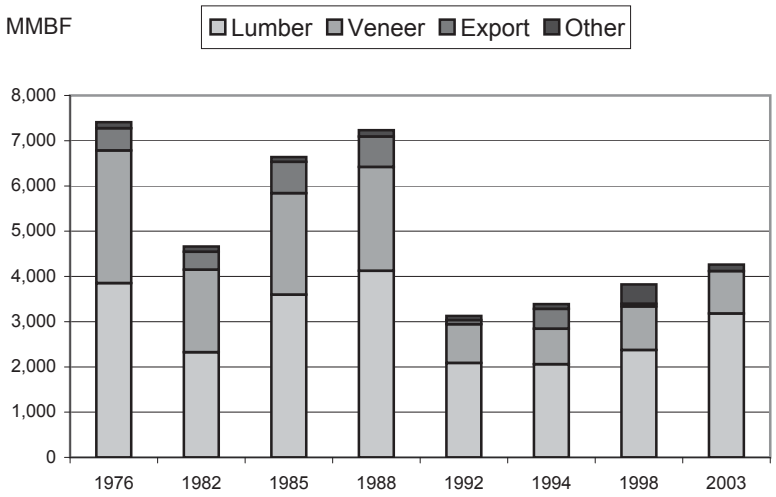
The Oregon primary wood products sector employs 51,900 workers that earn $1.9 billion annually (OLMIS[12] 2006), which is about 3.2% of total Oregon wages. Using a conservative employment multiplier of 2.5, the primary wood products sector accounts for about 130,000 nonfarm Oregon jobs, which is about 7.6% of the total.

Periodic surveys of wood product manufacturers show how the wood products manufacturing sector has changed (Brandt 2006). This information, coupled with annual production data, suggests that the current manufacturing sector could absorb additional timber from BLM lands.

[12] Oregon Labor Market Information System

Since the early 1990s, western Oregon's wood products manufacturing capacity has been shifting toward lumber production. See *Figure 39 (Log consumption by product in western Oregon)*. Lumber mills now account for about 75% of the wood consumed in western Oregon mills. Oregon's plywood and veneer mills were heavily dependent on larger logs, much of which came from federal forests. With the reduction in federal timber harvests, larger logs became more expensive at the same time that manufacturers in the Midwest and southern United States added lower cost panel capacity to oriented strand board mills. Very few logs are exported from Oregon's ports.

Figure 39. Log consumption by product in western Oregon



New investments in lumber mills have been concentrated in larger mills. *Figure 40 (Western Oregon sawmills by capacity)* shows that most of the remaining mills are larger mills, which produce over 120 mbf per shift. The average production per mill for this largest class, in fact, is now over twice what it was in 1976. The apparent increase in the number of small mills in 2003 is due to a difference in survey techniques.

Figure 40. Western Oregon sawmills by capacity

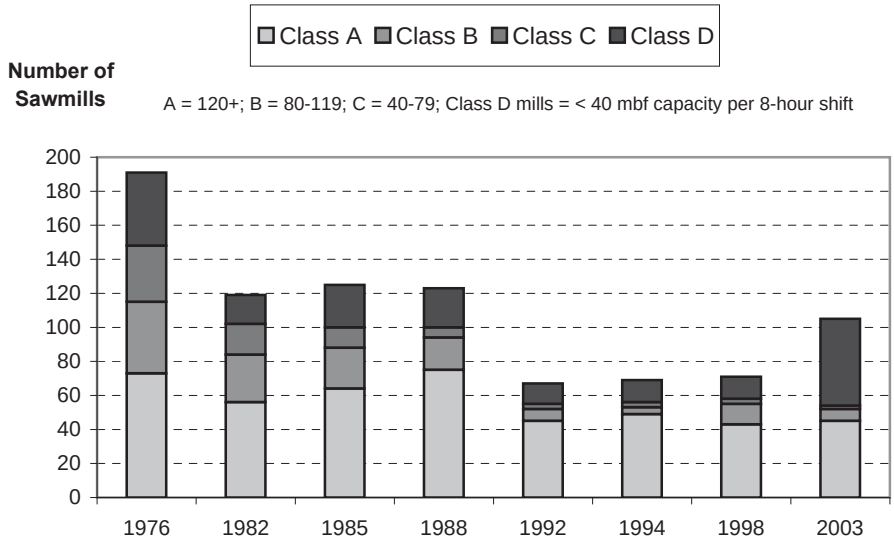
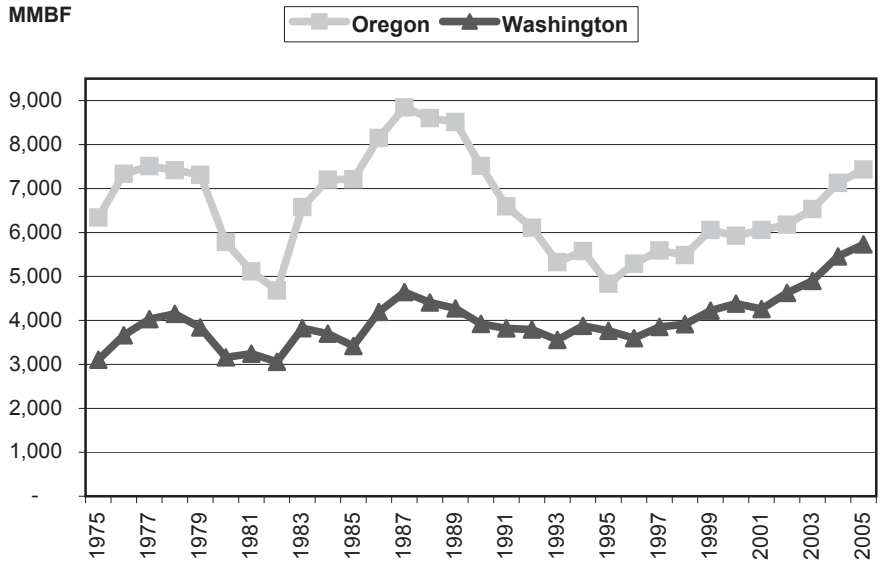


Figure 41 (Lumber production in Oregon and Washington) shows lumber production in Oregon and Washington (Western Wood Products Association 2006). Lumber production in western Oregon fell by about 45% between 1989 and 1995, primarily due to reduced federal log supplies. Production began increasing as mills invested in more equipment that could process smaller timber. A softening log export market, furthermore, resulted in a greater portion of the harvest becoming available to domestic mills.

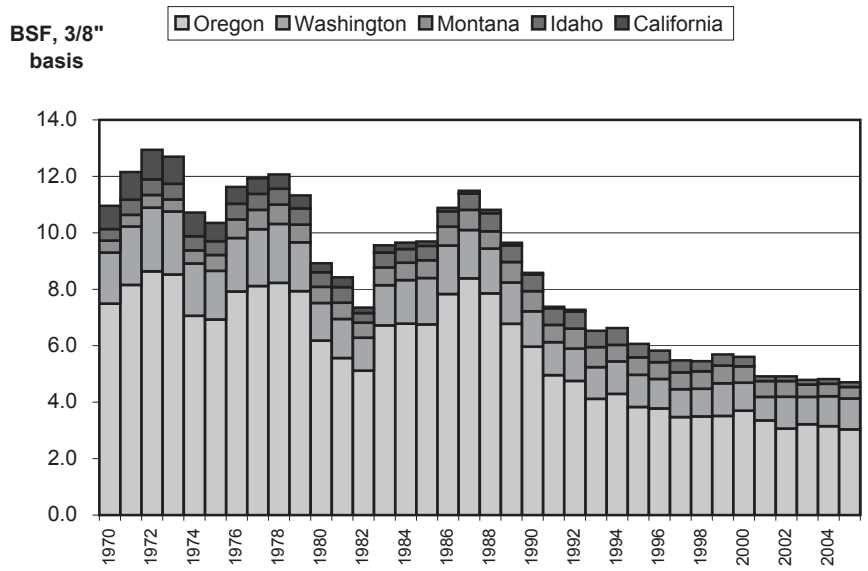
Figure 41. Lumber production in Oregon and Washington



Washington production trends are important as western Oregon mills currently compete for Washington logs. Lumber production in western Washington did not fall off as sharply as it did in Oregon, primarily because much of the western Washington timber was exported as logs rather than sawn into lumber. The reduction in log exports made more timber available to sawmills in both states. Since 1999, western Washington mills have added 1.0 bbf of net new lumber production capacity (Ehinger 2006) and production has been increasing steadily.

Western plywood production began a downward trend in the early 1990s. See *Figure 42 (Western plywood production)*. At 3.04 billion square feet for 2005, Oregon plywood is about 58% below the 1970 to 1990 average.

Figure 42. Western plywood production



The reduction in federal timber harvest, which is a source of large, clear veneer logs, created upward pressure on plywood prices. At the same time, panel manufactures in the Midwest, the southern United States, and Canada were adding capacity to produce less expensive oriented strand board (OSB) panels from low cost timber. U.S. Forest Service projections suggest that plywood will lose additional market share to OSB. *Figure 43 (U.S. panel production)* shows US plywood production at just half of current levels by 2020.

Figure 43. U.S. panel production

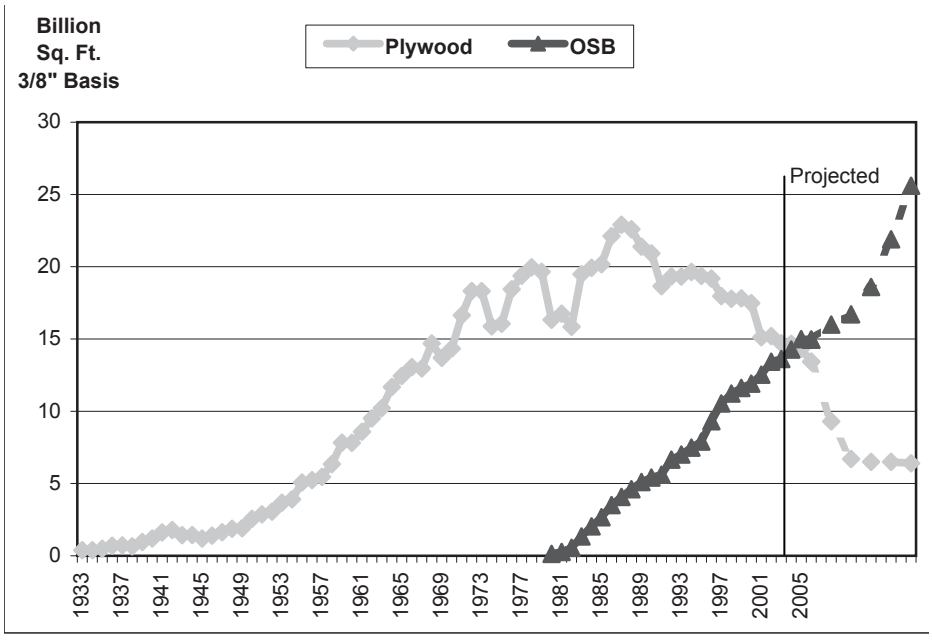
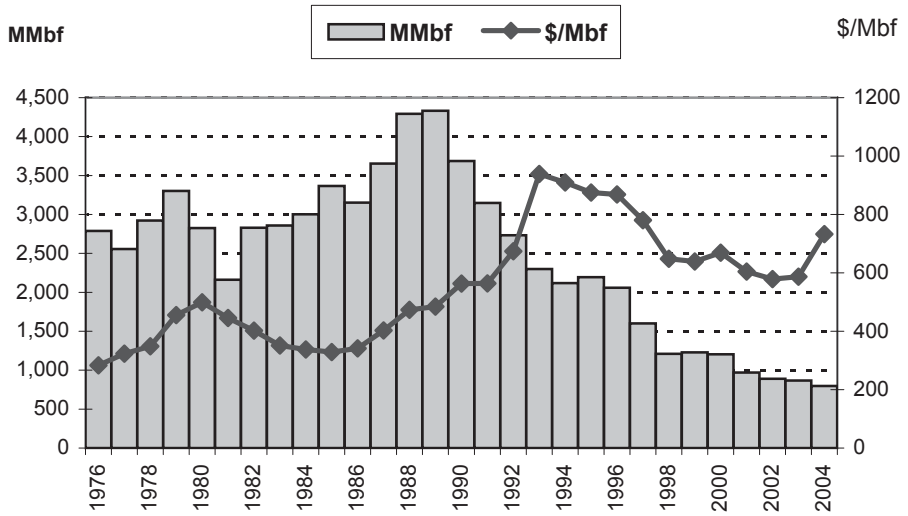


Figure 44 (Log exports from western United States ports) shows the volume and price of logs exported from western United States ports. Currently, about 800 mmbf of logs are exported, which is down 80% from the 4.4 bbf peak in 1989. The Asian financial crisis, the weakening of the Yen against the United States dollar, a shift toward Asian log suppliers, and stronger US domestic log markets account for most of the change.

Figure 44. Log exports from western United States ports



The BLM conducted an information gathering meeting with log buyers and timber industry representatives. There was a common concern that current western Oregon wood product production levels cannot be maintained without additional timber supplies. Current production relies on log imports from Canada and western Washington. Both those sources of supply are vulnerable to competition from the new mills in Washington and to export restrictions in Canada. (Rasmussen, pers. comm. 25 August 2006)

Changes in the level of employment in Oregon's forest product industry are indicated by U.S. Department of Commerce employment statistics, which tally forest products sector jobs into four sectors:

- forestry and logging (NAICS 113)
- forestry support activities (NAICS 1153)
- wood products manufacturing (NAICS 321)
- paper manufacturing (NAICS 322)

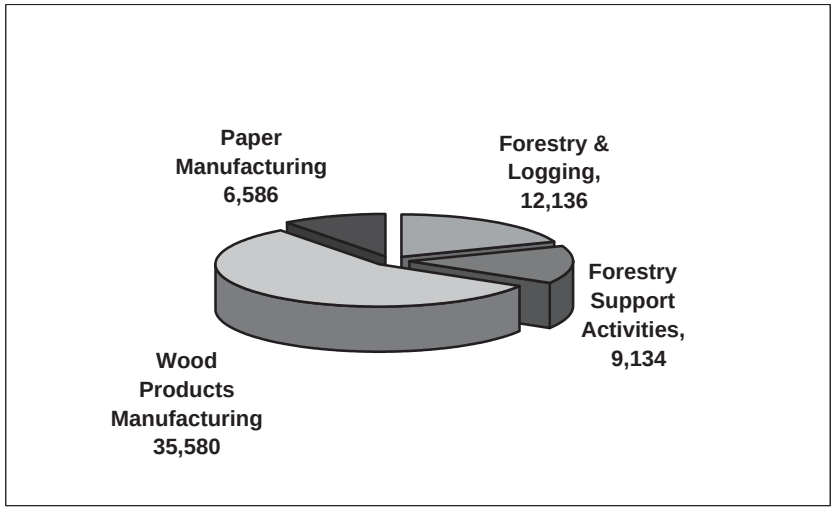
These sectors include both primary and secondary manufacturers along with the infrastructure (forestry workers, loggers, etc.) required to manage the growing and harvesting of timber crops.[13]

[13] The previous discussion of the economy of the wood products sector in western Oregon is based on research conducted for this DEIS, and resulted in adjustments to the U.S. Department of Commerce figures. Such adjustments are not available for previous periods, however. The U.S. Department of Commerce data, therefore, are used for the purpose of analyzing historic employment trends.

Primary manufacturing includes logging, processing of logs into lumber and other wood products, processing wood residues from timber-processing plants into such outputs as paper or electricity, and private sector forest management services. The secondary industry includes firms processing outputs from the primary industry. These outputs may come from mills in Oregon or elsewhere. Secondary products include prefabricated buildings, molding, millwork and cut stock, doors, windows, laminated veneer lumber, and other products (Brandt et al. 2006).

Employment in Oregon in these four sectors totaled nearly 63,400 workers in 2005 (U.S. Department of Commerce 2006). Wood products manufacturing represents the largest sector, which comprise 61% of the jobs. See *Figure 45 (Employment in Oregon's forest products sector (2005))*.

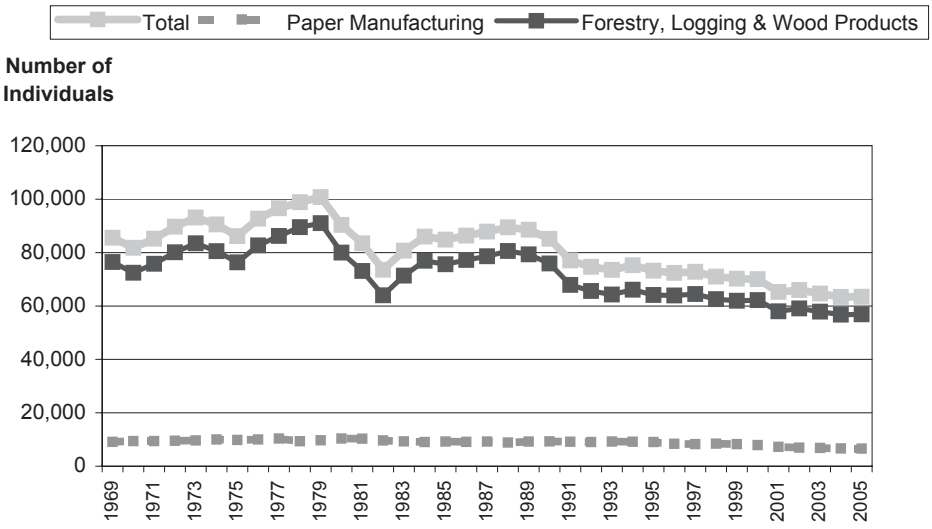
Figure 45. Employment in Oregon's forest products sector (2005)



Source: USDC 2006

Employment in 2005 was down 37% from peak employment of more than 100,700 workers in 1979. See *Figure 46 (Employment in Oregon's forest products industry (1969 to 2005))*. The decline in forest sector employment is due to the reduction in total timber harvest and technological change (Brandt et al. 2006; USDA, U.S. Forest Service 2006a). Oregon's forest sector job loss might have been greater, but was offset to some degree by a concurrent decrease in log exports, an increase in log imports from surrounding states, and an expansion of secondary wood products manufacturing (Brandt et al. 2006).

Figure 46. Employment in Oregon's forest products industry (1969 to 2005)



Source: Adapted and updated from Brandt et al. 2006

Forest industry employment trends for the coastal Pacific Northwest were recently studied as part of a 10-year review of the implementation of the Northwest Forest Plan. Across the region included in the Northwest Forest Plan—western Oregon, western Washington, and northern California—it has been estimated that 45,000 direct, indirect, and induced jobs were affected by reduced timber harvesting between 1990 and 2000. Of that, 30,000 were direct jobs including 7,500 in the logging industry and 22,500 in other primary wood industries.

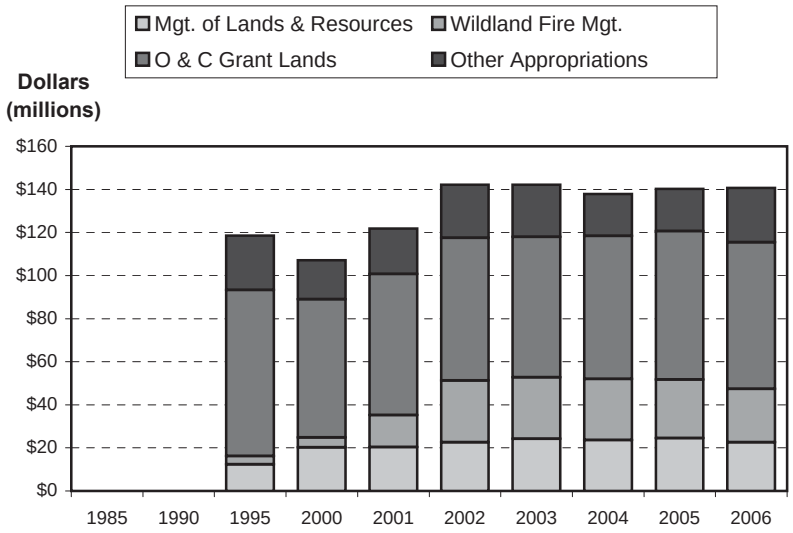
About 19,000 jobs were lost in the region between 1990 and 1994 as the volume of timber harvested but not exported fell from 10.1 bbf to 7.4 bbf. An additional 11,000 direct job losses occurred between 1994 and 2000, even though the volume of wood available for manufacture stabilized and even rose slightly. These latter job loses are attributable largely to additional industry restructuring and changes in technology (USDA, U.S. Forest Service 2006a).

Technological change has also impacted employment in the logging industry. In Oregon, for example, increased mechanization of harvest operations has increased annual productivity per worker from 544,000 board feet harvested per worker in 1990 to 592,000 board feet per worker in 2004, which is an 8% increase (Rooney 2006).

Oregon employment in the solid-wood industry was hit disproportionately hard compared to Washington and California. Oregon represented approximately 50% of solid-wood employment in the region. However, about 61% of the decline in jobs occurred in Oregon. The reverse is true of paper manufacturing—Oregon represented 30% of primary pulp and paper industry employment during the 1990's but only 21% of the job losses in that sector (USDA, U.S. Forest Service 2006a).

In addition to timber harvest, the western Oregon BLM budget contributes to local economic activity. The western Oregon BLM budget for 1995 to 2005 is summarized in *Figure 47 (Western Oregon BLM budget for selected fiscal years)*. The largest expenditure of funds, representing 64% of the current budget, is for the O&C land grants and management of lands and resources programs. These programs provide for forest management, reforestation and forest development, rangeland, recreation, soil, water and air, and wildlife and fish habitat on the O&C grant lands and public domain lands in western Oregon.

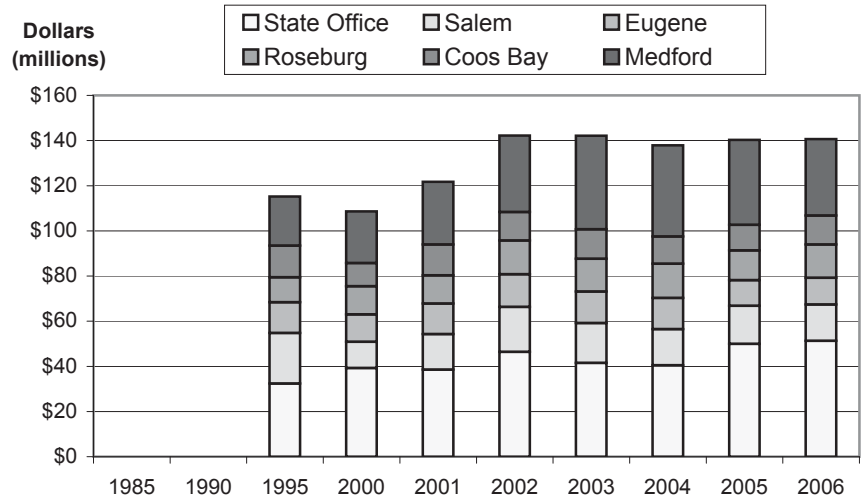
Figure 47. Western Oregon BLM budget for selected fiscal years



The wildland fire management program, which is 18% of the current budget, provides for fire preparedness, fire suppression operations, and other operations. Funding for hazardous fuels reduction and burned area rehabilitation is included in the latter category. Other appropriations represent another 18% of the total budget. This includes funding for acquisitions, construction projects, and other needs.

Over the past few years, the BLM budget for western Oregon has been relatively constant (averaging about $141 million annually). See *Figure 48 (BLM budget by district and state office for selected fiscal years)*.

Figure 48. BLM budget by district and state office for selected fiscal years



In addition to employment in the forest products industry, the management of the BLM-administered lands in western Oregon requires the employment of a staff of natural resource specialists, managers, and administrative personnel. *Figure 49 (Full-time equivalent positions by BLM district and state office)* shows that BLM staffing has been relatively constant. The state office in Portland provides administrative oversight and support for all BLM lands in Oregon and Washington. The full-time employee data shown includes all positions at this office.

Figure 49. Full-time equivalent positions by BLM district and state office

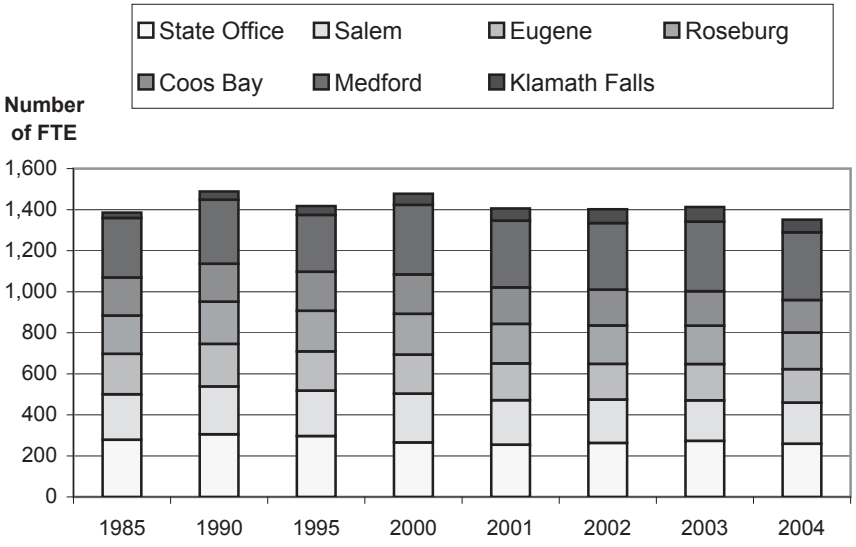
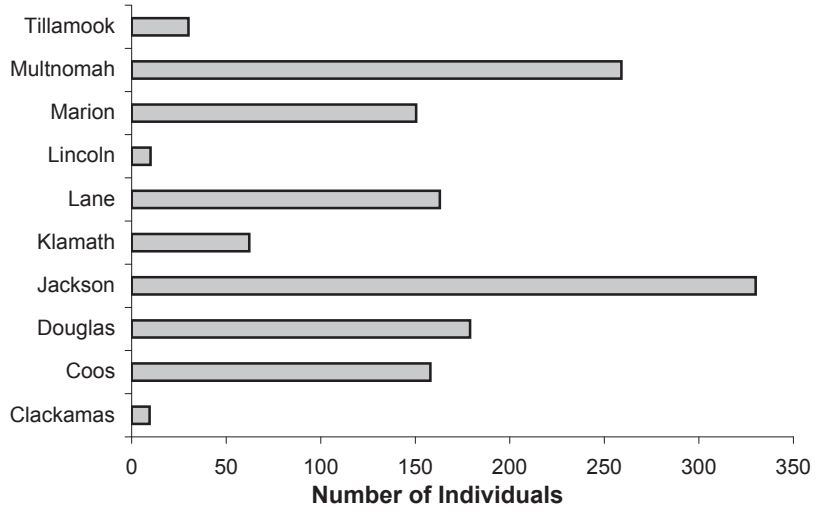


Figure 50 (Number of BLM full-time equivalent positions by county) shows the number of BLM full-time equivalent positions by the county in which the position is based for the fiscal year 2004. The jobs shown for Multnomah County are in the state office.

Figure 50. Number of BLM full-time equivalent positions by county



Timber

Key Points

- Recent inventories have indicated an increase in the standing inventory on BLM lands.
- The BLM lands contain a substantial amount of large, high-grade logs in older stands (i.e., mature and structurally complex forests).
- The majority of the younger stands (i.e., stand establishment and young forests) within the planning area have resulted from harvesting and the application of intensive forestry practices on the reforested acres.
- Stands with a management history comprise approximately 46% of the BLM forested lands, which are classified as suitable for a sustained harvest of timber.

The forests on BLM-administered lands can be characterized by their standing volume and their acres of existing age classes. The current standing volume is shown in *Table 78 (Current standing volume and acres of forested lands)*.

Table 78. Current standing volume and acres of forested land

BLM Districts	Forested Lands[a] (acres)	Standing Volume (bbf[b])
Salem	365,000	16.8
Eugene	296,000	13.4
Roseburg	399,000	15.5
Coos Bay	302,000	12.8
Medford	788,000	14.8
Klamath Falls Resource Area of the Lakeview District (west)	47,000	--[c]
Totals	**2,197,000**	**73.3**

Notes:

[a]See *Chapter 4* for definition.

[b]Billion board feet.

[c]Included in the Medford District inventory.

The volume figures in *Table 78* are based on current vegetative survey plots. See *Appendix Q. Vegetation Modeling* for further information on the continuous vegetative survey inventory system. The Klamath Falls Resource Area is not included in the above inventory and acres are rounded to nearest thousands

See *Table 79 (Historic timber volume estimates)* for the previous estimates of the volumes on portions of the BLM-administered lands. These figures are the best estimate of merchantable volume for the acreage and include the definitions of use at the time period indicated. Note that the definitions of use did change over time. Although these inventories were conducted using different inventory systems, different assumptions, and different portions of the BLM lands, they provide the basis for broad comparisons and general trends. These inventories also show that overall growth on the BLM lands has kept pace with harvesting, and that there is no evidence that cutting has exceeded growth.

Table 79. Historic timber volume estimates

Historic Estimates	1940[b]	1960[c]	1970[d]	1980[e]	1990[e]
Timber volume (mbf[a])	46,000,000	49,059,900	50,308,000	46,856,721	49,865,870
Acres	2,165,900	2,145,072	2,391,172	1,771,657	1,794,420
Diameter at breast height (dbh)	≥ 16 in.	≥ 11 in	≥ 11 in.	≥ 7 in.	≥ 7 in.

Notes:

[a]Thousand board feet.

[b]Andrews and Colvin 1940

[c]USDI, BLM 1960

[d]USDI, BLM 1970

[e]USDI, BLM 1991

In addition to the total standing volume, the forest can be characterized by the acres of existing age classes. The age class distribution is shown in *Figure 51 (Acres of forested lands within the planning area for 2006 by 10-year age class).*

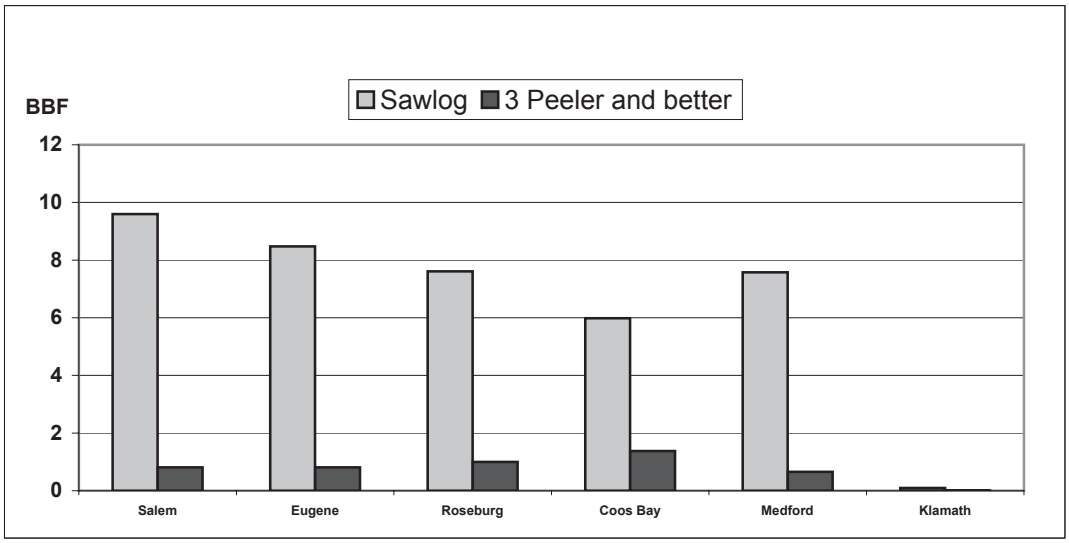
Figure 51. Acres of forested lands within the planning area for 2006 by 10-year age class

The above figure does not include the eastern management lands of the Klamath Falls Resource Area (of the Lakeview District) since no starting age class was assigned to these acres. The Salem, Eugene, Roseburg, Coos Bay, and Medford districts contain predominately Douglas fir by volume. Historical volume harvested by species shows that for most districts, forest stands average about 80% of their volume harvested from Douglas fir. See *Appendix D. Timber*. The Klamath Falls Resource Area of the Lakeview District has white fir as the primary commercial species along with ponderosa pine.

The inventory systems that the BLM maintains are not designed to record log quality by level of expected size and grades. Therefore, only general information is available. Log sizes and grades are highly variable depending on the stand type that is harvested. This is particularly true in older stands where substantial peeler grade logs might be expected. Some general information can be derived from examining the historical level of peeler versus sawlogs as a percent of

volume in past harvesting actions. This historic information can then be used to predict the future levels from different types of stands using the structural stage of stands as a classification with anticipated levels of peeler grade for each structural stage. See *Appendix D. Timber*. See *Figure 52 (Peeler versus sawlog grade of Douglas fir logs by district within the planning area)* for the level of anticipated peeler grades of Douglas fir on the BLM lands that are suitable for timber harvesting and not part of the National Landscape Conservation System.

Figure 52. Peeler versus sawlog grade of Douglas fir logs by district within the planning area

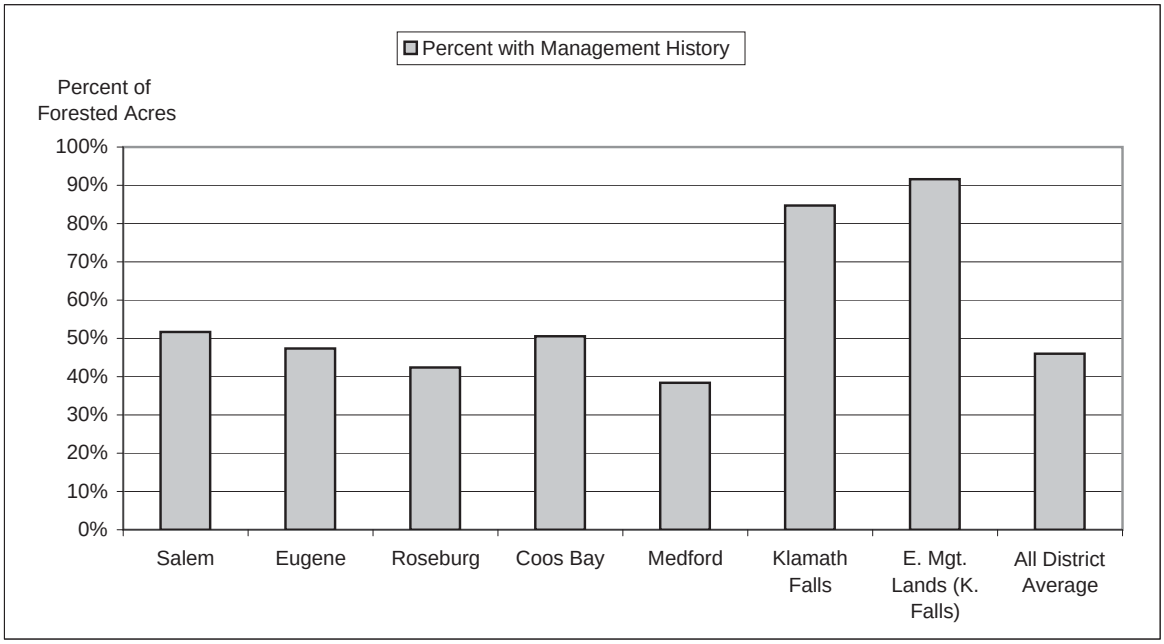


Existing stand condition is a codified classification system for inventory that separates stands into classes with similar management histories and conditions. This system is used to predict future growth and development trajectories of stands. As follows, past management history and current stand density can affect the future growth that is anticipated from stands:

- Managed stands are expected to have considerably higher volumes of timber per acre than natural stands of similar age due to the more consistent spacing, the changes in species composition, and the use of improved genetic stock during reforestation.
- Young stands resulting from regeneration harvesting where a component of the original stand is left as a legacy often have lower growth rates for the understory component of those stands.

See *Figure 53 (Percent of BLM lands within the planning area with management history that are suitable for sustained timber production)* for the percentage of BLM lands within the planning area with management history that are suitable for sustained timber production. In general, the BLM lands have had a substantial amount of past management from either regeneration harvesting or thinning.

Figure 53. Percent of BLM lands within the planning area with management history that are suitable for sustained timber production



Special Forest Products

Key Points

- There are 84 forest products in 10 categories that were harvested or collected over the past five years on BLM lands.
- Wood products (including firewood), mushrooms, and floral and greenery are consistently the highest three special forest product categories by the number of permits sold and by revenue.
- Collectors normally focus their harvesting efforts in areas where the commercial forest product is abundant and is easy and economical to harvest.

Special forest products are plant and fungi resources that are harvested, gathered, or collected, and have social, economical, or spiritual value. Common examples include conifer boughs, Christmas trees, mushrooms, edibles and medicinals, floral and greenery, mosses and lichens, ornamentals, seed and cones, tree burls, transplants and wood products including posts, poles, firewood, shakes, and rails. The types of special forest products are continually expanding as entrepreneurs develop new products and create new markets.

Most special forest products are common, widespread, and generalists (i.e., tolerant of a broad range of environmental conditions), while some require a specific community or habitat, or even a specific host. The demand for special forest products varies as markets conditions change. These changes can be seasonal variable or cyclical from year to year depending upon economic factors and environmental conditions. The availability of road access, particularly roads to harvest areas, and land use restrictions influences the type and amount of forest products available for harvest.

Although most commercial harvesters in the Pacific Northwest do not rely on special forest products for their sole source of income, these products do provide important supplemental or seasonal sources of income that contribute to household economies (Charnley 2006).

Special forest products are generally harvested from common plants and fungi that are associated with vegetative communities on BLM managed lands that include conifer forests, grasslands, shrublands, and hardwood communities. The 84 special forest products are grouped into 10 special forest product categories based on a retrospective analysis of BLM permit data over the past five years.

Following is a list of the special forest product categories and the number of products included in each category.

- boughs (coniferous) (12)
- burls and miscellaneous (2)
- Christmas trees (4)
- edibles and medicinals (8)
- floral and greenery (8)
- mosses (bryophytes) (3)
- mushrooms (fungi) (12)
- seeds and seed cones (5)
- transplants (13)
- wood products (17)

A general description of the common special forest products is provided below. See *Table 80 (Special forest products by category)* for a complete list of the special forest products.

Boughs. The typical species from which boughs are collected are western red cedar and incense cedars, true firs, pines, juniper, and Douglas fir. Conifer boughs are used by individuals and the floral industry primarily during the Christmas season for seasonal decorations. Boughs are generally collected from young or mature forest stands. Western red cedars occur in riparian zones.

Burls. Burls are used for woodcrafting in the manufacture of specialty items, such as clocks, tables, veneers, and other decorative items. Burls are found on either the bole (cluster burls) or on the stumps (stump burls) of trees. Burls are harvested from hardwood trees in mature and structurally complex forest stands of hardwood and mixed conifer and hardwoods forest types.

Christmas trees. Christmas trees are sold as seasonal decorations for personal or commercial use. Christmas trees are harvested from stand establishment conifer plantations.

Floral and greenery. Floral and greenery is collected and used as decorative arrangements. Common plants include salal, evergreen huckleberry, sword fern, and beargrass that generally occur in the understory of conifer forests. Floral and greenery are harvested from upland areas in conifer forest types in mature and structurally complex forests stands. Manzanita is harvested for decorative greens and bird perches and occurs in woodland and shrubland communities, mostly in southern Oregon.

Medicinals. Cascara and yew bark is peeled from the bole of trees and used to make laxatives and tonics. The majority of Cascara and yew occur along streams or seasonally wet areas. Harvest areas are limited because they occur in riparian zones.

Mushrooms. Mushrooms that are commonly harvested include golden chanterelle, winter chanterelle (yellow foot), morels, matsutake, shaggy parasols, coral mushrooms, truffles, and hedgehogs. Each mushroom is associated with one or more specific hosts in forested conifer or mixed hardwood stands. Mushrooms are generally harvested from hardwood and conifer forest communities of mature and structurally complex forests stands. Morels are harvested immediately after a wildfire.

Seeds and cones. Cones are collected commercially for seed or harvested for ornamental purposes from mature and structurally complex forests.

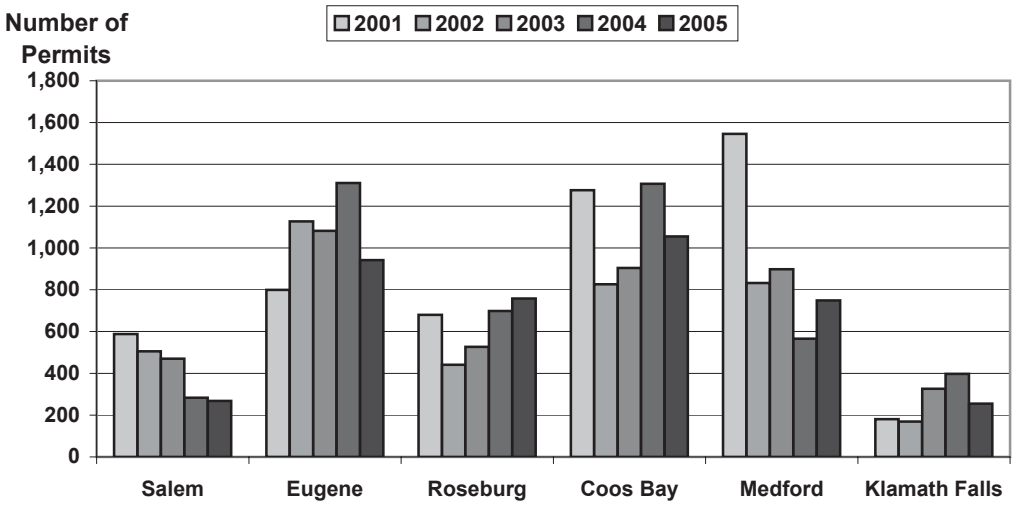
Transplants. Transplants include various native ground covers or shrubs, forbs, and tree species including root stock for medicinal purposes. These plant species are found in riparian and upland areas in all vegetation communities.

Wood products. Wood products include firewood, posts and poles, rails, cedar shake bolts, biomass, or pulp wood. Poles can be any length, but no more than 6 inches in diameter on the large end. Wood products are harvested from young, mature, and structurally complex forests. Wood products also includes ornamental wood species that include red alder, big leaf maple, madrone, vine maple, and willows. These are used to construct furniture and cabinetry, veneers, and bow staves. Ornamental wood species also include cut sticks, which are generally red alder or other hardwood species that measure less than 4 inches in diameter at the large end. Ornamental wood species are harvested from all forest communities, but generally from mature and structurally complex forests.

Permits for special forest products include restrictions to help meet renewable resource standards and to protect other sensitive resource values. Permits may restrict the type of species, the quantity harvested, the harvest or collection method, the location, access, and the season.

The types and abundance of special forest products vary across the planning area. The location of the commercial harvesting sites and the product and site conditions may change from year to year. These differences are reflected in the forest product permits issued by BLM district. See *Figure 54 (Trend in the total number of permits issued over five years by BLM district)*. The overall trend is mixed with a slight increase by three districts and a slight decrease by three districts.

Figure 54. Trend in the total number of permits issued over five years by BLM district



Many special forest products, such as firewood, Christmas trees, evergreen boughs, huckleberries, and mushrooms are broadly distributed throughout the planning area. Other special forest products are limited to a particular plant community, special environments, or narrow geographic area.

Overharvesting is not known to occur across the range of a species or to the extent that it creates concern for the sustainability of the product or species, except in a few local situations. When these situations are discovered, harvesting permits are discontinued or issued in other areas.

Natural disturbances, such as wildfire, storms, and floods, shape the types and productivity of special forest products over time. Wildfires change vegetative and structural components of the

landscape by consuming biomass, but can promote productive responses of some special forest products. For example, morel mushrooms respond quickly after wildfires. Wildfires can create conditions suitable for other vegetative products in subsequent years, such as willow whips, beargrass and other floral and greenery products, and medicinal forbs. Wildfires char and degrade the value of such special forest wood products as boughs, Christmas trees, firewood, and poles.

Floods alter vegetation and the special forest products found in riparian plant communities. Although initially floods may appear to destroy the existing riparian vegetation, the changed conditions provide vigor to the resprouting and reseeding shrubs and forbs, and within a few years provide a new potential crop of alder and willow products along streams and wetland areas.

Timber harvesting changes the forest condition and increases or decreases opportunities and quality depending on the product. Species composition, age, distribution of age classes, growth rate, and density of forest stands influence the type and productivity of special forest products.

Timber harvesting and associated fuels reduction treatments routinely alter stand structure and forest floor conditions, and combined, modify forest conditions on more acres than all other planned activities. The method of timber harvesting particularly influences special forest products. Ground-based harvesting operations disturb more area and at heavier levels of disturbance on the understory vegetation (and associated special forest products, such as mushrooms and floral and greenery) than cable operations. Helicopter harvesting has even less disturbance. Timber management activities, however, do provide road access to harvest areas that would otherwise not be available.

Regeneration harvesting reduces suitable conditions for numerous special forest products, while at the same time providing abundant biomass, fiber, and firewood as commercial by-products. For example, chanterelles do not fruit for the first 15 years after a regeneration harvest and matsutakes rarely fruit in stands under 40 years of age (Vance et al. 2001). Many commercial floral and greenery products, as well as boughs, may be lost from the harvest units. Huckleberries for greenery and moss products may be lost for decades. Commercial thinning generally provides conditions where understory greenery products can persist and the commercial value may even improve within a short period of time due to an increase in the light to the understory vegetation. Silviculture treatments in regeneration harvest units generally cut evergreen vegetation and hardwoods that would reduce the amount and commercial quality of other forest products. Understory greenery products can increase within a short period of time due to an increase in the light to the understory vegetation during thinning harvests.

Silviculture treatments in regeneration harvest units generally cut evergreen vegetation and hardwoods that reduces the amount and commercial quality of other forest products.

Fuels treatments target the pole component of forest stands as well as the hardwood and shrub understory. Fuels treatments include broadcast burning, hand, and mechanical treatments. Broadcast burning disposes logging slash and other forest floor fuels, burns wood products, and degrades quality. Manual treatments have less impact to understory vegetation and the forest floor duff layer and associated special forest products than mechanical treatments (such as slash-buster operations) due to the size of the equipment. Opportunistic situations occur where pole harvesting is coordinated with fuels projects. Flora and greenery products and mushrooms respond quicker to manual operations than mechanical operations.

The available data regarding the quantities and value of special forest products is limited to a basic comparison over time (trend) by the number of permits sold by category, units sold, and revenue. The number of units sold of special forest products has declined slightly for wood products, boughs, and floral and greenery over the last five years. Mushrooms is the only category that has increased.

The total number of special forest product permits varies by approximately 20% between any two-year interval. Each forest product group varies based on relevant market and environmental conditions.

Permit sales have averaged over $200,000 per year and totaled over $1,100,000 over the past five years. In the last two years, revenue from wood products, floral and greenery, and boughs has declined, while mushroom revenue has increased during the last three years. Wood product revenue has varied more than other special forest products due to pole sale fluctuations in Medford.

Field inventories of special forest products, harvest areas, and actual harvest data on BLM lands is not available. Detailed studies and analysis have been conducted where concerns for overharvesting and long-term sustainability existed in the past, such as moss harvesting in Eugene (Muir 2004) and yew wood harvesting (USDA, USDI 1993a).

See *Table 80 (Special forest products by category)* for the 10 categories of 84 specific forest products that are found on BLM-administered land within the planning area.

Table 80. Special forest products by category

Category	Special Forest Products		
Boughs (coniferous)	Douglas fir Grand fir Incense cedar Juniper	Noble fir Pacific silver fir Port Orford cedar Shasta red fir	Sugar pine Western hemlock Western red cedar White fir
Burls and miscellaneous	Big leaf maple Pacific madrone		
Christmas trees	Douglas fir Grand fir	Noble fir Shasta red fir	
Edibles and medicinals	Bay leaves Cascara bark Elderberries Oregon grape root	Pacific yew bark Pacific yew boughs Prince's pine St. John's wart	
Floral and greenery	Beargrass Bracken fern Cactus species Huckleberry	Manzanita Oregon grape Salal sp. Sword fern	
Mosses (bryophytes)	Lichen sp. Sheet moss Tree moss		
Mushrooms (fungi)	Black picoa Cauliflower Coral tooth Golden chanterelle	Horn of plenty King bolete Matsutake sp. Morel sp.	Shaggy parasol Spreading hedgehog White chanterelle Yellowfoot mushroom
Seeds and seed cones	Douglas fir Noble fir Ponderosa pine	Sugar pine Western hemlock	
Transplants	Bleeding heart Douglas fir Huckleberry Incense cedar Mountain mahogany	Oregon grape Rhododendron Sword fern Vine maple	Western hemlock Western red cedar Wild iris Willow sp.
Wood products	Alder stick (large) Bolts and shakes Corral poles Fence stays Fuelwood Hobby wood	Large poles Marginal logs Pitchwood Posts (corner) Posts (line) Pulpwood	Rails (split) Round wood Small poles Tepee poles (4 in. x 16 ft.) Whip stock (misc.)

Botany

Key Points

- Rare plants and fungi are not evenly distributed or predictable across the landscape, even when good potential habitat exists.
- There are 134 plant and fungi species that are listed as bureau special status species that exist on approximately 4,000 acres of BLM-administered lands and that consist of approximately 5,000 known populations.
- Of the 134 bureau special status species, 32 occur only on BLM-administered lands.

The BLM administers diverse ecosystems across the planning area. These lands include habitat and populations of some of the rarest plant and fungi species in the Pacific Northwest, including:

- 134 species that occur on BLM-administered lands within the planning area (not including the West Eugene Wetlands or the Cascades-Siskiyou National Monument);
- 59 species that have 20 or fewer populations;
- 32 species that occur *only* on BLM-administered lands; and
- 21 species that have five or fewer populations.

Since the landscape and the habitats of the planning area are extraordinarily diverse, they include a unique combination of geology, climate, and topography and these contribute to the presence of many rare and locally endemic plant and fungi species. Southwest Oregon and northern California have some of the highest rates of plant endemism in the United States (Della Salla et al. 1999). These rare species, also called bureau special status species, are distributed throughout the planning area and are found in nearly every habitat type.

Over 4,500 plant species are found in Oregon and the majority of the species occur within the planning area. Most of these plant species are considered common and are of no conservation concern from the standpoint of being threatened with, or trending toward, extinction. However, approximately 7% (324) of these species are considered bureau special status species and are of conservation concern due to the small number of known populations, loss of habitat, or the threats to their existence that are posed by human activity or other biological factors.

Habitats

The flora in Oregon is shaped by geologic history, topography, regional climatic factors, and natural disturbances. The geographic extent of the planning area is so broad that a wide range of conditions shape the diversity of plant communities and habitats. For example, rare plant and fungi species are known to occur on BLM-administered lands in the following physiographic provinces in the stated numbers:

- 38 within the Coast Range province
- 13 species within the Eastern Cascades and Willamette Valley provinces
- 59 within the Western Cascades province

In the planning area, over 250 plant species are endemic to serpentine soils with about 10% being considered rare (Kruckeberg 1984). Crinite mariposa-lily (*Calochortus coxii)* and Howell's mariposa-lily (*Calochortus howellii)* are examples of rare, narrow endemics found only on soils influenced by a serpentine substrate. Approximately 88 rare plant species and nearly two-thirds of the total known populations that occur on BLM-administered lands occur in the Klamath province.

Many plants are associated with the unusual habitat types that are generally shaped by the unusual features, climate, and hydrologic influences that exist throughout the planning area. The innumerous unusual habitats within the planning area range from rock substrates and outcrops of different origins with variable soil types and conditions (including sand dunes) to seasonal and permanent wetlands, vernal pools, fens, bogs, and marshes. The range of unusual habitats also includes the forest communities of conifer and mixed hardwoods and the communities of steppe juniper and sage. These habitats include a wide range of conditions and, because they have persisted over time, have become refuges for unusual plant communities (Franklin and Dyrness 1973). Many uncommon and rare species have adapted to these unique conditions over time and generally occur infrequently on associated habitat types.

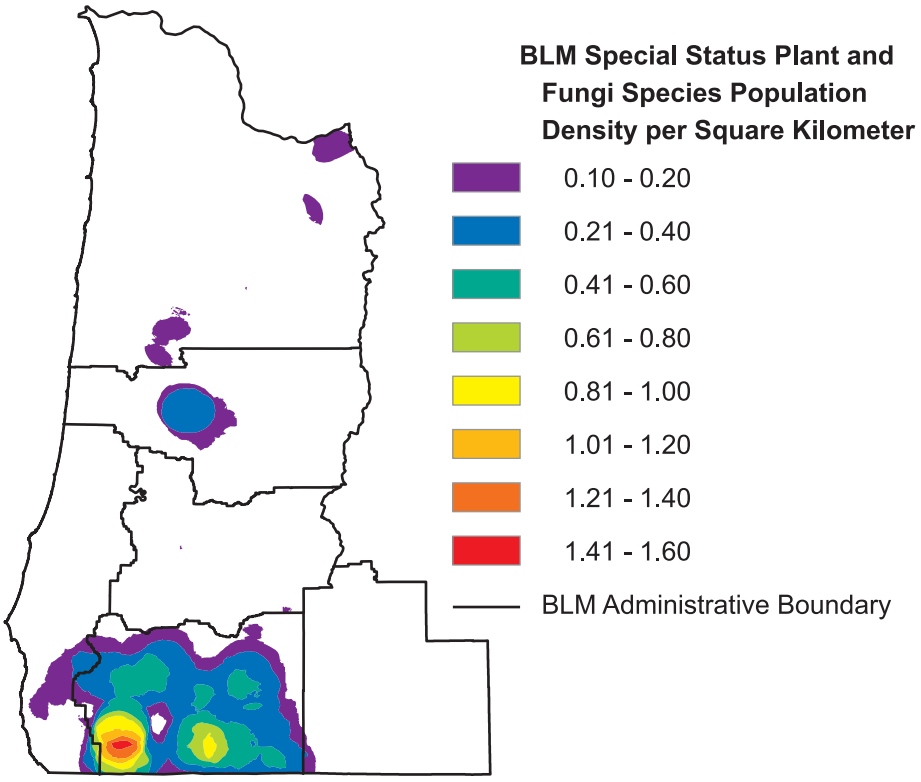
Rare plant and fungi species are generally not evenly distributed or predictable across the landscape, even when good potential habitat exists. Some species are generally associated with a specific plant series, habitat type, or an ecological feature that narrows their potential habitat. However, other rare species are associated with broader and less defined habitat types. Kaye et al. (1997) describes types of rarity, patterns, distribution, and threats to rare plant species in Oregon.

Biological factors (e.g., reproductive strategies, inbreeding depression, pollinators and pollination, consumption by herbivores, weed invasion, habitat connectivity, disease, predation, habitat change, and global climate change) play important roles in determining the distribution and abundance of a species. Some rare Oregon species appear to be lingering remnant populations from historic plant communities at the edge of their range with few remaining populations (e.g., Baker Cypress). Others are narrow endemics adapted over long periods of time to specific habitats or substrates, such as the serpentine endemic group. Other rare species may be isolated populations that are diverging morphologically from metapopulations, or may be the result of cross-pollination between two or more species (e.g., Gentner's fritillary (*Fritillaria gentneri*)). Other rare species of lichen and bryophytes appear to be more mobile within widespread ranges (e.g., *Usnea longissima*), but adapted to narrow environmental conditions. Other species in Oregon are rare because of a loss of habitat due to an expanding human population and the introduction and spread of invasive plants (USDA, USFWS 2003a; USDA, USFWS 1998a).

Searches for rare plants have occurred on more than 433,000 acres in the past six years and resulted in the discovery of more than 1,600 new populations in the past three years alone. Over 85% of all populations (and the greatest increase in new populations over the past three years), occurs in the Medford District, which includes the Klamath Mountains. At the opposite end of the range, approximately 1% of all populations occur in the Lakeview District in the Klamath Falls Resource Area.

Areas of high special status species richness (the number of different species in an area) and density (the number of one species in an area) can be mapped across the landscape as hot spots (greater richness and density) and cold spots (lesser richness and density). Hot spots occur at fine spatial scales (such as special habitat features—like meadows, wetlands, rock outcrops) and at larger geographic regions, which are helpful for large-scale planning. Areas of high levels of endemism at the broader landscape level, such as the Klamath- Siskiyou region or the Eugene Wetlands area, are easily identified. Cold spots result from low occurrence levels of rare species and populations, or areas where survey intensity is lower. See *Figure 55 (Special status species density shown as hot spots and cold spots)*.

Figure 55. Special status species density shown as hot spots and cold spots



Natural disturbances (wildfires, storms, and floods) occur frequently and change plant community and habitat conditions for rare plant and fungi species. Many factors determine whether a population will survive the disturbance, such as:

- the type, duration, and intensity of the disturbance;
- the season;
- the species habit and life-cycle requirements; and
- the adaptability of a species to a changed environment.

Some rare plant species (e.g., Bradshaw's desert parsley (*Lomatium Bradshawii*)) are adapted to frequent, low-intensity fires and respond positively (Kaye et al. 2001). Such species as Gentner's fritillaria, Kincaid's lupine, and coral seeded allocarya (*plagiobothrys* sp.) can respond positively to the increased light and moisture from the loss of overtopping and competing vegetation, and the increase in nutrients that are available after a wildfire. On the other hand, many rare lichen, bryophytes, and fungi, along with some vascular plants, are consumed in a fire and these populations can be lost, along with their habitat and hosts, unless they are protected in a niche or island where the fire was absent or less severe (S. Copeland, unpublished data).

Floods and debris flows can alter riparian and aquatic plant communities and can also alter the rare plant populations that occur in the disturbed areas. These types of events are very dynamic with some rare plant populations benefiting and others being lost. Although, initially, floods may appear to destroy the existing riparian and aquatic vegetation, they also deposit sediment, distribute seed, and reduce excess and nonnative vegetation, which provides vigor to resprouting and reseeding shrubs, perennial and annual grasses, and forbs. For example, many populations of rare species of juncus and sedges, along with popcorn flowers (*plagiobothrys*), are associated with streams and wetlands and adapted to periodic floods with their prolific seed production.

Special Status Species

Some species are both state and federally listed species. Special status species are rare plant and fungi species that include all federally listed, Oregon state-listed, proposed, and candidate species, as well as, bureau sensitive species, bureau assessment species, and bureau tracking species. Bureau tracking species have no management associated with them and are not further discussed in this draft environmental impact statement. The special status species list is based on federal listings, state listings, and the Oregon Natural Heritage Information Center rankings of species.

There are currently 324 plant and fungi species that occur in the planning area that are on the special status species list. However, only 134 species (41%) have documented populations on BLM-administered lands. The remaining 190 species (59%) are suspected or likely to occur on BLM lands because known sites occur nearby, their range coincides with the planning area, or suitable habitat exists on BLM-administered lands. Only 95 of 230 vascular plants (14 of which are federally listed and candidate species) are known on BLM-administered lands, as well as, 14 of 47 mosses and liverworts (i.e., bryophytes), 15 of 26 lichens, and 10 of 21 fungi.

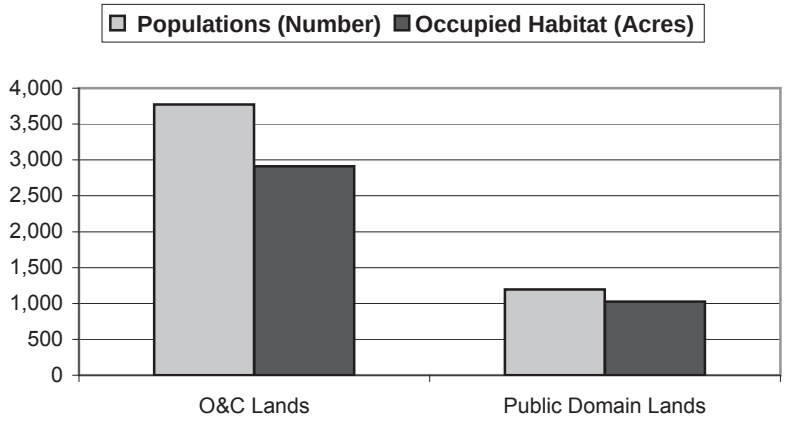
Table 81. Number of documented and suspected plant and fungi special status species

Special Status Plants and Fungi Species	Total Species	Vascular Plants	Bryophytes	Lichens	Fungi
Suspect	324	230	47	26	21
Documented	134	95	14	15	10

Special status species occupy approximately 4,000 acres of the approximately 2.5 million acres of BLM-administered lands within the planning area, which is itself approximately 22 million acres. Those 4,000 acres have approximately 5,000 populations of the 134 documented special status species, along with five additional species that occur in the West Eugene Wetlands and the Cascade-Siskiyou National Monument.

Approximately 74% of the occupied habitat (the 4,000 acres that are occupied by special status species) and 76% of the populations (the 5,000 populations of the documented special status species) occur on O&C lands, while 26% of the occupied habitat and 24% of the populations occur on public domain lands. See *Figure 56 (Populations and occupied habitat of bureau special status species on O&C and public domain lands within the planning area)*.

Figure 56. Populations and occupied habitat of special status species on O&C and public domain lands within the planning area



Federally Threatened, Endangered, and Candidate Species

There are 13 species that are listed under the federal Endangered Species Act that occur within the planning area, along with one federal candidate species—for a total of 14 federally listed and candidate species. Only 5 of the 13 federally listed species occur on BLM-administered lands, along with the one federal candidate species. There are eight species that are not documented on BLM-administered lands or do not occur on lands where management activities are proposed, but they are suspected and included because the range of the species overlaps public lands and suitable habitat exists. See *Table 82 (Federal status of federally listed plant species within the planning area)*. Also see *Appendix E. Botany*.

Table 82. Federal status of federally listed plant species within the planning area

Federal Status	Federally Listed Plant Species	
	Scientific Name	**Common Name**
FTO	*Castilleja levisecta*	Golden paintbrush
FTO	*Howellia aquatilis*	Water howellia
FTO	*Lupinus sulphureus ssp. kincaidii*	Kincaid's lupine
FTO	*Sidalcea nelsoniana*	Nelson's checker-mallow
FEO	*Arabis mcdonaldiana*	McDonald's rock-cress
FEO	*Astragalus applegate*	Applegate's milk-vetch
FEO	*Erigeron decumbens var. decumbens*	Willamette valley daisy
FEO	*Fritillaria gentneri*	Gentner's fritillary
FEO	*Lilium occidentale*	Western lily
FEO	*Limnanthes floccosa ssp. grandiflora*	Large-flowered wooly meadowfoam
FEO	*Lomatium bradshawii*	Bradshaw's desert parsley
FEO	*Lomatium cookii*	Cook's lomatium
FEO	*Plagiobothrys hirtus*	Rough popcorn flower
FCO	*Calochortus persistens*	Siskiyou mariposa-lily

FTO (federally threatened Oregon) FEO (federally endangered Oregon) FCO (federal candidate Oregon)

The federally listed and candidate species are vascular plants and they occur in every BLM district within the planning area. In general, federally listed plant species are adapted to special habitats within narrow geographic ranges, although some are broader and wider ranging. Individual population sizes are generally small and the area of occupied habitat is small. See *Appendix E. Botany* for a list of federally listed species, the number of known sites, the area occupied in acres, and the general habitat descriptions.

Oregon State Threatened, Endangered, and Proposed Species

The BLM policy for special status species applies to state-listed species that are under the authority of the Sikes Act. Species listed by the state of Oregon occur in every BLM district within the planning area and all are vascular plants. There are 29 plant species, along with 50 candidate species, that are listed under the Oregon Endangered Species Act. Of the Oregon listed species, 11 are also federally listed. In general, most of these species are narrow endemics that occur within restricted geographic areas or unique habitats. The populations of state-listed species are few and normally small in size. See *Appendix E. Botany*.

Bureau Sensitive Species and Bureau Assessment Species

Bureau sensitive species receive the same level of protection as federal candidate species under the BLM's special status species policy. Bureau assessment species are species of concern in Oregon, and impacts to populations and individual species are considered along with other resource considerations on a case-by-case basis.

There are 116 bureau sensitive species (of which are 19 state-listed species) and 194 bureau assessment species within the planning area. Of those 310 species, 216 are vascular plants (not including the 14 species that are federally listed and candidate species), 47 are mosses or liverworts (bryophytes), 26 are lichens, and 21 are fungi.

The vascular plants occur in a variety of habitat types and substrates including aquatic, riparian, and terrestrial. Bryophytes and lichen are associated with a variety of habitats (including rock, soils, and riparian, although primarily conifer and hardwood communities). Fungi are mycorrhizal and associated with host species in conifer and hardwood forest communities. The habitat groups (listed in the last section of this *Botany* section) delineate species by habitat types. Additional habitat descriptions can be found in *Appendix E. Botany*.

Conservation Plans

The following sections outline the recovery plans, conservation agreements, and conservation strategies that exist for rare plant species.

Recovery Plans for Federally Listed Plant Species

Recovery plans have been written for nine species within the planning area that are listed under the federal Endangered Species Act. Some recovery plans were written more than 15 years ago. The content, style, and vocabulary varies greatly between earlier and later plans. The primary conservation components of each recovery plan that applies to land management activities have been extracted and listed in *Appendix E. Botany*.

Table 83. Federally listed plant species with recovery plans

Scientific Name	Common Name
Arabis mcdonaldiana	McDonald's rock-cress
Astragalus applegatei	Applegate's milk-vetch
Castelleja levisecta	Golden paintbrush
Fritillaria gentneri	Gentner's fritillary
Howellia aquatilis	Water howellia
Lilium occidentale	Western lily
Lomatium bradshawii	Bradshaw's desert parsley
Lupinus sulphureus sp. kincaidii	Kincaid's lupine
Plagiobothrys hirtus	Rough popcorn flower
Sidalcea nelsoniana	Nelson's checker-mallow

Conservation Agreements

Conservation agreements outline mutual conservation goals that are necessary to reduce, eliminate, or mitigate specific threats to species that are at risk. They provide general guidance for the management of species. There are four interagency conservation agreements between the BLM and other agencies (usually involving the U.S. Fish and Wildlife Service) for species within the planning area. See *Table 84 (Plant species with conservation agreements)*. Three of the agreements are single-species agreements and one agreement covers a suite of rare species that occur in serpentine Darlingtonia wetlands and fens.

Table 84. Plant species with conservation agreements

Scientific Name	Common Name
Single-species agreements	
Calochortus coxii	Crinite mariposa lily (Oregon State listed as endangered)
Calochortus umpquensis	Umpqua mariposa lily (Oregon State listed as endangered)
Lupinus sulphureus sp. kincaidi	Kincaid's lupine (federally listed as threatened)
Multispecies agreement for the serpentine Darlingtonia wetlands and fens of southwestern Oregon and northwestern California	
Epilobium oreganum	Oregon willow-herb
Gentiana setigera	Mendocino gentian
Hastingsia bracteosa	Large-flowered rushlily (Oregon State listed as threatened)
H. atropurpurea	Purple-flowered rushlily
Viola primulifolia sp. occidentalis	Western bog violet

Conservation Strategies

Conservation strategies are more detailed than conservation agreements. They not only contain the information that is included in a conservation assessment, but they also provide specific details on species populations and habitat management. Conservation strategies have been written for five species within the planning area. See *Table 85 (Plant species with conservation strategies)*.

Table 85. Plant species with conservation strategies

Scientific Name	Common Name
Aster gormanii	Gorman's aster
Cimicifuga elata	Tall bugbane
Frasera umpquaensis	Umpqua gentian
Phacelia argentea	Silvery phacelia (Oregon State listed as threatened)
Rorippa columbiae	Columbia cress

See *Appendix E. Botany* for a complete list of conservation strategies and conservation agreements, which includes species, key conservation components that apply to land management actions, participating agencies, and field units.

Survey and Manage

Survey and manage is a mitigation measure for little known or rare species that was adopted as a set of standards and guidelines in the 1995 resource management plans of the districts within the planning area to direct management.

For comprehensive information regarding the species, refer to the:

- *January 2004 Final Supplemental Environmental Impact Statement To Remove or Modify the Survey and Manage Mitigation Measure Standards and Guidelines*; and the
- *January 2007 Supplement to the July 2006 Draft Supplement to the 2004 Final Supplemental Environmental Impact Statement To Remove or Modify the Survey and Manage Mitigation Measure Standards and Guidelines.*

For the management direction, refer to the:

- *January 2001 Record of Decision and Standards and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and other Mitigation Measures Standards and Guidelines in Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl.*

The information in these environmental impact statements is incorporated by reference.

See *Table 86 (Distribution of survey and manage species)* for the total number of survey and manage species within the area of the Northwest Forest plan (NWFP), the number that occur on BLM-administered lands, the number that are also bureau sensitive species (BSS), the number that are also bureau assessment species (BAS), and the number that have been removed from the survey and manage list in Oregon.

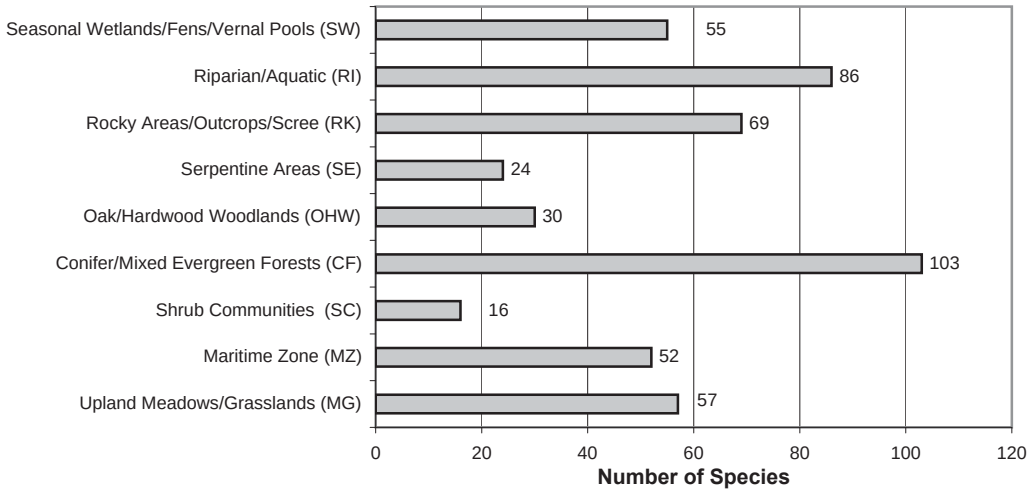
Table 86. Distribution of survey and manage species

Survey and Manage Species	Total Survey and Manage	Vascular Plants	Bryophytes	Lichens	Fungi
Number that occur within the area of the NWFP	254	10	17	40	187
Number that occur on BLM lands	246	10	13	39	184
Number that are also BSS	20	3	0	2	15
Number that are also BAS	21	3	8	10	0
Number that have been removed from Oregon listing	8	2	2	1	3

Habitat Groups and Rare Plant and Fungi Species

One method of grouping rare plant and fungi species is by the habitat associations that are based on biotic and abiotic features. See *Figure 57 (Number of special status species by habitat group)*. There are 324 special status plant and fungi species within the planning area from approximately 14 life-forms (e.g., forb, grass, tree, lichen, and fungi) that are found in numerous habitat-specific substrates, plant communities, and environments. There are nine habitat groups that were formed based on aggregating together similar habitat types that exist throughout the planning area. Each of the 324 species was placed into one or more groups. Each species was included in the broadest number of habit groups based on the variety of habitats and conditions that are associated with the species. See *Appendix E. Botany*.

Figure 57. Number of special status species by habitat group



The habitat groups used in this analysis include:

- conifer and mixed evergreen forests (CF)
- maritime zone (MZ)
- oak and hardwood woodlands (OHW)
- riparian and aquatic (RI)
- rocky areas, outcrops, and scree (RK)
- seasonal wetlands, fens, and vernal pools (SW)
- serpentine areas (SE)
- shrub communities (SC)
- upland meadows and grasslands (MG)

The above habitat groups relate to biotic and abiotic conditions as follows:

- Four habitat groups (CF, MG, OHW, and SC) relate to broad vegetative community types.
- Two habitat groups (RI and SW) relate to hydrologic and aquatic dependencies.
- Two habitat groups (RK and SE) relate to parent material substrates (one specifically to serpentine areas).
- One habitat groups (MZ) relates to wind and rain and is defined as taxa that is normally associated with coastal conditions within approximately 10 miles of the coast.

Invasive Plants

Key Points

- Invasive plant infestations are numerous and many are well-distributed on BLM-administered lands within the planning area.
- Invasive species are introduced and spread through a variety of mechanisms, including land management activities.

Invasive plants are alien plant species whose introduction causes economic or environmental harm, or harm to human health. Noxious weeds are a subset of invasive plant species. Noxious weeds are plant species that are designated by federal or state law, and generally possess one or more of the following characteristics:

- aggressive and difficult to manage
- parasitic
- carrier (or host) of serious insects or disease
- nonnative, new to, or not common to the United States

Invasive plants have been introduced into the planning area by various means. Some introductions were intentional—to make use of ornamental or erosion-control species. Examples include Scotch broom and purple loosestrife. Other species were introduced unintentionally—by air, water, or transportation routes. Frequently, invasive plants are introduced by the movement of contaminated seed, agricultural materials, or animals; the use of contaminated equipment; the spreading of infested gravel, road fill, and topsoil; and the sale of invasive species for ornamental purposes (USDI, BLM 1996).

Once introduced, these invasive species are spread primarily by vehicles, human activities, water, and wildlife. The initial infestations are often along roads and trails, landings, campgrounds, and other areas of high disturbance (Hansen and Clevenger 2005). Occasionally, infestations are also introduced into relatively undisturbed areas (USDI, BLM 2005a, 3-39).

More than 130 invasive plant species have been documented within the planning area. Of these, 61 are also listed as noxious weeds in Oregon. See *Table 87 (Number of invasive plant and noxious weed species on BLM-administered lands within the planning area)*. Several of the other identified invasive plants are also listed as noxious weeds in other states.

Table 87. Number of invasive plant and noxious weed species on BLM-administered lands within the planning area

Plant Category	Planning Area	BLM Districts					
		Salem	Eugene	Roseburg	Coos Bay	Medford	Klamath Falls
Invasive Plants	136	74	64	81	51	50	50
Noxious Weeds	61	26	28	28	29	36	28

An accurate accounting of the total acreage and distribution of invasive plant infestations and treatments is unavailable for the following reasons:

- No central source exists for compiling invasive plant infestation and treatment information within Oregon.
- There is no requirement for county, private, or corporate land owners to report invasive plant information.

Despite the limited reporting on weed locations, a good picture of the distribution of noxious weed species is available on a species-by-species basis by WeedMapper (a website).

WeedMapper

An interagency cooperative effort with Oregon State University to collect spatial information on the distribution of noxious weeds in the state of Oregon. See www.weedmapper.org.

The condition of invasive plant infestations on BLM-administered lands within the planning area can be characterized by analyzing a few invasive species. The following representative list of invasive species is used to describe the condition of invasive plants on BLM-administered lands within the planning area.

- Canada thistle
- dyer's woad
- false brome
- knotweeds
- leafy spurge
- meadow knapweed
- Scotch and French brooms
- spotted and diffuse knapweeds
- yellow starthistle

Each of these species or species groups has a unique distribution pattern and strategy for spreading and resisting different treatment methods. Many of the identified invasive species are well-distributed across the planning area. Some are limited in distribution and others have very few sites on BLM-administered lands. Although each species is unique, these sample invasive species represent a range of life histories and methods of introduction and spread sufficient to describe the condition of invasive species on BLM-administered lands within the planning area.

Canada Thistle

Canada thistle, a perennial with an extensive root system, occurs in a wide variety of open, moist, disturbed habitats including roadsides, streambanks, pastures, meadows, waste areas, campgrounds, clear-cuts, roads, fires, and landslides (Hansen 2005; Turner 1999; Titus 1998; Jensen 1991; Schoenberger 1982; Neiland 1958). Canada thistle is rarely found in undisturbed forests (Heckman 1999; Bailey 1998; Hutchison 1992; Chen 1996; Dewey 1991; Parendes 2000; Young 1967). A study at Yellowstone National Park revealed that Canada thistle was found in habitats with varying levels of disturbance and that there is a direct relationship with species abundance and the level of disturbance (Allen 1999; Turner 1997).

Canada thistle spreads sexually by seed and vegetatively by root and stem fragments. Most seeds are spread by animals, hay, contaminated crop seed, machinery, and irrigation water. Fewer are dispersed by wind (Nuzzo 2000). The majority of the seeds germinate

the year they are produced. Seeds are generally viable for less than 5 years, but could remain viable for up to 20 years in soil (Nuzzo 2000; Donald 1994).

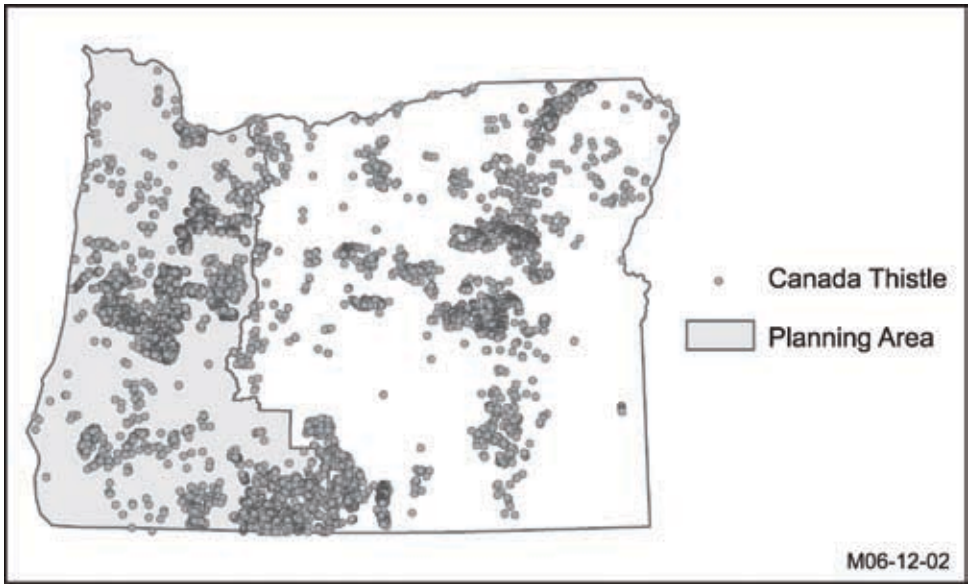
Once germinated, Canada thistle seedlings require space to grow and relatively high levels of light (Nuzzo 2000; Donald 1994). Once established, Canada thistle spreads rapidly by vegetative growth in the root and underground stems systems. Within one season a plant can grow up to 20 feet horizontally in good growing conditions (Magnusson 1987).

Canada thistle may establish in natural areas as part of the initial plant community after logging (Jensen 1991; Kellman 1969; Chen 1996; Young 1967), fire (Schoenberger 1982), grazing, and road building (Meier 1997).

A study in northern Idaho documented the establishment of Canada thistle following clear-cutting activities with varying levels of soil displacement. Timber harvesting activities with high levels of soil disturbance favor the establishment of forbs, including Canada thistle, to the detriment of tree seedling establishment (Jensen 1991). Canada thistle establishment may take two or more seasons after disturbance events (Doyle 1998; Willard 1995; Jensen 1991).

Canada thistle is well-distributed across the state and is present on BLM lands in every district within the planning area. See *Figure 58 (Distribution of Canada thistle)* (WeedMapper 2004a).

Figure 58. Distribution of Canada thistle



Source: WeedMapper 2004a

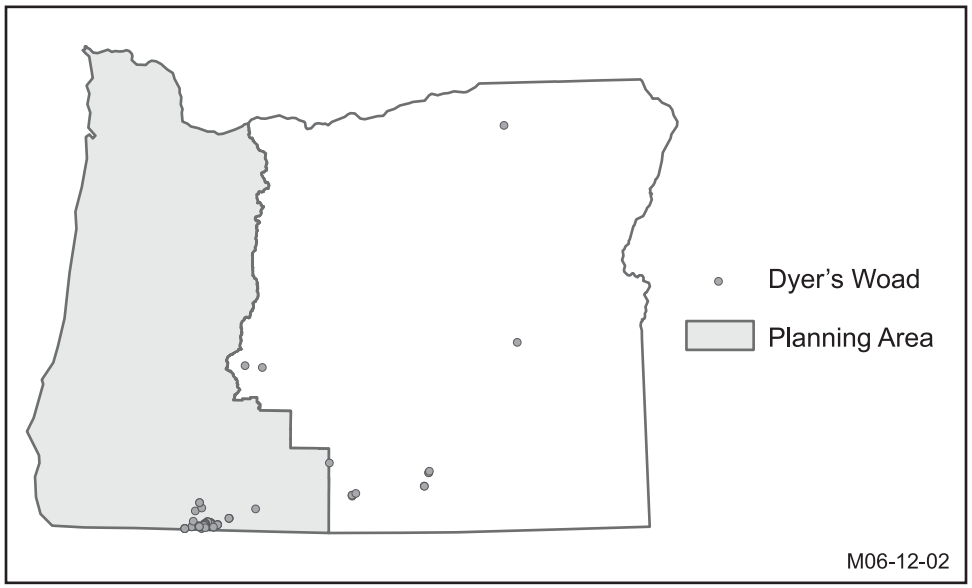
Dyer's Woad

Dyer's woad is an invader of rangelands and pastures. Dyer's woad behaves as a winter annual, biennial, or short-lived perennial. It is a prolific seed producer. The seeds are toxic to other plants and may remain viable in the soil for several years. This species only reproduces by seed (Kadrmas 2002; Forest Health Technology Enterprise Team *Update Team*. Spring 1997).

Dyer's woad is spread by the transport of contaminated livestock, machinery, and soil; the sowing of contaminated seed; and the feeding of contaminated hay. Natural movements of wind and water also contribute to the spread of dyer's woad (Kadrmas 2002).

The apparent distribution of dyer's woad in western Oregon is limited to the southeastern portion of the planning area. Dyer's woad infestations are reported from the Klamath Falls Resource Area of the Lakeview District and the Medford District. See *Figure 59 (Distribution of dyer's woad)* (WeedMapper 2004a).

Figure 59. Distribution of dyer's woad



Source: WeedMapper 2004a

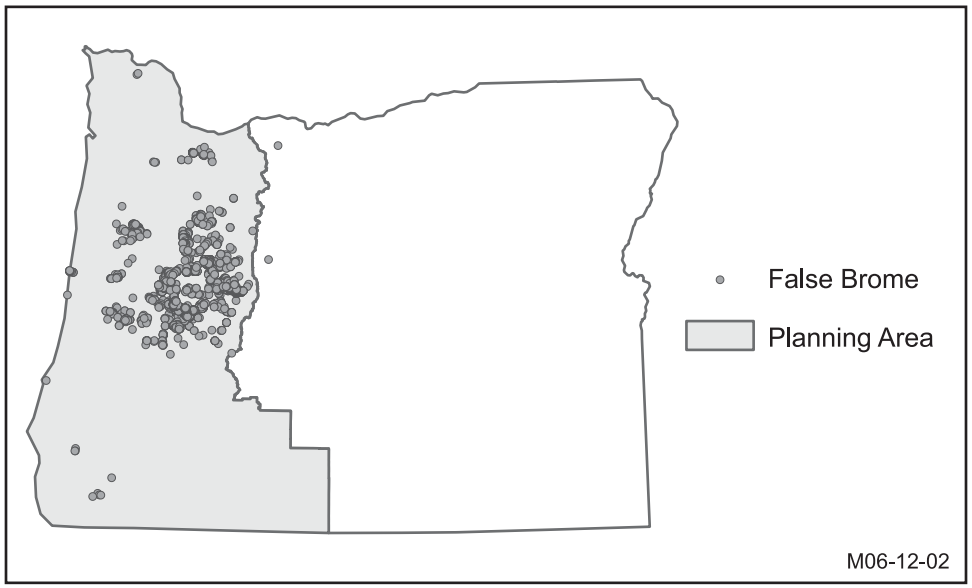
False Brome

False brome, a perennial grass, reproduces by producing large quantities of seed. The seeds are dispersed by water, gravity, animals, and are often spread long distances by vehicles, off-highway vehicles, people, and road construction and maintenance equipment (Kaye 2003; False-brome Working Group Newsletter 2004).

False brome is shade tolerant but can be easily crowded out by other shrubs and forbs. It grows in a wide variety of habitats including dry meadows and along streams, roads, trails, and under forest canopies. Infestations spread along roads, trails, and down streams (Kaye 2003; False-brome Working Group Newsletter 2004).

False brome has been reported on BLM lands in the Eugene, Salem, and Medford districts, and is also known to occur on nonfederal lands in southwestern Oregon and just over the crest of the Cascade Mountains in Jefferson County. See *Figure 60 (Distribution of false brome)* (WeedMapper 2004a).

Figure 60. Distribution of false brome



Source: WeedMapper 2004a

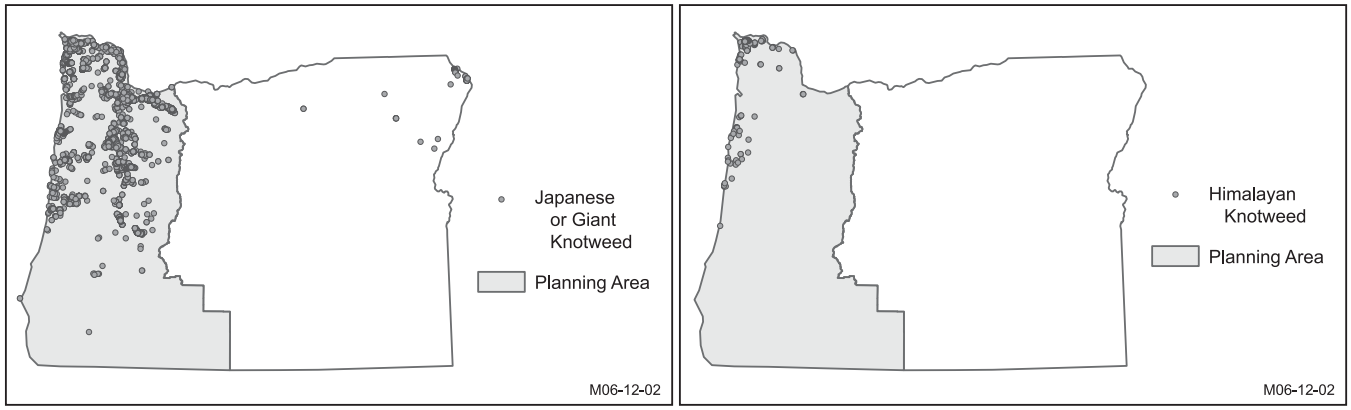
Knotweeds

The knotweeds are long-lived perennials that create dense infestations in disturbed areas, like stream banks, roads, and in waste areas. Roots and rhizomes can reach depths of 7 feet and distances of more than 20 feet from the parent plant. These infestations become dense and outcompete most native plant communities (Soll 2007; Seiger 1991).

Knotweeds favor habitats that are mostly light, but can persist in areas of partial shade, particularly where the overstory is dominated by broadleaf tree species. Knotweed infestations spread downstream during flood events, and are introduced along roads and waste areas as a result of human activity (Soll 2007; Seiger 1991).

Knotweeds are present on the BLM-administered lands in all of the planning area, except the Klamath Falls Resource Area of the Lakeview District. See *Figure 61 (Distribution of Japanese and giant knotwood and the Himalayan knotweed)* (WeedMapper 2004a). These figures only reflects the sites that have been reported. Considerable effort has gone into inventorying the invasive knotweed species in some watersheds. It is likely that these figures underrepresent the actual distribution of knotweeds within the planning area.

Figure 61. Distribution of Japanese and giant knotweed (left) and the Himalayan knotweed (right)



Source: WeedMapper 2004a

Japanese and giant knotweed **Himalayan knotweed**

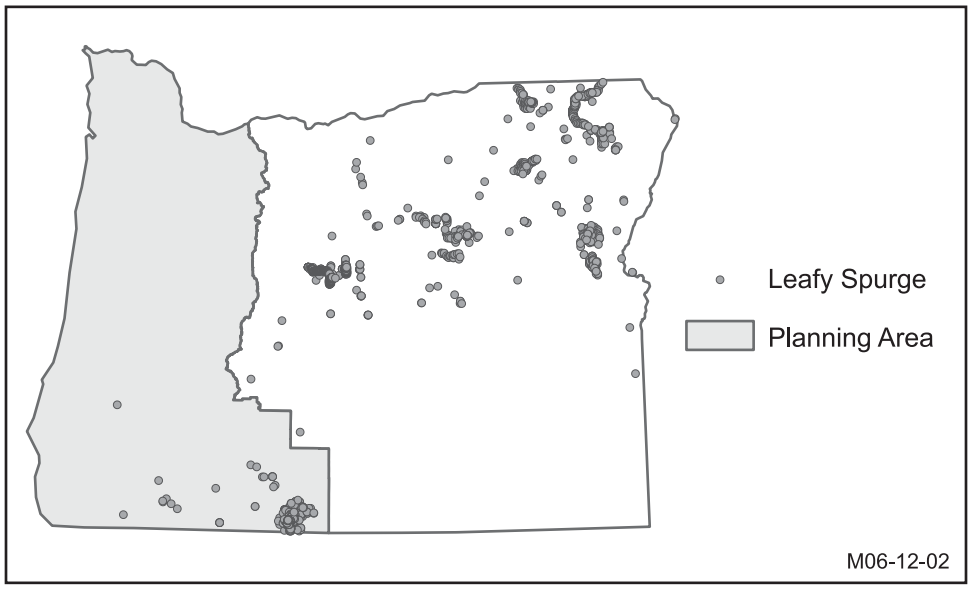
Leafy Spurge

Leafy spurge is known to occur in a wide variety of habitats including agricultural, urban areas, grasslands, shrublands, and forests. This species is most vigorous in full sunlight and dry habitats but can also inhabit woodlands, prairies, and other habitats. The root system of leafy spurge is extensive and can reach depths beyond 12 feet into the soil profile and reach more than 30 feet from side to side. Infestations tend to grow into dense stands, easily outcompeting native plant communities (WeedMapper 2004b; Global Invasive Species Database 2005).

Leafy spurge can be introduced to new locations by accidentally including seeds in agricultural seed mixes and may be used as an ornamental in landscapes. Infestations can grow from a single established plant at a rate of 4 feet per year (Global Invasive Species Database 2005).

The distribution of leafy spurge in Oregon is primarily east of the crest of the Cascade Mountains and has been reported on BLM lands in both the Medford District and Klamath Falls Resource Area of the Lakeview District. See *Figure 62 (Distribution of leafy spurge)* (WeedMapper 2004a).

Figure 62. Distribution of leafy spurge



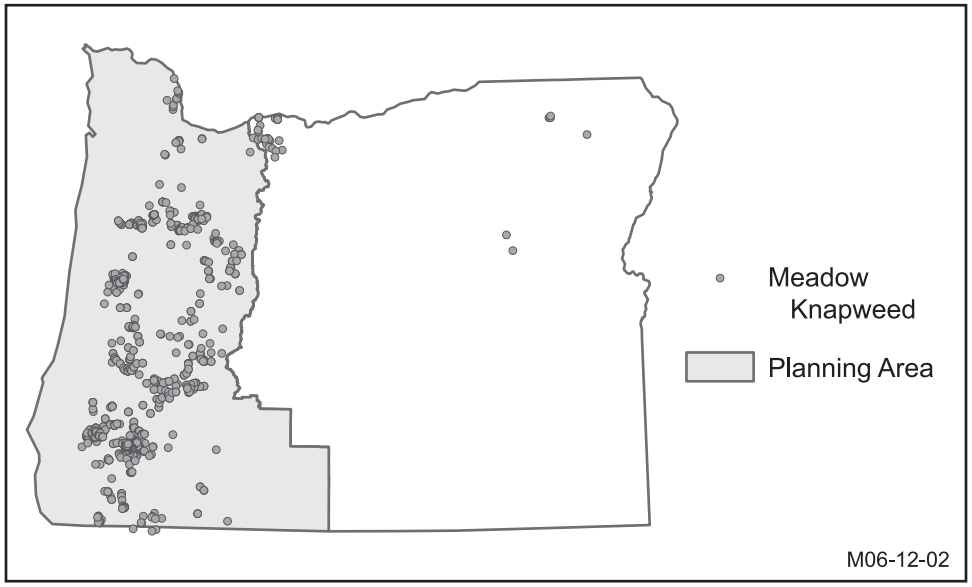
Source: WeedMapper 2004a

Meadow Knapweed

Meadow knapweed was introduced into Oregon as a forage plant and today invades a variety of habitats within the planning area including roadsides, pastures, meadows, native prairies, oak savannahs, and forest openings. In western Oregon, meadow knapweed is becoming more common in clear-cuts (Coombs et al. 2004). This species outcompetes native plant communities—reproducing by seed and spreading by both natural processes and human activity (WeedMapper 2004).

The reported distribution of meadow knapweed in Oregon is primarily west of the crest of the Cascade Mountains and has been documented on BLM lands in every district within the planning area. See *Figure 63 (Distribution of meadow knapweed)* (WeedMapper 2004a).

Figure 63. Distribution of meadow knapweed



Source: WeedMapper 2004a

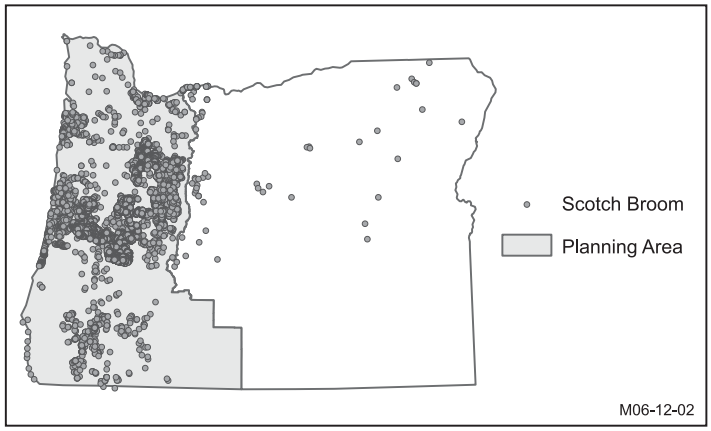
Scotch and French Brooms

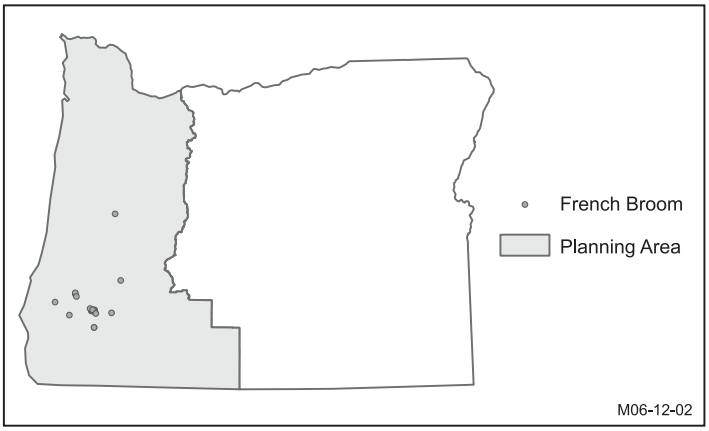
Scotch and French brooms are pioneer species known to displace native plant species and increase the costs of timber production. They readily invade disturbed sites in natural areas, dunes, recreational areas, dry riverbeds, utility right-of-ways, open habitats, and forest lands. Scotch broom is shade intolerant but, given a chance, it invades areas soon after logging, clearing, and burning (Coombs et al. 2004). French broom has similar characteristics (Oregon Department of Agriculture 2007; Hoshovsky 1986).

Scotch and French brooms reproduce primarily by long-lived and hard-coated seeds. Mature plants produce a multitude of seeds that can remain viable in the soil for more than 50 years (Soll 2007; Coombs et al. 2004 160-161). The seeds are transported in soils, down streams, on machinery, and sometimes by birds and other animals that carry the seeds to new isolated areas (Watterson 2006; Hoshovsky 1986).

Scotch broom infestations are present across Oregon, except in the southeastern portion of the state. In western Oregon, the species is well-distributed north to south and is reported on BLM lands in every district within the planning area. French broom infestations are currently limited to western Oregon and are reported to occur on BLM lands in the Coos Bay, Eugene, Medford, and Roseburg districts. See *Figure 64 (Distribution of French and Scotch brooms)* (WeedMapper 2004a).

Figure 64. Distribution of Scotch broom (left) and French (right) brooms





Source: WeedMapper 2004a

Scotch broom **French broom**

Spotted and Diffuse Knapweeds

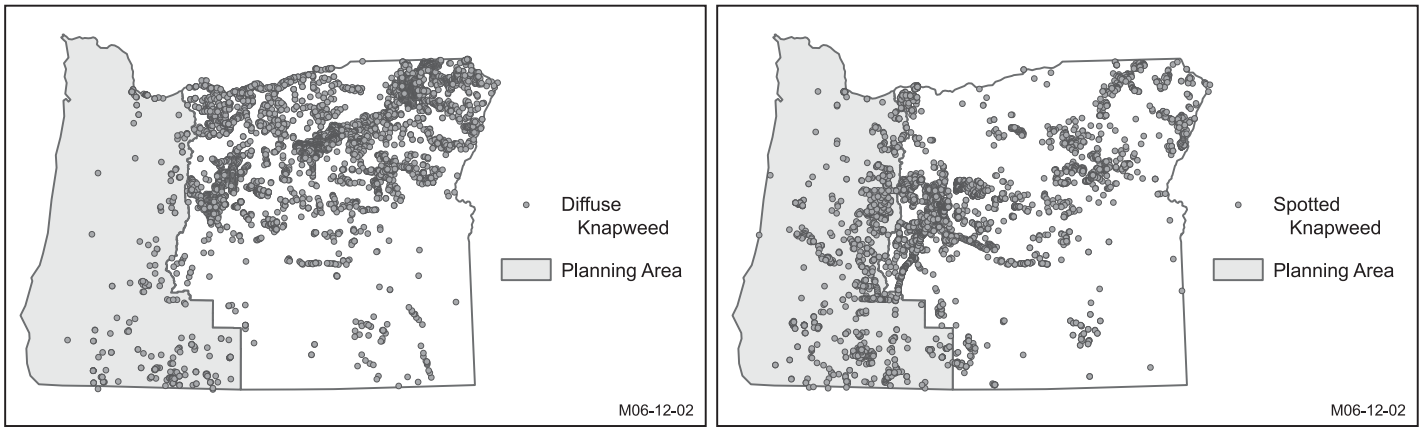
Spotted and diffuse knapweeds are tap-rooted biennials or short-lived perennials that are successful in outcompeting desirable species and native plant communities by growing into dense infestations in open habitats (WeedMapper Team 2004c, 2004d).

Spotted and diffuse knapweed seeds are often spread by being carried along on vehicle frames and shoes to new roadside or trail environments (Sheley et al. 1998). In British Columbia, logging trucks, off-highway vehicles, and trail bikes are documented sources of knapweed spreaders. These knapweeds are also spread along waterways in crop seed and in hay (Strang et al. 1979). Undisturbed infestations spread their seed by wind and water. The seeds can persist in the soil for more than five years (Coombs et al. 2004 198-199).

Transportation corridors, water ways, gravel pits, and industrial areas are common sites for diffuse knapweed infestations (Coombs et al. 2004 198-199; Roche and Roche 1988). Diffuse knapweed is also known to invade well-managed rangelands (Sheley et al. 1998).

Diffuse and spotted knapweeds have similar distribution patterns within the planning area but diffuse knapweed is reported less frequently. See *Figure 65 (Distribution of diffuse knapweed and spotted knapweed)* (WeedMapper 2004a). Both species are spread throughout the state. Diffuse knapweed has been documented on BLM lands in all of the districts within the planning area, except for Coos Bay and Medford. Spotted knapweed occurs in all of the districts within the planning area, except for Eugene and Roseburg.

Figure 65. Distribution of diffuse knapweed (left) and spotted knapweed (right)



Source: WeedMapper 2004a

Diffuse knapweed **Spotted knapweed**

Yellow Starthistle

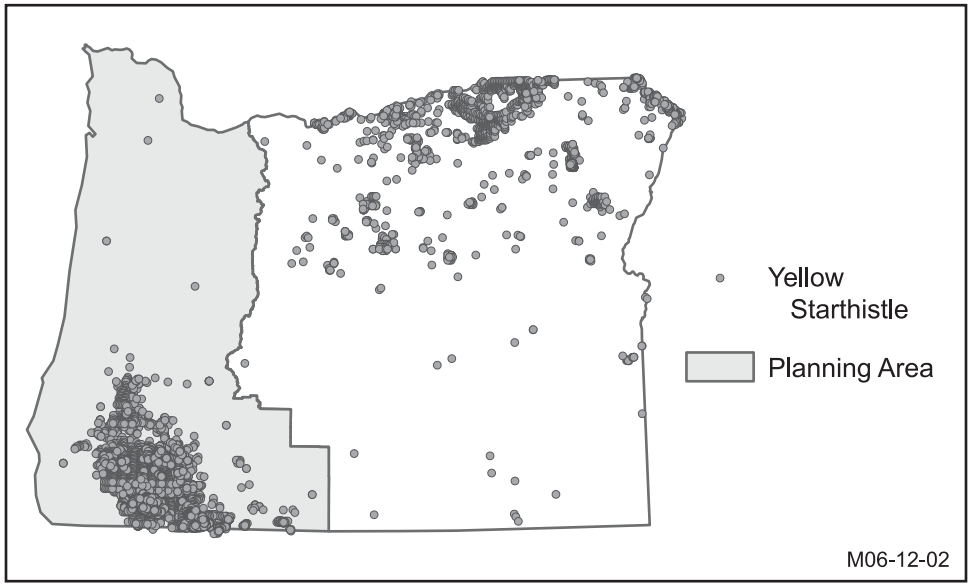
Yellow starthistle is an invasive winter annual or, rarely, a biennial or short-lived perennial forb, which grows best in full light and dry conditions and is almost always found in disturbed areas or open grasslands that are dominated by annuals.

Yellow starthistle infestations can reach more than 6 million plants per acre (Callihan 1993). At this density, yellow starthistle effectively displaces native plants; reduces wildlife habitats, species diversity, and land values; and limits access to recreational areas.

Seeds of yellow starthistle are dispersed short distances by wind and longer distances by animals and people. Yellow starthistle seeds may remain viable for up to 10 years (Callihan 1993). Seeds are most often distributed long distances by such human activities as the movement of livestock, the movement of seeds on the undercarriage of vehicles and on road maintenance equipment, and the use of contaminated hay and crop seed (Healy 2000; DiTomaso 2001). Yellow starthistle infestations have also been spread from gravel out of infested gravel pits to roadsides and other management activity sites (Roche 1988).

The yellow starthistle distribution pattern in Oregon is clustered in the northeast and southwest but is present in every physiographic province in the state. See *Figure 66 (Distribution of yellow starthistle)* (WeedMapper 2004a). Infestations of yellow starthistle are reported on BLM lands in all of the districts within the planning area, except Salem.

Figure 66. Distribution of yellow starthistle



Source: WeedMapper 2004a

Infestations of Invasive Species

Reported weed sites for the invasive species that are described above show high densities of reported invasive plant sites in portions of all of the planning area. See *Figure 67 (Reported infestations of representative invasive species within the planning area)* and *Figure 68 (Distribution categories of invasive species for the fifth-field watersheds within the planning area).*

Figure 67. Reported infestations of representative invasive species within the planning area

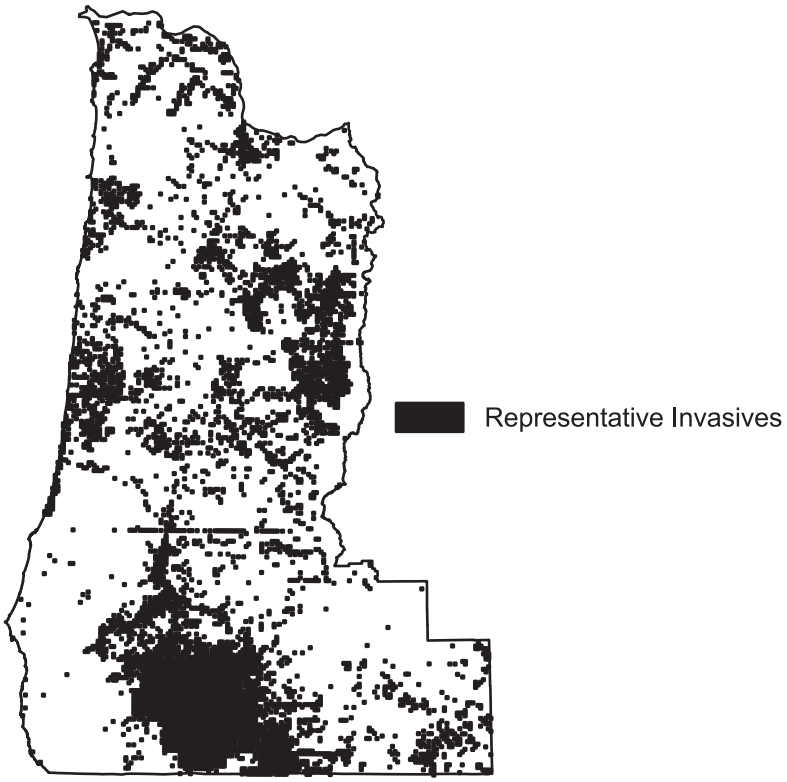
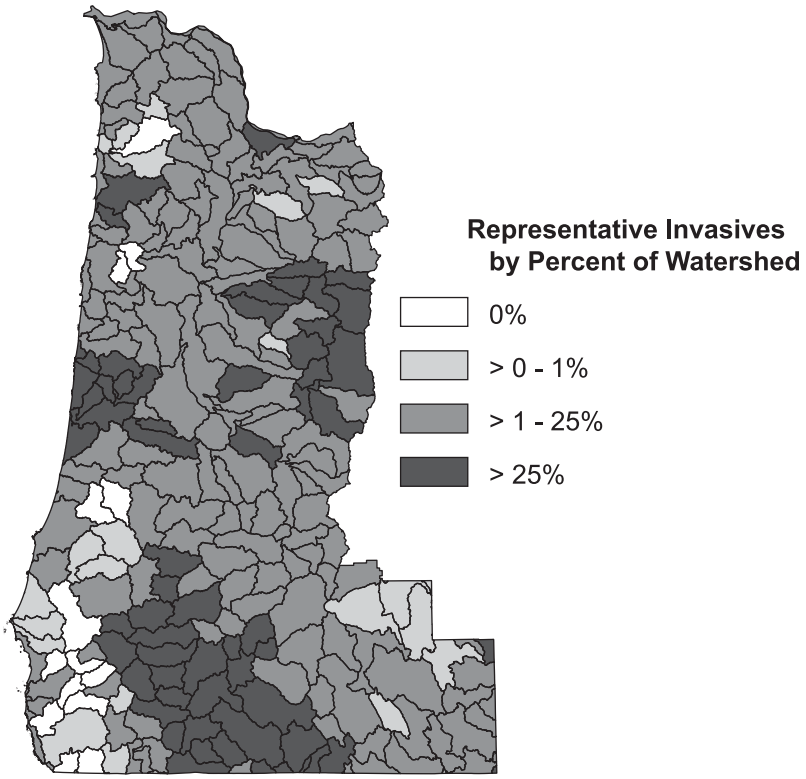


Figure 68. Distribution categories of invasive species for the fifth-field watersheds within the planning area



The highest density fifth-field watersheds (shown in black) are those that have reported infestations in more than 25% of the square miles within them. The lightest gray areas represent fifth-field watersheds with reported infestations in 1% or fewer of the square miles within them, and the white areas show fifth-field watersheds with no reported infestations. The most expansive high-density invasive plant area is located in the Medford District and extends north into the Roseburg and Coos Bay districts.

Roads, trails, high recreation use areas, urban areas, and gravel sources can serve as the primary source locations for many invasive plant species (USDA, U.S. Forest Service 2005, 3-18). These source locations are present on both BLM- and non-BLM-administered lands throughout the planning area.

Common methods of introduction (USDI, BLM 1996a) include the movement of:

- contaminated seed, feed grain, other plant materials;
- contaminated equipment across uncontaminated lands;
- wildlife;
- livestock;
- gravel, road fill, and topsoil; and
- the selling and trading of plants and seeds as ornamentals.

Once introduced, invasive plants are spread primarily by vehicles, humans, livestock, wind, water, and wildlife. Disturbed sites, like trailheads, landings, recreation areas, logging sites, and roads regularly support infestations (Watterson 2006; USDA, U.S. Forest Service 2005, 3-39).

Invasive plants are generally introduced and spread by human and management activities that result in ground disturbances and increased light levels. Examples are:

- Knotweed infestations are introduced along roads and waste areas as a result of human activity and then spread downstream during flood events (Hutchison 1992; Seiger 1991).
- False brome, knapweeds, Scotch broom, and other species also spread downstream once they are introduced into stream systems (Watterson 2006).
- Logging trucks, off-highway vehicles, and trail bikes have been documented sources of spreading knapweed (Strang 1979).
- Transportation corridors, waterways, gravel pits, and industrial areas are common sites for diffuse knapweed infestations (Roche 1988).

The association between disturbance and increased light levels, created by management activities (like logging and road maintenance activities), and the vigor of infestations are well-documented (Allen 1999; Turner 1997). The likelihood of successful invasions is increasingly high with more extensive ground disturbance activities. The factors that are associated with timber harvesting activities that increase the chances of invasion include (Nuzzo 2000; Parendes 2000; Heckman 1999; Bailey 1998; Doyle 1998; Titus 1998; Outcalt 1981; Chen 1996; Donald 1994; Kellman 1969; Nieland 1958):

- increased light levels reaching the forest floor;
- increased soil temperatures; and
- soil disturbances, which can increase the germination rates of seeds in a seed bank or create seed beds.

Harvesting methods and the size of logging units increases the susceptibility to invasive plant introductions. Timber harvesting activities and methods that disturb more soil and leave less postharvest shade would be more susceptible to invasive plant introduction and spread (USDA, U.S. Forest Service 2005, 3-14, 3-5).

Knotweeds, false brome, and Scotch broom tolerate moderate levels of shade. Spotted and meadow knapweeds, Canada thistle, dyer's woad, and yellow starthistle can be described as being fairly shade intolerant.

Infestations are introduced and spread readily in areas with frequent human activity, such as wildland urban interface and high recreational use areas (USDA, U.S. Forest Service 2005, 3-23, 3-25). These areas have more intensive disturbance activities occurring in higher concentrations than do areas with less human activity.

Invasive plants are more likely to spread throughout a landscape where disturbance activities are evenly distributed than in landscapes where the disturbance activities are spatially confined (USDA, U.S. Forest Service 2005, 3-14, 3-15, Appendix D 7-17).

Wildlife

Key Points

- The populations for the northern spotted owl in the Roseburg, Coos Bay, and Medford districts, and the Klamath Falls Resource Area of the Lakeview District, have been stable since 1985, while populations have declined in the Salem and Eugene districts.
- The habitat for the northern spotted owl within the planning area has increased since 1995, while the habitat for the marbled murrelet has remained relatively unchanged.
- The populations for the marbled murrelet in Oregon have declined approximately 50% from 1992 to 1995 and have experienced no change from 1997 to 2006.

Within the planning area, the BLM manages habitats that range from coastal beaches to montane forests and great basin sagebrush. There are several thousand vertebrate and invertebrate species that occur in the western and montane forests of Oregon. There are 11 species that are protected under the federal Endangered Species Act. A subset of individual species is specifically addressed in this draft environmental impact statement because of their importance in the analysis of the alternatives, the consultation with the U.S. Fish and Wildlife Service, or high public interest.

Northern Spotted Owl

The northern spotted owl (*Strix occidentalis caurina*) was federally listed as threatened by the U.S. Fish and Wildlife Service in June 1990 (Federal Register 1990, 26114-26194). The U.S. Fish and Wildlife Service issued a recovery plan as a draft in 1992, but did not issue a final recovery plan (USFWS 1992). A new recovery planning effort is currently underway and the final recovery plan is scheduled for completion in November 2007. Critical habitat was designated for the northern spotted owl in January 1992 and includes 3,257,000 acres of federal lands in Oregon, including 1,009,000 acres of land that is administered by the BLM (Federal Register 1992a, 1796-1838). A draft rule for the redesignation of critical habitat is expected in the summer of 2007.

The northern spotted owl was listed as threatened throughout its range “due to loss and adverse modification of suitable habitat as a result of timber harvesting and exacerbated by catastrophic events such as fire, volcanic eruption, and wind storms” (Anderson et al. 1990). More specifically, significant threats to the northern spotted owl included the following (Federal Register 1992a, 1796-1835):

- low or declining populations
- limited or declining habitat
- distribution of habitat or populations
- isolation of provinces
- predation and competition
- lack of coordinated conservation measures
- vulnerability to natural disturbance

These threats were characterized for each province within the range of the northern spotted owl as severe, moderate, low, or unknown. The following were identified as a severe or moderate threats to the northern spotted owl in all or most of the provinces, and represent the greatest concern to the conservation of the northern spotted owl:

- declining habitat in all 12 provinces
- isolation of provinces in 11 provinces
- declining populations in 10 provinces

The following were identified as severe or moderate threats to the northern spotted owl in many of the provinces, which suggests a concern throughout the majority of its range:

- limited habitat in nine provinces
- low populations in eight provinces

Vulnerability to natural disturbances was rated as low in five provinces. Since the listing of the northern spotted owl, new information suggests that hybridization with the barred owl is less of a threat (Kelly and Forsman 2004) and competition with the barred owl is a greater threat than previously anticipated, as detailed below (Courtney et al. 2004).

The following recent documents summarize the condition of the northern spotted owl across its range and are incorporated by reference:

- *Status and Trends in Demography of Northern Spotted Owls*, 1985-2003 (Anthony et al. 2006)
- *Scientific Evaluation of the Status of the Northern Spotted Owl* (Courtney et al. 2004)
- *Northern Spotted Owl Five-year Review: Summary and Evaluation* (USDI, USFWS 2004a)
- *Status and Trends of Northern Spotted Owl Population and Habitat* (Lint 2005)

Anthony et al. (2006) analyzed information gathered from 14 demographic study areas across the range of the northern spotted owl—11 include federal lands, 1 is located on private timberlands, and 2 are on tribal forest lands. The primary objectives of Anthony's analysis were:

- Estimate the age-specific survival and fecundity rates and their sampling variances for territorial owls on individual study areas.
- Determine if there were any trends in the apparent survival or fecundity rates among study areas.
- Estimate the annual rates of population change and the sampling variances for individual study areas and across study areas.
- Compare the demographic performance of the northern spotted owls on the eight areas that are the basis of the monitoring plan for the Northwest Forest Plan (Lint et al. 1999) to that of owls on other areas.

Courtney et al. (2004) was contracted by the U.S. Fish and Wildlife Service to "produce a report on the status of the northern spotted owl, summarizing and evaluating new information available since its listing, and any new understanding for information that existed at the time of listing" (USDI, USFWS 2004a). The U.S. Fish and Wildlife Service used the Courtney et al. (2004) report to conduct their five-year status review of the northern spotted owl as required under section 4(c) of the Endangered Species Act. The status review sought to answer three questions (USDI, USFWS 2004a):

1. Is the northern spotted owl a valid subspecies under the Endangered Species Act?
2. Is there new information about the threats or population status of the northern spotted owl?
3. If so, does the new information suggest that a change in listing status may be warranted?

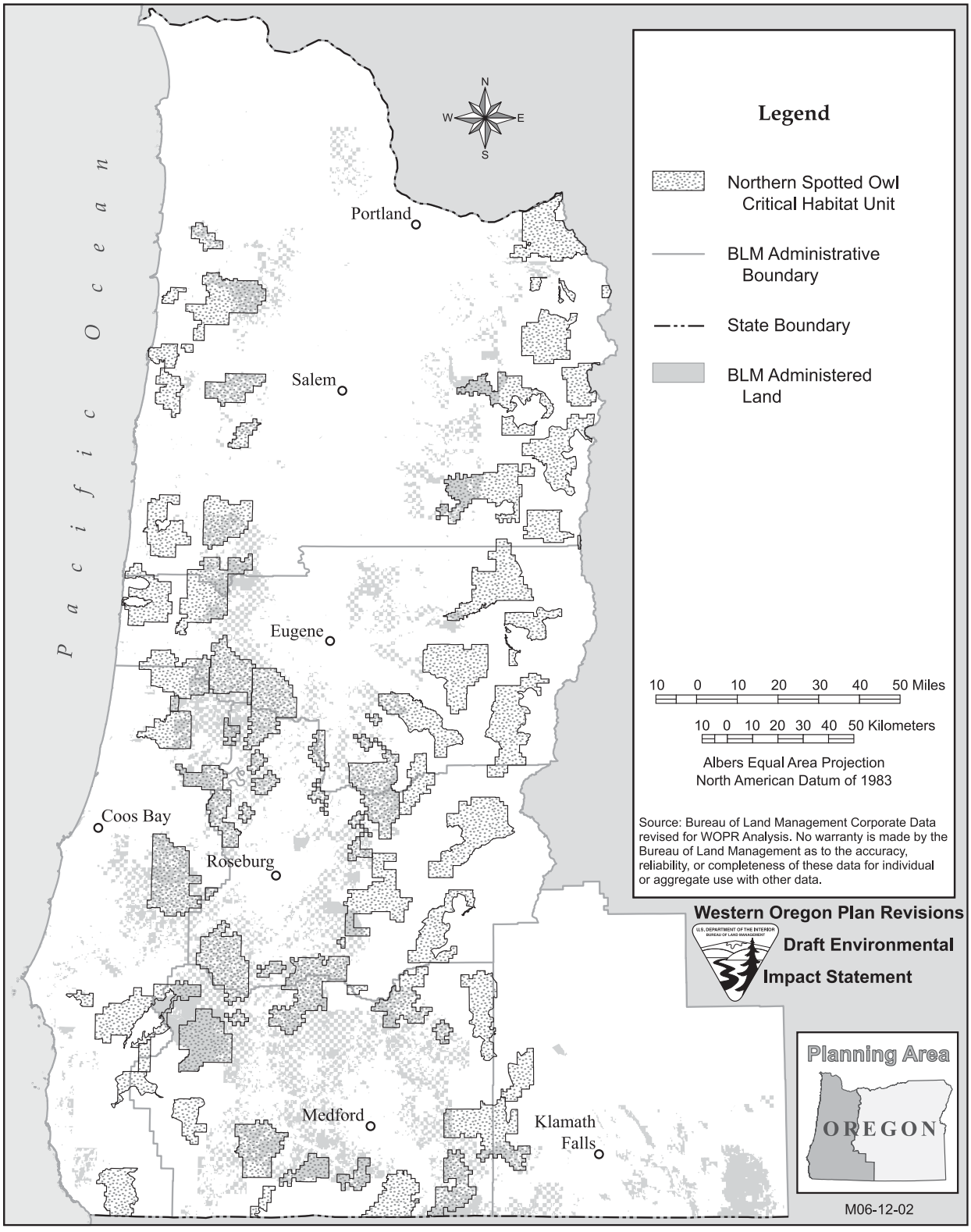
In 2004, the U.S. Fish and Wildlife Service determined that the listing of the northern spotted owl as a threatened species was still warranted (USDI, USFWS 2004a). Even though some risk factors had declined (e.g., habitat loss due to timber harvesting and existing regulations), other factors had continued unchecked (e.g., habitat loss due to wildfire and population decline) and new risk factors with uncertain effects had developed since 1990 (e.g., the barred owl (*Strix varia*), West Nile virus, and sudden oak death) (USDI, USFWS 2004a).

Lint et al. (2005) was one component of the effectiveness monitoring strategy of the Northwest Forest Plan and reports on the effects of the first 10 years of implementing the plan on the population and habitat of the northern spotted owl. The report established baselines for 1994 and then reported on the change from the subsequent 10 years of Northwest Forest Plan implementation. A summary of the findings in the report includes:

- The estimated decline of the northern spotted owl population varied from 0 to 10% across the study areas in the Northwest Forest Plan area. The presence of barred owls (*Strix varia*), weather, past and present harvesting of habitat, and wildlife and insect infestations that alter habitat are all possible contributors to these declines.
- Approximately 74% of the federal lands within the range of the northern spotted owl are capable of providing suitable habitat. Approximately 50% of the habitat-capable area was providing suitable owl habitat.
- Precipitation, owl age, and habitat influence the survival and productivity of the northern spotted owl.
- The barred owl is present throughout the range of the northern spotted owl, so the likelihood of competitive interactions between the species raises concerns as to the future of the northern spotted owl.
- Barred owls, West Nile virus, and the management of suitable habitat for the northern spotted owl in fire-prone areas are likely to be future management concerns.

The Endangered Species Act requires the U.S. Fish and Wildlife Service to designate critical habitat to the maximum extent prudent and determinable concurrently with listing a species as endangered or threatened. Critical habitat units have been identified based on the need to protect current primary constituent elements, as well as to provide for the future development of primary constituent elements necessary for the conservation of the northern spotted owl. See *Figure 69 (Designated critical habitat units for the northern spotted owl within the planning area)*. These elements include nesting, roosting, foraging, and dispersal habitat designated by the U.S. Fish and Wildlife Service in 1992 (Federal Register 1992a, 1797). The U.S. Fish and Wildlife Service designated 1,009,000 acres of northern spotted owl critical habitat on BLM-administered lands (see *Appendix G. Wildlife*). The land use allocations under the current resource management plans are not aligned with designated northern spotted owl critical habitat, and the resource management plans do not include management direction specific to critical habitat units.

Figure 69. Designated critical habitat units for the northern spotted owl within the planning area



Northern spotted owl suitable habitat is the common term for those forest stands that provide for foraging, roosting, and nesting for the northern spotted owl. Thomas et al. (1990, 164) described it as a "multi-layered, multispecies canopy dominated by large (greater than 30 inches diameter at breast height) conifer overstory trees, and an understory of shade-tolerant conifers or hardwoods; a moderate to high (60 to 80%) canopy closure; substantial decadence in the form of large, live conifer trees with deformities—such as cavities, broken tops, and dwarf mistletoe infections; numerous large snags; ground cover characterized by large accumulations of logs and other woody debris; and a canopy that is open enough to allow owls to fly within and beneath it."

The habitat classifications that are used for the analysis of effects for the planning area is based on five habitat criteria:

- quadratic mean diameter
- canopy cover
- presence of snags
- presence of down wood
- multilayered or single-layered canopies

See *Table 88 (Classification schedule for the habitat of the northern spotted owl)*.

In this analysis, northern spotted owl habitat is classified and mapped as:

- nonhabitat;
- dispersal habitat only (habitat capable of providing for the dispersal needs of the owl, but not nesting, roosting, and foraging); or
- suitable habitat (nesting, roosting, and foraging habitat).

Table 88. Classification schedule for the habitat of the northern spotted owl

Quadratic Mean Diameter	Canopy Cover (%)	Presences of Snags[a]	Presence of Down Woody Debris (dwd)[b]	Single-Layered or Multilayered Canopy	Habitat Category
11-20	0-40	absent	absent	n/a[c]	non
11-20	0-40	present	absent	n/a	non
11-20	0-40	absent	present	n/a	non
11-20	0-40	present	present	n/a	non
0-11	0-100	n/a	n/a	m/a	non
20-30	0-40	absent	absent	single	non
20-30	0-40	present	absent	single	non
20-30	0-40	absent	absent	multiple	non
20-30	0-40	present	absent	multiple	non
20-30	0-40	absent	present	single	non
20-30	0-40	present	present	single	non
20-30	0-40	absent	present	multiple	non
20-30	0-40	present	present	multiple	non
30-100	0-40	absent	absent	single	non
30-100	0-40	present	absent	single	non
30-100	0-40	absent	absent	multiple	non
30-100	0-40	present	absent	multiple	non

Quadratic Mean Diameter	Canopy Cover (%)	Presences of Snags[a]	Presence of Down Woody Debris (dwd)[b]	Single-Layered or Multilayered Canopy	Habitat Category
30-100	0-40	absent	present	single	non
30-100	0-40	present	present	single	non
30-100	0-40	absent	present	multiple	non
30-100	0-40	present	present	multiple	non
11-20	40-60	absent	absent	n/a	dispersal
11-20	40-60	present	absent	n/a	dispersal
11-20	40-60	absent	present	n/a	dispersal
11-20	60-100	absent	absent	n/a	dispersal
11-20	60-100	present	absent	n/a	dispersal
20-30	40-60	absent	absent	single	dispersal
20-30	40-60	present	absent	single	dispersal
20-30	40-60	absent	absent	multiple	dispersal
20-30	40-60	absent	present	single	dispersal
20-30	60-100	absent	absent	single	dispersal
20-30	60-100	absent	absent	multiple	dispersal
30-100	40-60	absent	absent	single	dispersal
30-100	40-60	present	absent	single	dispersal
30-100	40-60	absent	absent	multiple	dispersal
30-100	40-60	present	absent	multiple	dispersal
30-100	60-100	absent	absent	single	dispersal
30-100	60-100	absent	absent	multiple	dispersal
11-20	40-60	present	present	n/a	dispersal
11-20	60-100	absent	present	n/a	suitable
11-20	60-100	present	present	n/a	suitable
20-30	40-60	present	absent	multiple	dispersal
20-30	40-60	present	present	single	dispersal
20-30	40-60	absent	present	multiple	dispersal
20-30	60-100	present	absent	single	suitable
20-30	60-100	present	absent	multiple	suitable
20-30	60-100	absent	present	single	suitable
20-30	60-100	present	present	single	suitable
30-100	40-60	absent	present	single	dispersal
30-100	40-60	present	present	single	dispersal
30-100	60-100	present	absent	single	suitable
30-100	60-100	absent	present	single	suitable
20-30	40-60	present	present	multiple	suitable
20-30	60-100	absent	present	multiple	suitable
20-30	60-100	present	present	multiple	suitable
30-100	40-60	absent	present	multiple	suitable
30-100	40-60	present	present	multiple	suitable
30-100	60-100	present	absent	multiple	suitable
30-100	60-100	present	present	single	suitable
30-100	60-100	absent	present	multiple	suitable
30-100	60-100	present	present	multiple	suitable

[a] Snag presence (4 snags per acre that are greater than 10 in.)
[b] dwd presence (2% ground cover)
[c] n/a (has no bearing on habitat category)

Suitable habitat currently comprises 49% of habitat-capable acres on BLM-administered lands within the planning area. See *Table 89 (Summary of current northern spotted owl habitat on BLM-administered lands within the planning area by province)*.

Table 89. Summary of current northern spotted owl habitat on BLM-administered lands within the planning area by province

Province	Habitat-Capable (acres)	Suitable Habitat		Total Dispersal Habitat	
		(acres)	(%)	(acres)	(%)
Coast Range	742,500	315,200	42	641,800	86
West Cascades	634,500	308,300	49	543,800	86
Klamath	773,000	431,600	56	681,800	88
East Cascades	46,700	30,700	66	39,400	84
Totals	**2,196,700**	**1,085,800**	**49**	**1,906,800**	**87**

In 1994, about 7.4 million acres of suitable northern spotted owl habitat were estimated to exist on federal lands managed under the Northwest Forest Plan. See *Appendix G. Wildlife* for details. As of April 12, 2004, the U.S. Fish and Wildlife Service had consulted on the proposed removal of 575,447 of these acres (7.8% of 7.4 million acres) as a result of all management activities. Of the total acres consulted on for removal, approximately 190,429 acres (2.6% of 7.4 million acres) occurred on federal lands. Of the total federal acres consulted on for removal, approximately 167,134 acres (2.3% of 7.4 million acres) were removed as a result of timber harvesting.

From 1994 through April 12, 2004, habitat lost due to natural events was estimated at approximately 186,931 acres. See *Appendix G. Wildlife* for details. About two-thirds of this loss was attributed to the 2002 Biscuit Fire, which burned more than 500,000 acres in southwest Oregon (Rogue River basin) and northern California. This fire resulted in a loss of approximately 113,451 acres of northern spotted owl habitat, including habitat within five late-successional reserves. Approximately 18,630 acres of northern spotted owl habitat were lost due to the B&B Complex and Davis fires in the Eastern Cascades province.

From 1994 through July 19, 2005, the U.S. Fish and Wildlife Service has consulted on the removal or downgrading of 46,945 acres (1.49 %) of critical habitat due to management-related activities. The majority of these acres (33,008 acres) have been concentrated in the Western Cascades and Klamath provinces. In addition, natural events (including fire and insect outbreaks) have resulted in the removal or downgrading of 42,679 acres. See *Appendix G. Wildlife* for details. In general, fires have had more of an impact to northern spotted owl critical habitat in the interior provinces of Washington and California and the southern and interior provinces of Oregon than the coastal provinces. At the time of listing there was recognition that large-scale wildfire posed a threat to the northern spotted owl and its habitat (Anderson et al. 1990). New information suggests fire may be more of a threat than previously thought (Lint 2005; Moeur et al. 2005).

Moeur et al. 2005 estimated an increase of approximately 1.25 to 1.5 million acres of medium and large older forest (greater than 20 inches diameter at breast height, single and multilayered canopies) on federal lands in the Northwest Forest Plan area between 1994 and 2003. The increase occurred primarily in the lower end of the diameter range for older forest. In the higher end of the diameter range (greater than 30 inches diameter at breast height) the area increased from 102,000 to 127,000 acres.

The estimates of changes in habitat were based on change-detection data for losses due to harvesting and fires, and remeasured inventory plot data for increases due to ingrowth. Transition into and out of medium and large older forest over the 10-year period was extrapolated from inventory plot data based on a subpopulation of U.S. Forest Service land types and applied to all federal lands. Because size class and general canopy layer descriptions do not necessarily account for the complex forest structure that is often associated with northern spotted owl habitat, the significance of these increases in acres to northern spotted owl conservation remains unknown.

The types of forest that are used by the northern spotted owl have been studied recently and study results show the following:

- "Studies consistently showed that mature/old forest patch area was an important predictor of forest occupancy by northern spotted owls. While a fragmentation index was negatively associated with site occupancy in some studies, a trade-off between large patches of mature/old forest and juxtaposition of land cover types appear to benefit Spotted Owls in other studies"(Courtney et al. 2004, 5-13).
- Studies in the Klamath province in southern Oregon reinforce Courtney et al. (2004) finding that the apparent survival and reproductive rate of owl territories are positively associated with older forest types closer to the activity center (Dugger et al. 2005).
- Olson et al. (2004) found that survival in the Oregon Coast Range had a quadratic relationship with the amount of late- and mid-seral forest near nesting centers. Reproductive rates fluctuated biennially and were positively related to the amount of edge between late- and mid-seral forests and other habitat classes. Olson et al. (2004) conclude that their result indicates that while mid- and late-seral forests are important to owls, a mixture of these forest types with younger forest and nonforest may be best for owl survival and reproduction in their study area.
- Survival decreased dramatically when the amount of nonhabitat exceeded approximately 50% (Dugger et al. 2005). Northern spotted owl territories with habitat fitness potentials (i.e., expressed as a lambda estimate for the territory) of less than 1.0 were generally characterized by less than 40 to 50% old-forest habitat near the territory center (Dugger et al. 2005). The authors conclude that they found no support for either a positive or negative direct effect of intermediate-aged forest on either the survival or reproduction of the northern spotted owl.

There have been 1,333 known northern spotted owl sites located on BLM-administered lands since 1984. Surveys are currently being conducted primarily where they are

required for timber sale clearances and within the demography study areas (Coast Range, Tyee, Klamath, and South Cascades) that overlap BLM-administered lands. There are 645 sites (48%) that have survey data indicating occupancy between 2000 and 2004.

Numerous studies, summarized in Courtney et al. (2004), illustrate that the northern spotted owl feeds predominantly on small mammals. Northern flying squirrels and woodrats are usually the predominant prey both in biomass and frequency (Barrows 1980; Forsman et al. 1984; Ward 1990; Bevis et al. 1997; Forsman et al. 2001, 2004) with a clear geographic pattern of diet, paralleling differences in habitat (Thomas et al. 1990).

- Northern flying squirrels are generally the predominant prey item in the more mesic Douglas fir and western hemlock forests characteristic of the northern portion of the range, whereas woodrats are generally the predominant prey item in the drier mixed conifer and mixed evergreen forests typically found in the southern portion of the range (Forsman et al. 1984; Thomas et al. 1990; Ward et al. 1998; reviewed by Courtney et al. 2004). These prey items were found to be codominant in the southwest interior of Oregon (Forsman et al. 2001, 2004). Zabel et al. (1995) showed that northern spotted owl home ranges are larger where flying squirrels (*Glaucomys sabrinus*) are the predominant prey and are smaller where woodrats (*Neotoma* sp.) are the predominant prey.
- Other prey species, such as the red tree vole (*Arborimus longicaudus),* red-backed voles (*Clethrionomys gapperi),* mice, rabbits and hares, birds, and insects, may be seasonally or locally important (reviewed by Courtney et al. 2004). For example, Rosenberg et al. (2003) showed a strong correlation between the annual reproductive success of northern spotted owls (number of young per territory) and abundance of deer mice (*Peromyscus maniculatus*), despite the fact that they only made up 1.6% ±0.5% of the biomass consumed. However, it is unclear if the causative factor behind this correlation was prey abundance or a synergistic response to weather (Rosenberg et al. 2003). The secondary species play important roles locally and seasonally.
- Forest heterogeneity and structure effect prey species occurrence and abundance. Ward (1990) found that northern spotted owls foraged in areas that had lower variance in prey densities (prey were more predictable in occurrence) within older forests and near ecotones of old forest and brush seral stages. Habitat components such as snags, down wood, shrub and herbaceous components, and edge are all important to prey species and therefore the northern spotted owl (Courtney et al. 2004). Where woodrats are the predominant prey in southwestern Oregon, studies suggest that some amount of forest heterogeneity may benefit owls as a result of increased prey abundance (Franklin and Gutierrez 2002; Ward et al. 1998).

Sudden oak death presents a potential influence on northern spotted owl habitat, but there is inadequate information to analyze the affects on habitat. Sudden oak death is a recently recognized disease that is killing tanoak (*Lithocarpus densiflorus*), oaks (*Quercus* sp.), and other plant species in California. The disease has been confirmed in one location in

Curry County in southwestern Oregon (Kanaskie et al. 2006). The disease is caused by the introduced pathogen, *Phytophthora ramorum*. Widespread infections could affect suitable northern spotted owl habitat in southwestern Oregon through the removal of subdominant canopy and shrub species; impacting habitat structure and prey base numbers. However, there is inadequate information on the potential spread and influence on forest structure and northern spotted owl prey species to analyze effects (see the *Incomplete and Inadequate Information* section in *Chapter 4*).

The conservation needs of the northern spotted owl include:

- providing large blocks of suitable habitat that is distributed across a variety of ecological conditions and is spaced so as to facilitate owl movement between the blocks;
- providing dispersal habitat within and between large blocks; and
- providing habitat within areas of concern for genetic interchange between owl populations (Raphael 2006; Lint 2005; Courtney et al. 2004; USFWS 1992; Thomas et al, 1990).

Northern spotted owl conservation is predicated on providing blocks of suitable habitat that support clusters of owls. A cluster is at least 20 breeding pairs of owls that support each other demographically and thereby maintain a stable population (Thomas et al. 1990, 24). The Interagency Scientific Committee strategy (Thomas et al. 1990), 1992 draft northern spotted owl recovery plan (USDI, USFWS 1992), northern spotted owl critical habitat designation (Federal Register 1992a, 1796), and the Northwest Forest Plan (USDA, USDI 1994b) used this principle in developing systems of large blocks of habitat.

Several studies have suggested that some amount of forest heterogeneity or intermingling of forest types may improve foraging habitat, especially where woodrats are the predominant prey as described above. However, there is a strong association of nesting and roosting habitat with older, structurally complex forests (Olson 2004; Ward et al. 1998). As noted by Raphael (2006, 128): "no new evidence suggests that large blocks of habitat are not critical to the persistence of the owl." Therefore, large blocks of suitable habitat remain a fundamental conservation need of northern spotted owls throughout the planning area (Courtney et al. 2004, 5-9 to 5-12, 9-11).

In addition to large blocks of suitable habitat, owl conservation requires habitat within and between blocks that supports roosting, protection from predators, and foraging to allow for successful dispersal among blocks (FSEIS, Appendix G 16, G-9; Thomas et al. 1990). Owls not only leave their territories and move across the landscape as juveniles dispersing from their natal territories but also as single adults seeking mates or new territories (Forsman et al. 2002). As owls fly across the landscape, they require stands that have room beneath the branches to provide:

- protection from predators and weather;
- foraging opportunities, including prey base and hunting perches; and
- potential nesting sites.

Data on the movements of 1475 adult and juvenile northern spotted owls found that the median movement distance was between 22.9 to 24.5 km for females and 13.5 to 14.6 km for males; only 8.9% of juveniles dispersed distances greater that 50 km (Forsman et al. 2002). Northern spotted owls have not been shown to disperse across the types of large nonforested lowlands found within the planning area, including the Willamette Valley, Umpqua Valley, and Rogue Valley (Forsman et al. 2002). In a study on habitat use by dispersing juvenile northern spotted owls in the Coast Range, Klamath, and Western Cascades provinces (Miller et al. 1997), mature and old-growth forest were used slightly more than expected based on availability during the transient phase and nearly twice its availability during the colonization phase. Closed pole-sapling-sawtimber habitat was used roughly in proportion to availability in both phases; open sapling and clear-cuts were used less than expected based on availability during colonization.

Dispersal habitat is comprised of both suitable habitat and additional habitat that supports only owl dispersal. The quality of dispersal quality increases with the portion of that habitat that is comprised of suitable habitat. Thomas et al. (1990) noted that "[h]abitats between blocks function better to allow owls to move (disperse) through them the more nearly they resemble suitable habitat …" (p. 23).

The science on the northern spotted owl does not provide a specific threshold for the quantity, quality, and distribution of dispersal habitat against which this analysis could evaluate the effect of alternatives. Thomas et al. (1990, 27, 327) suggested that if 50% of the land base in a regulated forest supported forest stands with a minimum 11-inch average diameter at breast height and 40% canopy cover, then that land base would support owl dispersal (the so-called 50-11-40 rule). The 50-11-40 rule as presented in Thomas et al. (1990) was measured at the quarter-township scale (approximately 5,760 acres). The 50-11-40 rule does not present a definitive threshold for evaluating dispersal habitat, because it does not reflect dispersal quality (NWFP FSEIS, Appendix G, 18, G-24), and because its application to the scattered federal land ownership is problematic.

In the Northwest Forest Plan FSEIS, the 50-11-40 rule was incorporated into several alternatives, although not the selected alternative. However, in contrast to the recommendation of Thomas et al. (1990), the Northwest Forest Plan alternatives applied the 50-11-40 rule as "50% of the federal forest landscape" (NWFP FSEIS, 2-27, emphasis added), instead of 50% of the entire landscape. In the current analysis, applying the 50-11-40 rule to the planning area as "50% of the federal forest landscape" would have dramatically different results than applying the rule as "50% of the forest landscape" on all ownerships, because BLM-administered lands are typically interspersed among nonfederal lands.

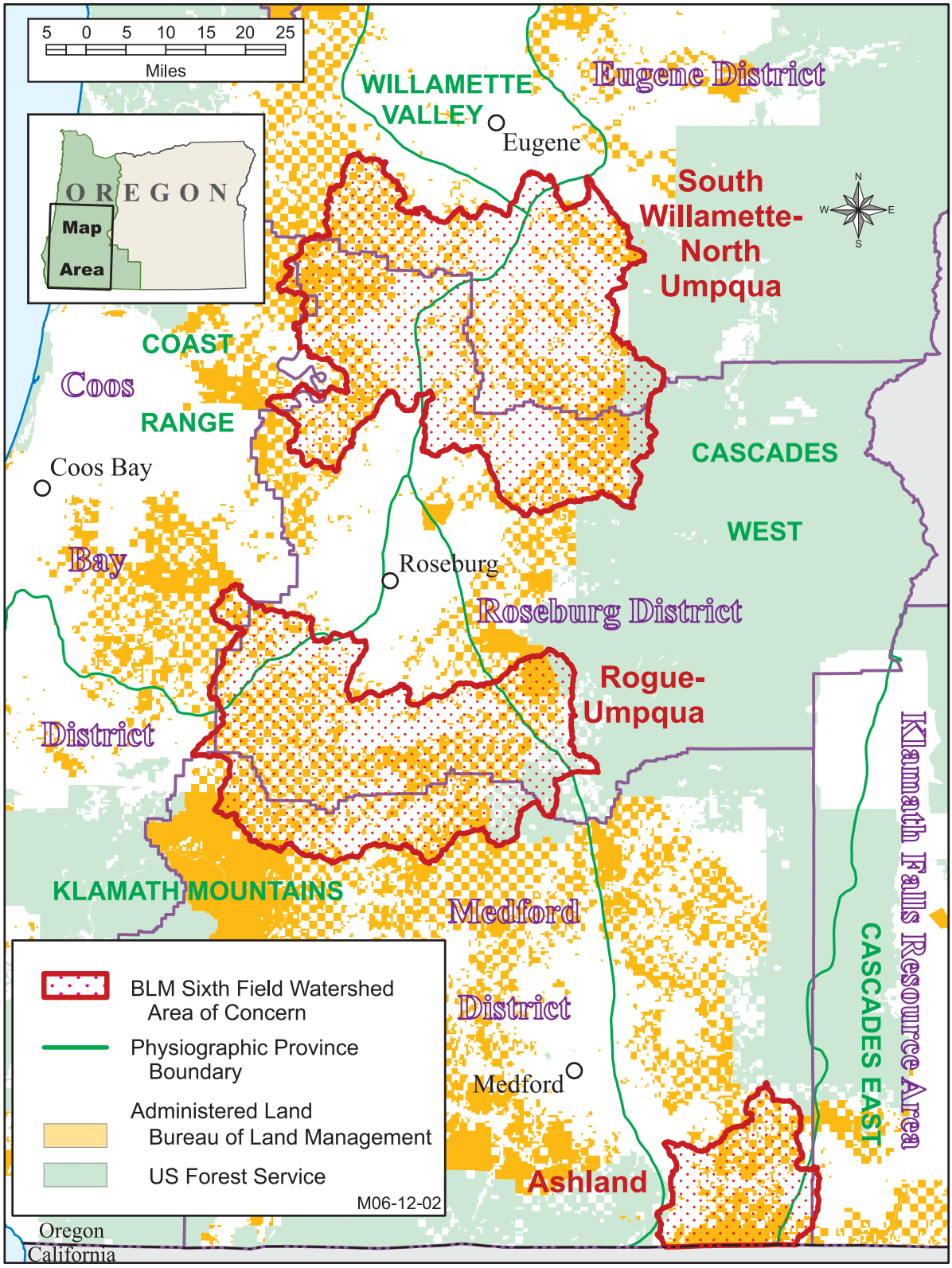
Forsman et al. (2002) demonstrated the importance of forested bridges linking the Coast Range, West Cascades, and Klamath provinces. These bridges have been identified by one term or another since 1988 (USDA, U.S. Forest Service 1988). The movement records provide evidence that northern spotted owls are currently dispersing across the landscape and genetic or demographic isolation of local populations is not likely because dispersal between reserves is likely to be a common occurrence even if the landscapes

between these reserves consists of highly fragmented forests (Lint 2005; Forsman et al. 2002). Forsman et al. (2002) pointed out three areas through which dispersing northern spotted owls moved between the provinces:

- between Cottage Grove and Drain, Oregon (South Willamette-North Umpqua);
- between Canyonville and Grants Pass, Oregon (Rogue-Umpqua); and
- south of Ashland, Oregon (Ashland).

These three areas of concern were identified but not specifically delineated by the USDA (1988), the USDA (1991), Anderson et al. (1991), Tweten (1992), and the USDI (1992) because of "poor distribution and quality of existing habitat in some areas; high level of natural and man-made fragmentation; and localized deficiencies in habitat connectivity" (USDA 1991, 3&4:27). These three areas of concern were not mapped or described in detail prior to this analysis, but they have been identified and discussed in ESA (Endangered Species Act) consultation documents between the BLM and the U.S. Fish and Wildlife Service. The areas of concern are mapped here for the purposes of this analysis.

Figure 70. Areas of concern for the northern spotted owl



Northern spotted owl populations are currently being affected by other factors besides habitat, especially competition with barred owls, and may be affected in the future by West Nile virus.

Barred owls compete with northern spotted owls through a variety of mechanisms including prey overlap (Hamer et al. 2001), habitat overlap (Hamer et al. 1989; Dunbar et al. 1991; Herter and Hicks 2000; Pearson and Livezey 2003), and agonistic encounters (Leskiw and Gutiérrez 1998; Pearson and Livezey 2003). New information on encounters between barred owls and northern spotted owls comes primarily from anecdotal reports that corroborate the initial observations that barred owls react more aggressively towards northern spotted owls than the reverse (Courtney et al. 2004). The evidence of barred owl predation on northern spotted owls, however, is limited and circumstantial (Leskiw and Gutiérrez 1998; Johnston 2002). Information collected to date indicates that encounters between these two species tend to be agonistic in nature, and that the outcome is unlikely to favor the northern spotted owl (Courtney et al. 2004).

Kelly et al. (2003) also found that in northern spotted owl territories where barred owls were detected, northern spotted owl occupancy was significantly lower ($P < 0.001$) after barred owls were detected within 0.8 km of the territory center. Occupancy was only marginally lower ($P = 0.06$) if barred owls were located more than 0.8 km (0.5 mi) from northern spotted owl territory centers. In a Roseburg, Oregon study area, 46% of northern spotted owls moved more than 0.8 km (0.5 mi), and 39% of northern spotted owls had not relocated again in at least two years after barred owls were detected within 0.8 km (0.5 mi) of the territory center. Observations provided by Gremel (2000) from the Olympic National Park are consistent with those of Kelly et al. (2003). He documented significant displacement of northern spotted owls following barred owl detections "coupled with elevational changes of northern spotted owl sites on the east side of the park" (Courtney et al. 2004). Pearson and Livezey (2003) reported similar findings on the Gifford Pinchot National Forest where unoccupied northern spotted owl sites were characterized by significantly more barred owl sites within 0.8 km, 1.6 km, and 2.9 km (0.5, 1.0, and 1.8 miles) from the territory center than in occupied northern spotted owl sites. Since barred owl presence is increasing within the range of northern spotted owls, Olson et al. (2005) suggests that further declines in the proportion of sites occupied by northern spotted owls are likely.

Olson et al. (2005) showed that barred owl presence had a negative effect on northern spotted owl detection probabilities, and it had either a positive effect on local extinction probabilities (at the territory scale) or a negative effect on colonization probabilities for three study areas in Oregon. Olson et al. (2005) conclude that future analyses of northern spotted owls must account for imperfect and variable detectability and barred owl presence to properly interpret results. Thus, some proportion of seemingly vacant territories may be an artifact of reduced detection probabilities. Nonetheless, previously occupied territories that were apparently vacant of both northern spotted owls and barred owls suggests that factors other than barred owls alone are contributing to declines in northern spotted owl abundance and territorial occupancy (Courtney et al. 2004).

Although the barred owl currently constitutes a significantly greater threat to the northern spotted owl than originally thought at the time of listing (Courtney et al. 2004), at present it is unclear whether forest management influences the outcome of interactions between barred and northern spotted owls (Courtney et al. 2004; summarized by Lint 2005). Gutierrez et al. (2004) identified three clearly plausible outcomes:

- Barred owls will replace the northern spotted owl throughout its range.
- Barred owls will replace the northern spotted owl in the northern, more mesic portion of its ranges.
- Barred and northern spotted owl populations will reach equilibrium in most but not all of the present northern spotted owl range.

West Nile virus is known to be fatal to many species of birds, including the northern spotted owl, and has been documented in wild bird populations in Oregon. There is no known connection between forest management and West Nile virus. The future impacts of West Nile virus are unknown and if the northern spotted owl is especially susceptible, it could cause widespread mortality (Courtney et al. 2004).

Marbled Murrelet

The marbled murrelet (*Brachyramphus marmoratus*) was federally listed as threatened by the U.S. Fish and Wildlife Service in October 1992 (Federal Register 1992b, 45328-45337). A recovery plan was finalized in 1997 (USDI, USFWS 1997). The recovery plan outlines the conservation strategy for the species. A draft rule for the revision of critical habitat was published in September 2006.

The short-term actions that are necessary to stabilize the population include:

- maintain occupied habitat
- maintain large blocks of suitable habitat
- maintain and enhance buffer habitat
- decrease risks of nesting habitat loss due to fire and windthrow
- reduce predation
- minimize disturbance

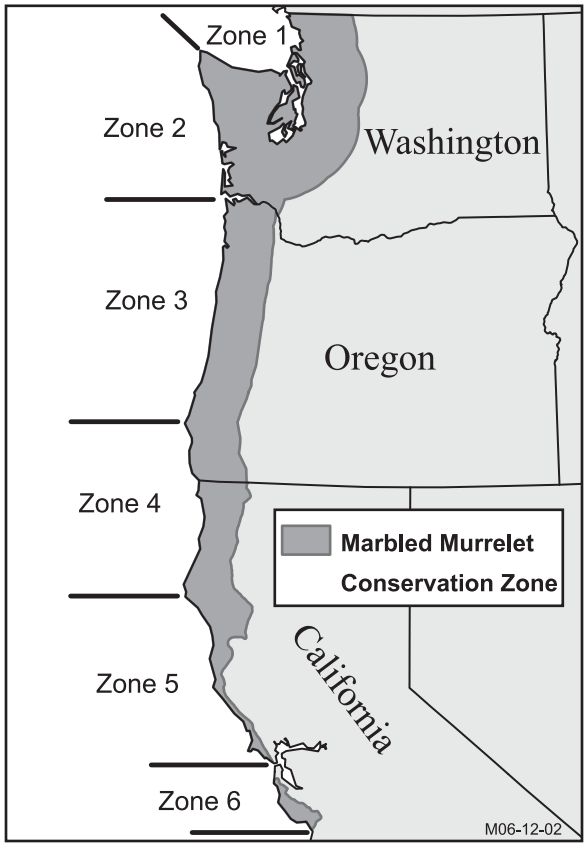
The long-term conservation needs include:

- increase productivity (abundance, the ratio of juveniles to adults, and nest success) and population size
- increase the amount (stand size and number of stands), quality, and distribution of suitable nesting habitat
- protect and improve the quality of the marine environment
- reduce or eliminate threats to survivorship by reducing predation in the terrestrial environment and anthropogenic sources of mortality at sea

The U.S. Fish and Wildlife Service (USDI, USFWS 1997) estimates recovery of the marbled murrelet will require at least 50 years.

Six conservation zones were designated in the marbled murrelet recovery plan (USDI, USFWS 1997). The recovery objectives for the marbled murrelet are measured in each conservation zone with the objective of ensuring a well-dispersed population of marbled murrelets. Recovery Zone 3 (in its entirety) and the northern half of conservation Zone 4 overlay the planning area. See *Figure 71 (Marbled murrelet conservation zones)* (USDI, USFWS 1997). Conservation Zone 3 extends from the Columbia River, south to North Bend, Oregon; extending 1.2 miles out to sea and approximately 35 miles inland (coinciding with conservation Zone 1, as designated by the Northwest Forest Plan (USDA, USDI 1994)). Conservation Zone 4 extends from North Bend, Oregon to the southern end of Humbolt County, California; extending 1.2 miles out to sea and approximately 35 miles inland (coinciding with conservation Zone 1, as designated by the Northwest Forest Plan (USDA, USDI 1994)).

Figure 71. Marbled murrelet conservation zones



The following recent documents summarize the condition of the marbled murrelet across its range and are incorporated by reference:

- the evaluation report for the five-year status review of the marbled murrelet in Washington, Oregon, and California (McShane et al. 2004);
- the marbled murrelet five-year review (USDI, USFWS 2004b); and
- the status and trends of populations and nesting habitat for the marbled murrelet (Huff et al. 2006).

A panel of scientific experts was convened by the U.S. Fish and Wildlife Service to evaluate, synthesize, and interpret the information pertaining to the relevant scientific issue concerning the marbled murrelet. The threats to marbled murrelets and any changes since the 1992 listing were also evaluated. The report was used in the five-year status review (USDI, USFWS 2004b) of the marbled murrelet. The status review sought to answer the following questions:

- Does the currently listed distinct population segment meet the criteria established in the U.S. Fish and Wildlife Service 1996 Distinct Vertebrate Species Policy?
- Is there new information about the threats or population status of the marbled murrelet?
- If so, does the new information suggest that a change in listing status may be warranted?

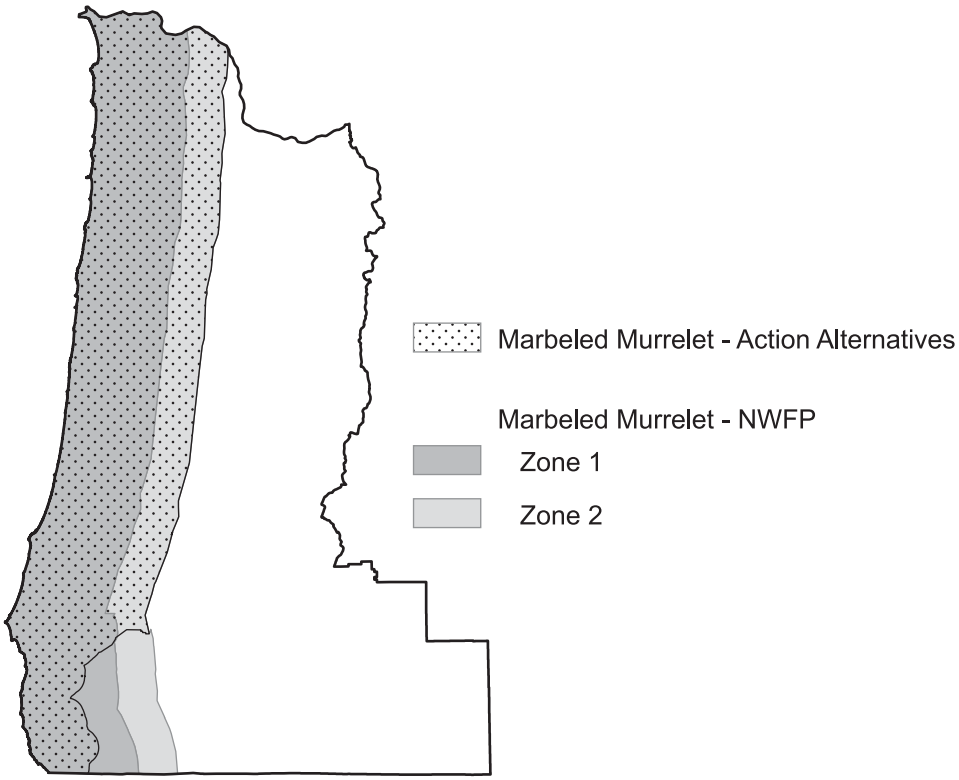
The U.S. Fish and Wildlife Service determined:

- The Washington, Oregon, and California populations do not constitute a discrete population from the remainder of the species and therefore does not constitute a distinct population segment.
- All of the threats to the species identified in the listing are still relevant, new information confirms the importance of predation in limiting nesting success, and new gill-netting regulations in California and Washington may reduce impacts to the species.

The marbled murrelet remains listed as a threatened species at this time (USDI, USFWS 2004b).

The Northwest Forest Plan established two management zones for the marbled murrelet. Zone 1 extended from the coast to approximately 35 miles inland. Zone 2 extended from the eastern boundary of Zone 1 to approximately 50 miles inland from the coast. Combined, these zones include 14,825 square miles. See *Figure 72 (Range of the marbled murrelet within the planning area).*

Figure 72. Range of the marbled murrelet within the planning area



Systematic surveys in the Klamath province have indicated that marbled murrelets are likely confined to the hemlock-tanoak vegetation zone (USDA, USDI 2002). The portion formally considered part of the range of the marbled murrelet in the Medford District is highlighted in *Figure 72*.

The range of the marbled murrelet for this management plan increases approximately 6,010,000 acres in Zone 1 and 2,553,000 acres in Zone 2, and incorporates portions of the Salem, Eugene, Roseburg, and Medford districts, and incorporates the Coos Bay District in its entirety.

A report by Huff et al. (2006) regarding the effects of the first 10 years after the implementation of the Northwest Forest Plan on the population and habitat of the marbled murrelet was completed as part of the Northwest Forest Plan's 10-year effectiveness monitoring effort. The team reported:

- An estimated marbled murrelet population of 22,000 birds for coastal waters adjacent to the Northwest Forest Plan area.
- The available sampling effort was insufficient to detect significant population change.
- The highest densities of marbled murrelets occurred along the Oregon and northern Californian coasts.
- The lowest densities of marbled murrelets occurred from the Mendocino and Humboldt county line south to San Francisco Bay.

- Habitat models predicted that marbled murrelet nesting habitat is more likely at sites that:
  - are closer to the sea;
  - are on relatively flat terrain;
  - are topographically cooler;
  - have relatively fewer conifers that are greater than or equal to 10 inches (diameter at breast height);
  - have great base areas of trees that are greater than or equal to 10 inches (diameter at breast height); or
  - have greater basal areas of trees that are greater than or equal to 30 inches (diameter at breast height).
- Inland management Zone 2 (furthest from the coast) accounted for less than two percent of the estimated high-quality habitat on federally administered lands.
- Only 13% of the federal lands provide more than medium-quality nesting habitat for the marbled murrelet.

Nelson et al. (2006) completed a recent review of marbled murrelet biology and nesting habitat. The results included:

- Marbled murrelet are secretive, noncolonial nesters, who forage at sea and nest inland.
- The majority of marbled murrelets nest within 37 miles of the coast, although nests have been documented up to 52 miles inland in Washington and 47 miles inland in Oregon (Espinosa, pers. comm. 2007).
- The most important component in the nesting habitat for the marbled murrelet is the presence of large platforms—limbs or other structures that are at least 4 inches in diameter with a substrate capable of forming a nest cup (moss or other duff).
- Other important factors include vertical and horizontal cover location with respect to forest openings or edge, and height of platform. Platforms should be high enough to provide for jump-off departures and open enough to provide for stall landings, while still providing protection from predators and the weather.
- Nest trees documented in the Northwest Forest Plan area are greater than 19 inches (diameter at breast height) and greater than 98 feet tall. Nest trees are typically taller than the average nonnest tree.
- Vertical cover (cover above the nest) is typically above 70%.

Nest stands typically possess a high density of large trees with platforms, have multiple canopy layers, and are typically older. Studies summarized for Oregon indicate that the density of trees with platforms and the number of platforms in general were the most important variable in predicting marbled murrelet nesting habitat at the stand level.

Actual nests and behaviors indicate that marbled murrelets select old-growth forests for nesting. The proportion of older forest (mature and old growth) on the landscape and size of the forest patch were greater in occupied sites than unoccupied. Marbled murrelets nest in landscapes with larger stands with less edge, farther from logged areas than random watersheds. Habitat modeling efforts have shown that distance from the coast is an important factor in determining marbled murrelet occurrence. Patches of suitable nesting trees of only a few acres and with only a few suitable nesting trees are thought to be capable of supporting marbled murrelet nesting. The resolution and attributes of the vegetation maps used in this planning effort limited the identification of small stands with only a few suitable nesting trees.

For this plan revision, marbled murrelet nesting habitat was modeled as those stands in the mature (with multilayered canopy) and structurally complex structural stages of forest within the range described in *Figure 72 (Range of the marbled murrelet within the planning area)*.

Mature stands in the western hemlock and tanoak retention zones are those that contain more than 23 trees per acres with a diameter at breast height greater than or equal to 20 inches. In the Douglas fir zone, mature stands are those with more than 11 trees per acre with a diameter at breast height greater than or equal to 20 inches.

There are approximately 373,000 acres of marbled murrelet nesting habitat within the planning area. See *Table 90 (Summary of marbled murrelet nesting habitat on BLM-administered lands within the planning area).*

Table 90. Summary of marbled murrelet nesting habitat on BLM-administered lands within the planning area

BLM Districts	Habitat-Capable (acres)	Nesting Habitat	
		(acres)	(%)
Salem	215,000	77,000	36
Eugene	147,000	49,000	33
Roseburg	179,000	99,000	55
Coos Bay	302,000	123,000	41
Medford	47,000	25,000	53
Totals	**890,000**	**373,000**	**42**

Studies to determine the characteristics of marbled murrelet nesting habitat at the landscape scale include:

- McShane et al. (2004, 4-103) reported that "[a]t the landscape level, areas with evidence of occupancy tended to have higher proportions of large, old-growth forest, larger stands and greater habitat complexity, but distance to the ocean (up to about 37 miles [60 km]) did not seem important."
- Elevation had a negative association in some studies with marbled murrelet habitat occupancy (Burger 2002). Hamer and Nelson (1995) sampled 45 nesting trees in British Columbia, Washington, Oregon, and California and found the mean elevation to be 1,089 feet (332 m).

- Multiple radar studies (Burger 2001; Cullen 2002; Raphael et al. 2002; Steventon and Holmes 2002) in British Columbia and Washington have shown radar counts of marbled murrelets to be positively associated with total watershed area, increasing amounts of late-seral forests, and with increasing age and height class of associated forests.
- The radar counts of marbled murrelets are also negatively associated with increasing forest edge and areas of logged and immature forests (McShane et al. 2004).
- There are also several studies concluding marbled murrelets do not pack into higher densities within remaining habitat when nesting habitat is removed (Burger 2001; Manley et al. 2001; Cullen 2002).

Studies about the relationship between the proximity of human-modified habitat and an increased abundance of avian predators and increased predation on marbled murrelet nests include:

- Luginbuhl et al. (2001, 565) reported in a study, which used simulated marbled murrelet nests, that "[c]orvid numbers were poorly correlated with the rate of predation within each forested plot." Luginbuhl et al. (2001, 569), conclude, "that using measurements of corvid abundance to assess nest predation risk is not possible at the typical scale of homogenous plots (0.5 to 1.0 km^2 in our study) [0.19 to 0.39 mi^2]. Rather this approach should be considered useful only at a broader, landscape scale on the order of 5 to 50 km^2 [1.93 to 19.31 mi^2] (based on the scale of our fragmentation and human-use measures)".
- Artificial marbled murrelet nest depredation rates were found to be highest in western conifer forests where stand edges were close to human development (De Santo and Willson 2001; Luginbuhl et al. 2001).
- Bradley (2002) found increased corvid densities within 3 miles of an urban interface (probably due to supplemental feeding opportunities from anthropogenic activities).
- Golightly et al. (2002) found extremely low reproductive success for marbled murrelets nesting in large old-growth blocks of redwoods in the California Redwoods National and State Parks. Artificially high corvid densities from adjacent urbanization and park campgrounds are suspected to be a direct cause of the high nesting failure rates for marbled murrelets in the redwood parks (Golightly et al. 2002).
- If the surrounding landscape has been permanently modified to change the predators' numbers or densities due to agriculture, urbanization, or recreation, and predators are causing unnaturally high nest failures, then reproductive success of the marbled murrelet may remain depressed. Because corvids account for the majority of depredations on marbled murrelet nests and corvid density can increase with human development, corvid predation on marbled murrelet habitat is a primary impact consideration. The threat of predation on marbled murrelet populations (both nests and adults) appears to be greater than previously anticipated (McShane et al. 2004).

The present population estimates for the marbled murrelet include 9,500 (± 3,000) in Oregon and 23,700 (± 5,200) within the conterminous United States (Huff et al. 2003; Strong 2003a; Strong 2003b). Spiech and Wahl (1995) concluded that marbled murrelet populations in Puget Sound are lower now than they were at the beginning of this century, and total estimates for Washington are still about 9,800 marbled murrelets (Huff et al. 2003). Ralph and Miller (1995) estimated the California population to be approximately 6,500 birds, and this estimate remains within the statistical confidence interval (Strong 2003a and Strong 2003b).

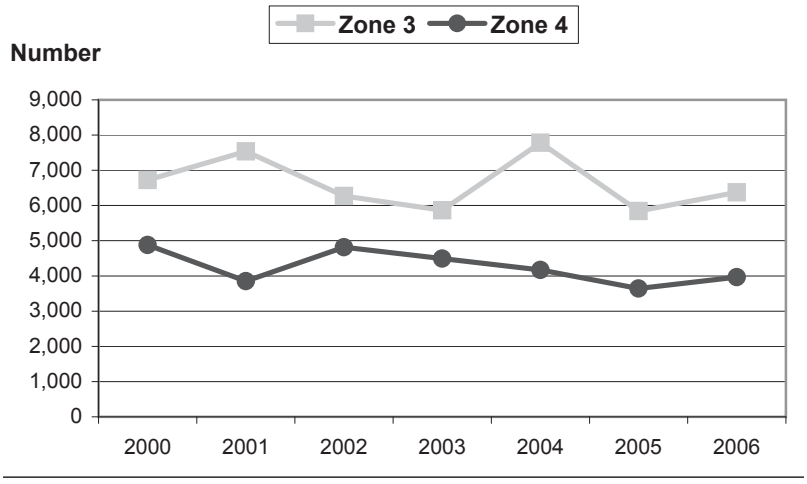
The estimates of marbled murrelet populations that are based on monitoring data have fluctuated between approximately 5,800 and 7,800 birds in conservation Zone 3 and between approximately 3,600 and 4,900 birds in conservation Zone 4. See *Table 91 (Marbled murrelet population estimates for conservation Zones 3 and 4)* and *Figure 73 (Marbled murrelet population estimates in conservation Zones 3 and 4).* Conservation Zones 3 and 4 overlay the planning area. See *Figure 71 (Marbled murrelet conservation zones)* (USDI, USFWS 1997). Estimates are based on at-sea monitoring (USFWS, pers. comm. 2006).

Table 91. Marbled murrelet population estimates for conservation Zones 3 and 4

Year	Conservation Zones			
	Zone 3		Zone 4	
	Density*	Number of Birds	Density*	Number of Birds
2000	10.9	6,724	10.9	4,880
2001	12.2	7,538	8.6	3,851
2002	10.2	6,271	10.8	4,816
2003	9.5	5,866	10.0	4,495
2004	12.6	7,781	9.3	4,169
2005	9.5	5,843	8.1	3,642
2006	10.3	6,375	8.9	3,968

*Density equals the number of birds per square mile.

Figure 73. Marbled murrelet population estimates in conservation Zones 3 and 4



Studies on the demographic trends of the marbled murrelet include:

- Beissinger (1995) constructed a demographic model of the marbled murrelet and concluded that the population may be declining at rates of 4 to 6% per year, but this estimate is hampered by the possibility that the age-ratio data used in the model are reflective of a relatively temporary decline due to unusual ocean conditions (Ralph et al. 1995).
- Boulanger et al. (1999) found that change in adult survivorship is the single most important factor when projecting demographic trends for marbled murrelets.
- Similarly, Strong and Carten (2000) suggest that there may have been a 50% decline from 1992 to 1996 in the Oregon population, but the population appears to have stabilized since then (Strong 2003a; Strong 2003b).
- Ralph et al. (1995) summarized some of the reasons for variability in population estimates among researchers, including differences in methodology, assumptions, spatial coverage, and survey and model errors.
- Lank et al. (2003) states that "[r]egardless of the approaches taken to estimate [(sic) vital rate] parameter values, the output from the Leslie Matrix models representing survivorship and fecundity values for all populations in Washington, Oregon and California (Beissinger and Nur 1997) suggest negative population growth rates." Present at-sea surveys for effectiveness monitoring have a 95% chance of detecting annual population changes of ± 20% or greater.

McShane et al. (2004) produced a demographic model of marbled murrelet populations in Washington, Oregon, and California by each of the six conservation zones. Similar to previous studies, they found that populations in all conservation zones are in decline with mean annual rates of decline between 2.1% and 6.2%. The highest rates of decline were in Zone 6 at the southern extent of the range. Furthermore, they conclude it is likely that populations in Zone 5 and 6 could become nonviable in the near future.

At the conservation zone scale, marbled murrelet abundance is positively correlated with the estimated amount of inland habitat (McShane et al. 2004). The precise number of acres of nesting habitat in Washington, Oregon, and California is unknown. However, suitable habitat for the marbled murrelet on federal lands is estimated at 2,223,048 acres of which 154,838 acres (7%) are classified as remnant habitat within the listed range of this species (McShane et al. 2004). Approximately 93% of the suitable habitat occurs on federal lands. The BLM in Oregon manages approximately 249,000 acres of nesting habitat. See *Table 92 (Summary of critical habitat units and marbled murrelet nesting habitat on BLM-administered lands within the planning area)*. There are 177 known occupied marbled murrelet sites on BLM-administered lands. Surveys are currently being conducted in conjunction with timber sales.

The recovery plan identified the primary threats to the species as:

- predation
- loss of nesting habitat
- by-catch in gill nets
- oil pollution both chronic and from major spills

More recently, McShane et al. (2004) has concluded that all of these threats are still present, although loss of nesting habitat, particularly on federal lands, has declined, and the new gill-netting regulations in northern California and Washington have reduced the threat from by-catch in gill nets. The threat from oil pollution continues to be unpredictable and effects are variable. New information on predation indicates a high threat level due to limiting marbled murrelet nesting success (Hebert and Golightly 2003; Peery et al. 2004; Luginbuhl et al. 2001; Marzluff and Restani 1999).

Marbled murrelets, adult and chicks, appear to be fairly tolerant of disturbance, both visual and auditory. Several studies noted changes in adult feeding behaviors, but not nest abandonment. Chicks appear to be very tolerant of visual and auditory disturbance, habituating very quickly. The predominant response of marbled murrelet chicks to disturbances is to freeze or flatten out in the nest cup. Noise disturbance to nest sites is thought to be minimal, although much is unknown (Nelson et al. 2006).

The recovery plan states that four of the six zones must be functional in order to effectively recover the marbled murrelet in the short- and long-term (e.g., to maintain viable populations that are well-distributed). However, based on the newest population estimates, it appears only three of the zones contain relatively robust numbers of marbled murrelets (Zones 1, 3, and 4). Zones 1 and 4 contain the largest number of marbled murrelets compared to the other four zones, but areas of concern remain. Of the population in Zone 4, 10% was killed in oil spills in 1997 (Bentivoglio et al. 2002; Ford et al. 2002).

Marbled murrelets in conservation Zones 3, 5, and 6 are also experiencing significant declines in reproduction, numbers, and distribution, resulting in reduced population viability. Marbled murrelets have suffered variously from past oil spills, which killed a large number of birds (Zone 3) (Ford et al. 2002), extremely small population sizes (Zones 5 and 6), and alarmingly low reproductive rates (Zone 6) (Peery et al. 2002). In at least two of these four zones (Zones 5 and 6), these factors taken singly or in combination have brought the status of the species to a point where recovery in Conservation Zones 5 and 6 may be precluded (Beissinger 2002). The poor status of marbled murrelet populations in the southern zones emphasizes the importance of supporting marbled murrelet populations in Zones 1 and 2 in order to achieve marbled murrelet recovery objectives.

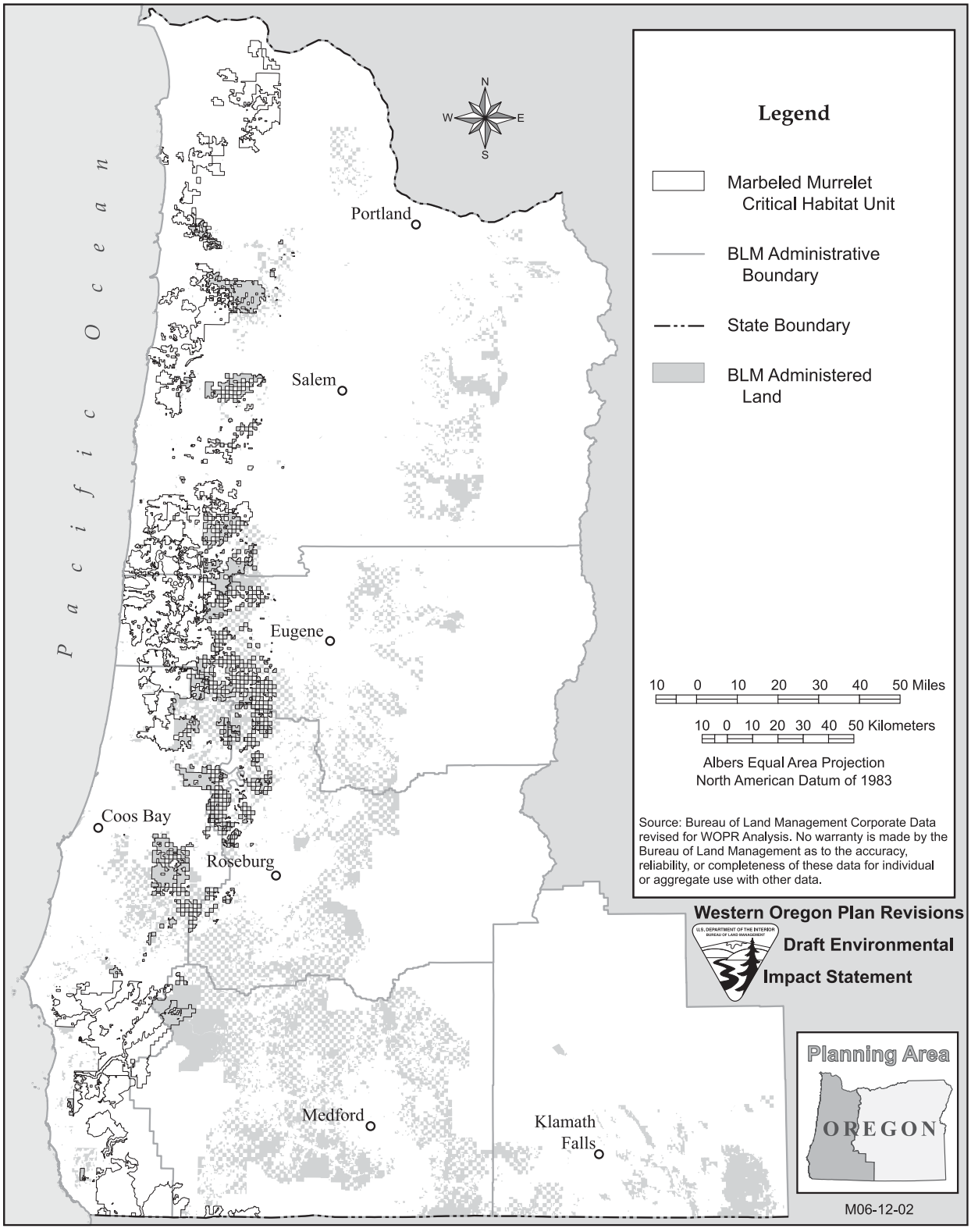
Critical habitat was designated for the marbled murrelet in January 1996 and encompasses 1,515,300 acres of land in Oregon; 1,338,200 acres of federal land (Federal Register 1996a, 26256-26320). The U.S. Fish and Wildlife Service is currently reviewing the critical habitat designation. Critical habitat includes those lands that may be needed for a species' eventual recovery and delisting. Critical habitat units were identified based upon the need to protect current and provide for future development of the primary constituent elements necessary for the conservation of the marbled murrelet. The primary constituent elements include individual trees with potential nesting platforms and forested areas within 0.5 miles that possess a canopy height of at least one-half the site-potential tree height (Federal Register 1996a, 26264). Approximately 463,000 acres of critical habitat occur on Bureau of Land Management managed lands. See *Table 92 (Summary of*

critical habitat units and marbled murrelet nesting habitat on BLM-administered lands within the planning area) and *Figure 74 (Critical habitat for the marbled murrelet within the planning area).*

Table 92. Summary of critical habitat units and marbled murrelet nesting habitat on BLM-administered lands within the planning area

Critical Habitat Unit	Habitat-Capable (acres)	Nesting Habitat	
		(acres)	(%)
CA-01-e	14	10	71
OR-01-b	1	1	100
OR-01-c	7,217	5,025	70
OR-02-a	--	--	--
OR-02-b	11	1	9
OR-02-c	3,526	1,898	54
OR-02-d	25,937	6,731	26
OR-02-e	38,666	20,858	54
OR-03-a	41	41	100
OR-03-c	8,530	4,012	47
OR-04-a	1,300	802	62
OR-04-b	1,084	940	87
OR-04-c	13,388	8,012	60
OR-04-d	20,073	11,097	55
OR-04-e	50,534	27,656	55
OR-04-f	20,109	12,220	61
OR-04-g	15,368	8,354	54
OR-04-i	79,983	40,807	51
OR-04-j	56,450	30,882	55
OR-04-k	25,919	16,083	62
OR-06-a	39	26	67
OR-06-b	49,904	28,609	57
OR-06-c	4,608	3,524	76
OR-06-d	16,178	8,792	54
OR-07-a	2,366	1,252	53
OR-07-b	2,171	990	46
OR-07-d	1,840	845	46
OR-07-f	15,611	8,616	55
OR-07-g	2,086	984	47
Totals	**462,953**	**249,069**	

Figure 74. Critical habitat for the marbled murrelet within the planning area



Sage Grouse

Sage grouse (*Centrocercus urophasianus*) were once found throughout most of the sagebrush (*Artemisia sp.*) habitat of eastern Oregon (Hagan 2005). There are currently no known populations within the planning area. However, there is currently suitable habitat and the potential to restore additional lands to a suitable condition within the planning area (specifically, the Klamath Falls Resource Area of the Lakeview District). There are currently 28,000 acres of sage grouse habitat and four historic leks within the Klamath Falls Resource Area.

The major threat to the species is habitat modification and its resultant effects on reproductive capacity and predation (Holloran and Anderson 2005; Gregg et al. 1994; Hagen 2005). Within Oregon, since the 1940s, the sage grouse population has exhibited an overall decline (Hagan 2005; Gregg et al. 1994). Population indices in the last decade have shown a stable to slightly increasing population (Hagan 2005).

From 2002 until 2004, the U.S. Fish and Wildlife Service received multiple petitions to list one or more sage grouse populations. In 2005, they came out with a combined finding that the petitions were not warranted (Federal Register 2005a, 2244). Concurrent with the status reviews, there was an assessment of the nationwide condition of the sage grouse. Connelly et al. (2004) compiled a comprehensive review of the status of the sage grouse and sagebrush habitats entitled *Conservation Assessment of Greater Sage-grouse and Sagebrush Habitats*.

The Oregon Department of Fish and Wildlife, in conjunction with the BLM and other land management organizations, produced the *Greater sage-grouse conservation assessment and strategy for Oregon: a plan to maintain and enhance populations and habitat* (Hagan 2005). The information contained within the Oregon conservation assessment regarding natural history and habitat condition is incorporated by reference. The following is a brief synopsis:

- Sage grouse are a sagebrush obligate species. Sagebrush provides important habitat components necessary for their nesting and diet. There are three main habitat requirements for the sage grouse: breeding (lekking and nesting), brood rearing, and over-wintering habitat.
- Males attract females by displaying (strutting) on open sites called leks. Leks are used annually. Leks are typically devoid of or contain short vegetation. Adjacent sagebrush provides escape cover.
- Females use areas rich in forbs to facilitate egg development. Nesting habitat consists of a sagebrush community containing sagebrush and a herbaceous understory of grasses and forbs. Nests are typically located under sagebrush plants.
- Cover, both overhead and vertical, are critical to nesting success. Good habitat provides concealment from predators, herbaceous forage for prelaying and nesting females, and insect forage for chicks.

- Once broods move off the nest, they move to a more open sagebrush habitat—a habitat that still maintains a rich growth of grasses and forbs, and at least 15% canopy closure. Chicks feed on forbs and invertebrates. Later in the summer broods move to moister habitats were succulent vegetation is still available.
- Winter diets consist mainly of sagebrush. Sage grouse may congregate in areas of higher canopy closure and taller big sagebrush.
- Oregon sagebrush habitats have been reduced 21% from the late 1800s. The lack of connectivity (contiguity) between patches compounds the loss of habitat. High viability patches are those that have greater than 2,500 acres of contiguous habitat.
- The greater loss of sagebrush habitat in eastern Oregon has been due to the conversion of such habitat to agricultural and grazing uses. Fire and seeding with nonnative species continue play a significant role in converting sagebrush habitat to grasslands. Roads and utility corridors play an additional role in habitat degradation by providing corridors and perches for predators, spreading nonnative vegetation, and introducing disturbances. Human disturbances, both low-keyed bird-watching and intense off-highway vehicle use, may cause lek and nest abandonment.

Bald Eagle

The bald eagle of North America (*Haliaeetus leucocephalus*) is listed under the Endangered Species Act as threatened in Oregon. Breeding and wintering populations occur throughout the planning area and are addressed in the Pacific States Bald Eagle Recovery Plan (USDI, USFWS 1986). In 1999, the bald eagle was proposed for delisting in the contiguous 48 states. A recovery plan was completed in 1986 (USDI, USFWS 1986). The planning area includes portions of six bald eagle management zones (10, 11, 12, 13, 22, and 23) (USDI, USFWS 1986, 29).

Bald eagles in the Pacific Northwest nest predominantly in conifer stands adjacent to or near large rivers or other large bodies of water (USDI, USFWS 1986; Anthony et al. 1982; Buehler 2000; Federal Register 2006a, 71 FR 8239).

- Distances to water bodies from nests varies but could extend up to 1,378 yards in portions of the planning area (USDI, USFWS 1986; Buehler 2000; Anthony et al. 1982). Vessely et al. (2001) modeled potential nesting habitat up to 3 km (1.9 miles) away from water.
- Nesting habitat can encompass a wide range of stand types but they all can be described has having a variety of canopy layers and some component of large diameter or old-growth trees. Anthony et al. (1982) found that the diameter of nesting trees vary by forest types, but, invariably, they were some of the largest trees in the stand. The average diameters of nesting trees varied between:
  - 41 inches (diameter at breast height) in Oregon mixed conifer stands
  - 46 inches in ponderosa pine forests
  - 69 inches in Douglas fir forests.

- Douglas fir is the dominant species for nesting trees west of the Cascade Mountains, while ponderosa pine is dominant east of the Cascade Mountains (Anthony et al. 1982).

Fish, waterfowl, jackrabbits, and carrion provide the most common source of food for eagles in the Pacific Northwest (USDI, USFWS 1986). Nesting sites, roosts, and wintering areas tend to be associated with sources of food (Anthony et al. 1982; USDI, USFWS 1986; Buehler 2000; Federal Register 2006a, 8242), although overwintering area locations may also be driven by remoteness (Federal Register 2006a, 8239; USDI, USFWS 1986).

There are 3,600 miles of stream and 291,000 acres of ponds and lakes that provide foraging habitat for the bald eagle. There are approximately 1,630,000 acres of BLM lands that are capable of growing eagle nesting and roosting habitat in the planning area (those forest-capable lands within 4 miles of foraging waters) and approximately half of those are currently providing bald eagle nesting and roosting habitat. See *Table 93 (Potential bald eagle nesting habitat within the planning area)*.

Table 93. Potential bald eagle nesting habitat within the planning area

BLM Districts	Habitat-Capable (acres)	Nesting Habitat	
		(acres)	(%)
Salem	377,379	192,786	51
Eugene	169,928	71,399	42
Roseburg	264,901	134,901	51
Coos Bay	231,863	97,106	42
Medford	536,924	279,736	52
Klamath Falls	166,179	50,761	31
Totals	**1,747,174**	**826,689**	**50**

Communal roosts are selected for and favor those stands that have a high degree of stratification (Anthony et al. 1982). Roost trees are the largest trees in the stand or have open branching patterns, provide visibility, and may be close to a consistent food source (Anthony et al. 1982; Buehler 2000).

There are 149 bald eagle nesting trees located on BLM lands within the planning area. These nests are contained within 89 known territories (Isaacs and Anthony. 2005). Monitoring data indicates that bald eagle numbers have increased steadily since 1973 (Isaacs and Anthony 2005). The bald eagle was proposed for delisting in 1999 (Federal Register 1996b, 36454). See *Table 94 (Summary of the 2005 monitoring data for the bald eagle)* for the current population data for the management zones that overlap the planning area (Isaacs and Anthony 2005).

Table 94. Summary of the 2005 monitoring data for the bald eagle

Bald Eagle Conservation Zones	Breeding Areas Surveyed (number)	Breeding Areas Occupied[a] (number)	Occupied Breeding Areas with Known Outcomes	Successful Breeding Areas[b] (%)	5-year Average of Successful Breeding Areas (%)	Young/Breeding Areas (number)	5-Year Average of Young/ Breeding Areas (number)	Young/Successful Breeding Pairs (number)
10 – Columbia River (OR)	12	11	71	70.0	63.8	1.00	1.04	1.43
11 – High Cascades	69	64	63	61.9	65.7	0.94	1.01	1.51
12 – Willamette Basin	63	61	55	70.9	68.8	1.15	1.17	1.62
13 – Oregon Coast	93	91	90	72.2	70.0	1.11	1.10	1.54
22 – Klamath Basin	134	129	119	60.5	62.2	0.87	0.96	1.43
23 – CA/OR Coast	25	22	20	70.0	67.3	1.05	1.05	1.50

[a]Where one or two adults and a nest were observed.

[b]Breeding areas where 1 or more nestlings or fledglings were observed.

There are 161 bald eagle management areas designated on BLM lands within the planning area. They range in size from 4 to 960 acres and total 16,220 acres. See *Table 95 (Bald eagle management areas within the planning area)*. Bald eagle management areas were carried forward from the previous plan and were created for sites found since 1994. Bald eagle management areas are designed to protect existing nest sites, winter and communal roosting areas, and potential nesting habitat.

Table 95. Bald eagle management areas within the planning area

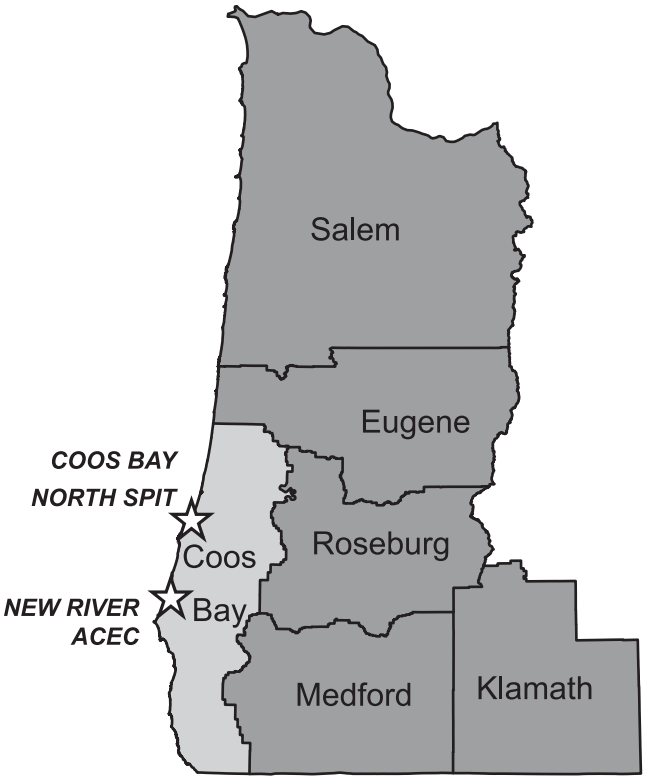
BLM District	Number of Areas	Acres
Salem	10	2,227
Eugene	73	8,266
Roseburg	25	3,682
Coos Bay	26	769
Medford	21	1,091
Klamath Falls	22	1,931
Totals	**177**	**17,966**

Western Snowy Plover

The Pacific Coast population of the western snowy plover (*Charadrius alexandrinus nivosus*), hereafter referred to as the snowy plover, is listed as threatened under the federal Endangered Species Act (Federal Register 1993,12864) and by the state of Oregon (ODFW 2006). The primary threats to the snowy plover were identified as the loss and degradation of habitat from human activities (Federal Register 1993, 12864). The snowy plover occurs along the Pacific Coast from British Columbia, Canada to Baja California, Mexico; and at interior areas in Oregon, California, Nevada, Utah, New Mexico, Colorado, Kansas, Oklahoma, and north-central Texas (Federal Register 1993, 12864; Page et al. 1995). The coastal population is genetically distinct from the interior population (Federal Register 1993, 12864; Federal Register 2006b, 20607).

The coastal population occurs within the geographic boundaries of the Salem, Eugene, and Coos Bay districts. The BLM manages snowy plover nesting and wintering habitat only on the Coos Bay District. The Coos Bay District manages 436 acres of snowy plover nesting and overwintering habitat, which is located on the Coos Bay North Spit (138 acres) and the New River Area of Critical Environmental Concern (298 acres). See *Figure 75 (Locations of the Pacific coast population of the western snowy plover on BLM lands within the planning area).*

Figure 75. Locations of the Pacific coast population of the western snowy plover on BLM Lands within the planning area



Snowy plovers nest above the high tide line on "wide-open sandy beaches, river mouths, or dredge spoils, often with scattered driftwood or vegetation. Driftwood, wrack, and native dune plants often harbor snowy plover food sources, and provide cover for chicks hiding from predators" (OPRD 2004, 42-43) Much open sand habitat was lost in Oregon when European beachgrass was introduced in the early to mid 1900s. European beachgrass created extensive vegetated foredunes that narrowed beaches and provided thick cover for predators.

The Coos Bay North Spit has been the most productive snowy plover breeding area since intensive monitoring began in the early 1990s. Unique to Oregon, snowy plover habitat on the Coos Bay North Spit is found along the beach as well as inland of the ocean foredune on old dredge material deposits and restored open sand habitat. Through time much of this habitat was lost or degraded due to beachgrass encroachment. Most of the BLM-administered lands in this area are designated as an area of critical environmental concern. The North Spit Plan (USDI, BLM 2005a) contains direction for plover management. The management measures were developed in cooperation with the U.S. Fish and Wildlife Service and Oregon State agencies. Management measures include recreational restrictions, predator control, outreach activities, and habitat restoration.

In cooperation with the Army Corps of Engineers, the Oregon Department of Fish and Wildlife, and the U.S. Fish and Wildlife Service, the BLM has restored and maintained approximately 76 acres of habitat inland of the ocean foredune. A variety of methods have been used to remove European beachgrass and other invasive plant species from these habitat restoration areas (including heavy equipment, saltwater treatments, hand pulling, and herbicides). In addition to the habitat restoration areas, snowy plovers also nest on the adjacent ocean beach.

Snowy plover numbers have increased on the Coos Bay North Spit since active management measures and monitoring began in the early 1990s. The total number of fledglings has risen from a low of 3 in 1990 to a high of 35 in 2004 (Lauten et al. 2006). Plover reproductive success is measured by the number of chicks fledged per male and is currently estimated of 1.57 fledglings per male at the Coos Bay North Spit, which is approximately 10% below the 15-year average of 1.71 fledglings per male (Lauten et al. 2006).

Snowy plovers also use a long, relatively isolated stretch of beach from the southern portion of Bandon's beaches to Floras Lake. This approximately 16 mile length of beach is managed under several jurisdictions (including 5.75 miles that are included in the BLM New River Area of Critical Environmental Concern). The New River Area of Critical Environmental Concern Management Plan (USDI, BLM 2004a) contains direction for plover management. Management measures were developed in cooperation with the U.S. Fish and Wildlife Service and Oregon State agencies. Management measures include recreation restrictions, predator control, outreach activities, and habitat restoration.

Approximately 120 acres of habitat (nearly 2.75 miles in length) have been restored and maintained using heavy equipment, burning, and hand pulling to remove European beachgrass and other invasive plant species. In addition, the BLM cooperatively

manages approximately 1 mile of ocean beach and inland snowy plover habitat north of Floras Lake.

Over the past several years, locations of snowy plover activity have varied in the New River area. In general, numbers have increased on the New River spit, including the area of critical environmental concern since active management measures and monitoring began in the early 1990s. The total number of fledglings associated with the New River spit has risen from a low of zero in 1993 to a high of 21 in 2004 (Lauten et al. 2006). Snowy plover reproductive success is measured by the number of chicks fledged per male. This fledgling rate has increased through time and is currently at 1.33 chicks per male at New River, which is 49% higher than the 15-year average of 0.89 fledglings per male (Lauten et al. 2006). Predation is a greater problem at this location than other Oregon snowy plover sites (Lauten et al. 2006). The New River area is the only location with nonnative red fox present in the area. The beaches also abut extensive ranch lands with sheep and cattle operations.

The final rule for listing the snowy plover (Federal Register 1993, 12864) and the draft recovery plan (Federal Register 2001a) provides comprehensive discussions of the following threats to the snowy plover:

- loss or degradation of habitat through
- over utilization for commercial, recreational, scientific, or educational purposes
- disease and predation
- inadequacy of existing regulatory mechanism
- other natural or manmade factors affecting their continued existence

The state of Oregon describes threats to the snowy plover as habitat degradation, introduction of nonnative vegetation, beach development, resource extraction, human disturbance, and predation (OPRD 2004).

Beaches are unstable habitats—they change with each winter storm event and are constantly broken down and renewed. Human activities (building jetties and seawalls, and stabilizing dunes) modify or eliminate these natural destabilizing cycles (OPRD 2004). The introduction of European beachgrass (*Ammophila arenaria*) has stabilized foredunes and prevented the replenishment of the open sand areas thus diminishing the availability of snowy plover habitat and changing the natural vegetative and sand dynamics (OPRD 2004; Federal Register 2001a). Beachgrass also provides cover for predators, which benefit from its dense growing habit.

Nest losses due to predation at some sites on the Oregon coast have been as high as 68% (Sterns et al. 1990 and Hogan 1991; Federal Register 1993, 12871). Predator numbers are thought to increase with increased human presence for a number of reasons. Trash near nesting areas attracts such predators as crows, ravens and rats; European beachgrass, and the subsequent vegetation changes to dune plant communities results in increased hiding cover; and greater human presence may lead to an increase in human disturbance, which flushes adult and snowy plover chicks from nests and increases their vulnerability to predation.

Human activity has been documented as a major threat to the breeding success of the snowy plover (OPRD 2004). Human disturbance, either on foot or in off-highway vehicles, may flush birds from nests, resulting in nest abandonment or lengthening of the incubation period, as birds stay off of the eggs for extended periods of time; may result in trampled or crushed birds or eggs; and may separate broods from adults.

Critical habitat was designated for the Pacific coast population of the snowy plover in 2005 (Federal Register 2005b, 26970). The primary constituent elements for the designated critical habitat units are:

- sparsely vegetated areas above daily high tides that are relatively undisturbed by the presence of humans, pets, vehicles, or human–attracted predators;
- sparsely vegetated sandy beach, mud flats, gravel bars, or artificial salt ponds that are subject to daily tidal inundation, but not currently under water, that support such small invertebrates as crabs, worms, flies, beetles, sand hoppers, clams, and ostracods; and
- surf or tide cast organic debris (such as seaweed or driftwood) located on open substrates (such as those mentioned above) (Federal Register 2005b, 56994).

The latter provide essential habitat for invertebrate food sources, and provide shelter from predators and inclement weather. Two critical habitat units contain BLM lands—OR 9 and OR 10—which overlay BLM-administered lands in the Coos Bay District. See *Table 96 (Critical habitat for the Pacific coast populations of the western snowy plover)* and *Figure 75 (Locations of the Pacific coast population of the western snowy plover on BLM lands within the planning area)*.

Table 96. Critical habitat for the Pacific coast populations of the western snowy plover

Critical Habitat Units	Total Area (acres)	Federal Area (acres)	BLM Area (acres)	Habitat Capability (number of breeding birds)
OR 9 (Coos Bay North Spit)	278	278	138	54
OR 10A (Bandon to Floras Creek)	632	304	178	54

Special Status Species

BLM special status species are those species that include federal- and state-listed species, proposed and candidate species, and BLM sensitive and assessment species. Some species are both state and federally listed.

The primary objectives of the BLM special status species policy are:

- to conserve listed species and the ecosystems on which they depend;
- to ensure that actions requiring authorization and approval by the BLM are consistent with the conservation needs of special status species and do not

contribute to the need to list any special status species under the provisions of the Endangered Species Act; and

- to use all methods and procedures necessary to improve the condition of special status species and their habitats to a point where their special status recognition is no longer warranted.

There are two categories of BLM-designated special status species:

- **Sensitive Species.** In Oregon and Washington, BLM sensitive species are those taxa that are eligible for listing as federal-listed, federal-candidate, state-listed or state-candidate (plant) status.
- **Assessment Species.** Plant and vertebrate species that are not included as federal threatened, federal endangered, federal proposed, federal candidate, state listed, or BLM sensitive, and are on List 2 of the Oregon Natural Heritage Database.

As of March 14, 2005, 117 special status animal species (amphibians, reptiles, birds, invertebrates, and mammals) are documented or suspected to occur within the planning area. See *Appendix G. Wildlife*. The numbers vary, but between 28 and 57 species occur in each district. See *Table 97 (Animal special status species in BLM districts within the planning area)*.

Table 97. Animal special status species in BLM districts within the planning area

Status*	District					
	Salem	Eugene	Roseburg	Coos Bay	Medford	Klamath Falls
Amphibians and Reptiles						
FE	0	0	0	0	0	0
FT	0	0	0	0	0	0
FC	0	0	0	0	1	1
BS	4	3	1	1	2	1
BA	4	2	1	2	2	1
Totals	**8**	**5**	**2**	**3**	**5**	**3**
Birds						
FE	0	1	0	1	1	0
FT	3	3	3	4	3	2
FC	0	1	0	1	1	0
BS	10	11	5	14	12	10
BA	4	4	3	8	4	5
Totals	**17**	**20**	**11**	**28**	**21**	**17**
Invertebrates						
FE	1	1	0	0	0	0
FT	1	0	0	0	1	0
FC	1	2	0	1	1	0
BS	17	12	8	14	14	9
BA	0	0	0	0	0	0
Totals	**20**	**15**	**8**	**15**	**16**	**9**
Mammals						
FE	1	0	0	3	0	0
FT	0	0	0	1	0	0
FC	0	1	0	1	1	1
BS	2	1	2	1	1	1
BA	4	4	5	5	4	5
Totals	**7**	**6**	**7**	**11**	**6**	**7**
Total All	**52**	**46**	**28**	**57**	**48**	**36**

*Status Codes:
FE (federally listed as endangered); **FT** (federally listed as threatened); **FC** (candidate for federal listing); **BS** (bureau sensitive species); **BA** (bureau assessment species)

The federally listed threatened and endangered animal species addressed individually inhabit significant portions of the planning areas. There are other threatened and endangered animal species that either occur on the periphery of the planning area (i.e., in the ocean) or inhabit habitats that constitute a very small portion of the planning area. See *Table 98 (Documented or suspected federally listed animal species within the planning area that are not typically found in forested habitat)* and *Table 99 (Habitat requirements for federally listed animal species within the planning area that are not typically found in forested habitat).*

Table 98. Documented or suspected federally listed animal species within the planning area that are not typically found in forested habitat

Status*	Scientific Name	Common Name
FC	*Eremophila alpestris strigata*	Streaked horned lark
FC	*Euphydryas editha taylori*	Whulge checkerspot (butterfly)
FC	*Polites mardon*	Mardon skipper (butterfly)
FC	*Rana pretiosa*	Oregon spotted frog
FT	*Branchinecta lynchi*	Vernal pool fairy shrimp
FT	*Eumetopias jubatus*	Steller sea lion
FT	*Speyeria zerene hippolyta*	Oregon silverspot butterfly
FE	*Balaenoptera musculus*	Blue whale
FE	*Eschrichtius robustus*	Gray whale
FE	*Icaricia icarioides fenderi*	Fender's blue butterfly
FE	*Megaptera novaeangliae*	Humpback whale
FE	*Pelecanus occidentalis californicus*	California brown pelican

*Status Codes:
FC (federal candidate for listing); **FT** (federally listed as threatened); **FE** (federally listed as endangered)

Table 99. Habitat requirements for federally listed animal species within the planning area that are not typically found in forested habitat

Common Name	Habitat Conditions
Streaked horned lark	• Found in the Willamette Valley • Nesting habitat included native prairies and a wide range of agricultural fields (Marshall et al. 2003)
Whulge checkerspot (butterfly)	• Low-elevation upland prairies • Host plant is narrow-leaved plantain (*Plantago lanceolata*) (ODFW 2006)
Mardon skipper (butterfly)	• Meadow habitats • Host plants are native fescues (ODFW 2006)
Oregon spotted frog	• Permanent ponds, marshes and meandering streams through meadows • Bottom of dead and decaying vegetation • Springs and other slow moving water (ODFW 2006)
Vernal pool fairy shrimp	• Small, cooler ephemeral pools (ODFW 2006) • Found on BLM lands in the Medford District • Recovery plan (USDI, USFWS 2005) and designated critical habitat (Federal Register 2006c, 7118-7166) available
Steller sea lion	• Marine habitats include coastal waters near shore and over the continental slope • Sometimes rivers are ascended in pursuit of prey • Terrestrial habitats include beaches that are commonly used as rookeries and haulouts (NatureServe 2006)

Common Name	Habitat Conditions
Oregon silverspot butterfly	• Salt spray meadows • Host plants early blue and western blue violets (*Viola sp.*) (ODFW 2006) • Recovery plan (USDI, USFWS 2001b) and designated critical habitat (Federal Register 1980, 44935-44938) available
Blue whale	• Mainly pelagic • Generally prefers cold waters and open seas (NatureServe 2006)
Gray whale	• Mostly in coastal and shallow shelf waters • Young are born in lagoons and bays (NatureServe 2006)
Fender's blue butterfly	• Seasonally wet native prairies • Host plant is Kincaid's lupine (*Lupinus sulphureus kincaidii*) (ODFW 2006) • Draft critical habitat (Federal Register 2005c, 66492-66540) available
Humpback whale	• Pelagic and coastal waters • Sometimes frequenting inshore areas such as bays (NatureServe 2006)
California brown pelican	• A coastal marine species rarely found inland • Roosts on sandy shores and offshore rocks • Nests on islands and offshore rocks (Marshall et al. 2003)

Bureau sensitive and assessment species have been grouped according to habitat requirements to facilitate effects analysis. See *Table 100 (Bureau sensitive species and bureau assessment species found within the planning areas and grouped by habitat requirements to facilitate analysis)* and *Appendix G. Wildlife*. For many groups, habitat requirements are similar to those of species receiving individual analysis. Therefore, any additional analysis for those groups would be redundant.

Table 100. Bureau sensitive species and bureau assessment species found within the planning areas and grouped by habitat requirements to facilitate analysis

Habitat Association or Group	Common Name
Species effects that are common to all alternatives. Includes species that are associated with special habitats or features. Also includes accidental or occasional migrants where impacts are unlikely.	Yellow rail
	American peregrine falcon
	Rhinoceros auklet
	Cassin's auklet
	Tufted puffin
	Upland sandpiper
	Fork-tailed storm petrel
	Aleutian Canada goose
	Dusky Canada goose
	American white pelican.
	Red-necked grebe
	Trumpeter swan
	Ferruginous hawk
	Common nighthawk (Willamette Valley population)
	Tule goose
	Merlin
	White-tailed kite
	Insular blue (butterfly)
	Hoary elfin (butterfly)
	Newcomb's littorine snail
	Larch mountain salamander
	American grass bug
	Siskiyou short-horned grasshopper
	Diminutive pebblesnail
	Fall creek pebblesnail
	Keene creek pebblesnail
	Klamath pebblesnail
	Nerite pebblesnail
	Crater lake tightcoil (snail)
	Montane pea clam
	Evening fieldslug
	Crowned tightcoil (snail)
	Robust walker
	Pacific walker
	Toothed pebblesnail
	Townsend's big-eared bat
	Spotted bat
	Fringed myotis*
	Pallid bat (Pacific Pallid and Pallid considered the same)

Habitat Association or Group	Common Name
Neotropical Birds	Purple martin
	Yellow breasted chat
	White-headed woodpecker
	Three-toed woodpecker
	Black-backed woodpecker
	Grasshopper sparrow
	Tricolored blackbird
	Burrowing owl
	Flammulated owl
	Lewis woodpecker
	Oregon vesper sparrow
	Western meadowlark
	Streaked horned lark
Snag Dependent	Fringed myotis
	Pallid bat (Pacific Pallid and Pallid considered the same)
Older Forest Associates	Red tree vole
	Northern goshawk
	Johnson's hairstreak (butterfly)
	Survey and manage species
Aquatic and Riparian Associates	Haddock's rhyacophilan caddis fly
	Cope's giant salamander
	Scott's apatanian caddis fly
	Cascade torrent salamander
	Columbia torrent salamander
	Willamette floater (mussel)
	Harlequin duck
	Foothill yellow-legged frog
	Oregon spotted frog
	Scale lanx (snail)
	Rotund lanx (snail)
	Northwestern pond turtle
	Painted turtle

Habitat Association or Group	Common Name
Forest Floor Associates	Puget Oregonian
	Tillamook westernslug
	Salamander slug
	Spotted tail-dropper
	Bald hesperian
	Oak springs hesperian
	Oregon giant earthworm
	Roth's blind ground beetle
	Oregon slender salamander
	Traveling sideband (snail)
	Klamath taildropper
	Modoc sideband (snail)
	Siskiyou hesperian
	Chase sideband (snail)
	California slender salamander
	Oregon shoulderband (snail)
	Black salamander
	Siskiyou mountains salamander
	Sisters hesperian
	Green sideband (snail)
Gophers	Pistol river pocket gopher
	Gold beach pocket gopher

Fisher

The west coast population of the fisher (*Martes pennanti*) was petitioned for listing under the federal Endangered Species Act in 2000. In 2004, the U.S. Fish and Wildlife Service found that listing was "warranted but precluded" by higher priority actions (Federal Register 2004, 18770). Subsequently, the fisher was added to the U.S. Fish and Wildlife Service's candidate species list (Federal Register 2004, 18770). Within the planning area, the fisher has been documented to occur in two districts and suspected to occur in two others. See *Appendix G. Wildlife*.

Fisher historically occurred throughout the Cascades, Coast Range, and the Siskiyou and Blue mountains of Oregon (Bailey 1936). They have declined since the late 1800s and early 1900s as a result of overtrapping, loss of habitat, and predator control programs (Aubry and Lewis 2003). Aubry and Lewis (2003) recognized two disjunct populations of fisher within the planning area—one in the southern Cascade Range and another in the northern Siskiyou Mountains. The southern Cascade fisher population is separated from the northern Siskiyou Mountains population by Interstate 5, large expanses of nonhabitat (nonforested and agricultural lands), and the populated Rogue River Valley.

Genetic studies found the population in the southern Cascades originated from animals that were introduced from British Columbia and Minnesota at various times from

the 1960s through the early 1980s (Aubrey and Lewis 2003). Genetic analysis has determined that "[t]he high degree of relatedness among fishers in the southern Cascade Range (R-.56) is consistent with the hypothesis that this population is small and isolated" (Aubry et al. 2003).

Small population sizes and isolation make the "Oregon populations vulnerable to extirpation" (Federal Register 2004, 18789). Recent survey efforts in southwestern Oregon have detected fisher in the landscape between the southern Cascade and other northern Siskiyou Mountains population centers, but the extent of connectivity between the two populations is still believed to be limited (Aubrey et al. 2004; Aubrey and Lewis 2003; Federal Register 2004, 18771).

Forest structure and associated prey are thought to be the critical features of habitat requirements for the fisher (Buskirk and Powell 1994). Powell (1993) (as cited in Federal Register 2004, 18773) stated "that forest type is probably not as important to fishers as the vegetative and structural aspects that lead to abundant prey populations and reduced fisher vulnerability to predation, and they may select forest that have low and closed canopies." The fisher uses different forest structures for the various stages of life:

- natal sites (where young are born and weaned)
- maternal habitat (where young are raised)
- resting sites
- foraging habitat

Aubry and Raley (2002) found that female fishers use trees (alive or dead) with hollows created by heart rot for natal sites. Natal den trees ranged from 61 to 138 cm (24 to 54 inches) in diameter (average 93 cm (37 inches)) (Aubry and Raley 2002). Elsewhere along the Pacific coast, natal dens are typically located in the largest diameter trees. Weir and Harestad (2003) reported natal dens in cottonwoods that were averaging 103 cm (40 inches) in diameter. The U.S. Fish and Wildlife Service (Federal Register 2004, 18774) cited studies in northern California reporting average diameters of natal den trees of 62.5 to 295 cm (24 to 116 inches). Maternal dens were located in cavities in live trees and snags between the bole and sloughing bark on mistletoe brooms, on a rodent nest, and in large hollow logs that were greater than 50 cm (20 inches) in diameter (Aubry and Raley 2002). Approximately 56% of natal and maternal den sites in the southern Cascade study were located in unmanaged forests, 38% in managed forests (some evidence of past harvest activities), and 6% in second growth forests (Aubry and Raley 2002).

Rest sites occur predominantly in live trees. Aubry and Raley (2002) found that mistletoe brooms were used more than any other platform or microsite. Snags and down logs were also used for resting sites (Aubry and Raley 2002; Zielinski et al. 2004; Yeager 2005). In the southern Cascades, resting sites were found in unmanaged forests 63% of the time, 25% in managed second growth, and 22% in managed forest (Aubry and Raley 2002). In the Klamath province of northern California, Yeager (2005) determined that rest sites were located in trees significantly larger diameter at breast height than the four largest tree on a plot (0.4 ha) (1 acre) centered on the rest site structure.

Trees providing rest sites in the Shasta-Trinity National Forest and the Hoopa Valley Indian Reservation averaged from 87 to 124 cm (34 to 40 inches) in diameter at breast height (Yeager 2005). Rest sites in the north coast study area (northern California) averaged approximately 118 cm (46 inches) in diameter (Zielinski et al. 2004). Resting structures need to be sufficiently large in diameter to provide resting substrates that can accommodate the large-bodied fishers. Trees must be old enough for ecological processes to form cavities of sufficient size to be of use to fishers (Zielinski et al. 2004). Zielinski et al. (2004) described resting locations in their coast study areas (northern California) as being best distinguished from random locations by having large trees, dense canopies, and large diameter snags.

Foraging habitat is a function of coarse woody debris and stand structural complexity, which translates into a diverse prey base (Weir and Harestad 2003; Buskirk and Powell 1994). The fisher is a predator of small- to medium-sized mammals and birds. They also feed on a variety of vegetable matter, including berries and nuts (Powell and Zielinski 1994). Fungal spores found in fisher scats indicate that fishers may also directly consume fungi (Zielinski *et al*. 1999). Throughout their range, fishers commonly feed on ungulate carrion (e.g., deer, elk, moose, and cattle), especially in the winter, when other prey species are less available.

Fishers may select prey based upon their availability (Banci 1989). Fishers tend to occur in habitat that provides both prey numbers and the opportunity to capture them (Powell 1993, as cited in Federal Register 2004, 18772; Weir and Harestad 2003).

Literature reviews have shown that home ranges for fishers vary up to 122 km^2 for males and 53 km^2 for females (Banci 1989; Powell and Zielinski 1994). Zielinski et al. (2003) found that home ranges averaged 5,806 ha (14,350 acres) for males and 1,498 ha (3,700 acres) for female fisher in their coastal study area (northern California). Approximately 76% of the home range was composed of mature and older Douglas fir and true fir habitat types (Zielinski et al. 2004). Fishers avoid habitats without overstory or shrub cover (Weir and Harestad 2003; Federal Register 2004, 18773).

Approximately 2.2 million acres of BLM-administered lands are commercial forest lands capable of growing into fisher natal (including denning) and foraging habitat. See *Table 101 (Available fisher natal and foraging habitat on BLM-administered lands with in the planning area).* Within the planning area, fisher natal habitat comprises from 13 to 39% of the BLM forest lands. Foraging habit constitutes 61% of the BLM forest lands, which varies from 45% in the Eugene District to 81% in the Klamath Falls Resource Area of the Lakeview District. The Medford District contains the most fisher foraging habitat at approximately 605,000 acres.

Table 101. Available fisher natal and foraging habitat on BLM-administered lands with in the planning area

BLM Districts	Habitat-Capable (acres)	Natal Habitat		Foraging Habitat	
		(acres)	(%)	(acres)	(%)
Salem	365,000	48,428	13	204,866	54
Eugene	296,000	51,052	17	135,093	45
Roseburg	399,000	154,948	39	226,978	57
Coos Bay	302,000	84,035	28	143,933	48
Medford	788,000	213,342	27	604,753	77
Klamath	47,000	7,840	17	38,484	81
Totals	**2,197,000**	**559,646**	**25**	**1,354,107**	**61**

In their finding on the petition to list the fisher, the U.S Fish and Wildlife Service concluded that habitat loss and fragmentation appeared to be significant threats to the fisher (Federal Register 2004, 18780). Timber harvesting is a primary threat (Powell 1993) by reducing the amount of suitable habitat, fragmenting the remaining landscape, and changing the forest structure. Timber management activities tend to simplify stands by reducing species diversity, removing snags and down wood, and creating simple canopy structures (Federal Register 2004, 18778-18779).

Land Birds

"The temperate rain forests of the Pacific Northwest support the highest abundance of birds of any coniferous forest system in North America" (Altman 1999). There are potentially 164 species of birds that could occur within the planning area. See *Table 102 (Bird occurrence within the montane and western forest habitat types of Oregon and Washington)* (Olsen et al. 2001).

Table 102. Bird occurrence within the montane and western forest habitat types of Oregon and Washington

Total number of bird species	Bird Occurrence			
	Montane Mixed Conifer	Southwest Oregon Mixed Conifer-Hardwood	Westside Oak and Dry Douglas fir and Woodlands	Westside Lowlands and Conifer-Hardwoods
164	107	161	119	120

Detailed descriptions of the habitat needs and conservation concerns land birds are detailed in *Birds of Oregon* (Marshall et al. 2003) and *Wildlife-Habitat Relationships in Oregon and Washington* (Johnson and O'Neil 2001), and in the numerous species accounts contained within the *The Birds of North America* (Poole and Gill 2002).

Threats facing land birds include loss of habitat, habitat fragmentation, declining populations, and forest simplification (Altman 1999; Marshal et al. 2003; Rich et al. 2004; Pashley et al. 2000). Past management practices (including clear-cutting,

commercial thinning, fire suppression, salvage, slash burning, and herbicide use) has tended to simplify the forest habitat (Altman 1999). More recent management has begun to improve habitat structure and diversity by recognizing the need to provide for diverse forest structures (including legacy trees, snags, down wood, multiple canopy layers, and variable densities of tree retentions).

The Oregon/Washington Partners in Flight has developed a tiered scheme of segregating species into management groups based on forest condition and habitat attribute. Focal species are then identified for each group (Altman 1999, 2000a, 2000b). "By managing for a group of species representative of important components in a functioning…forest ecosystem, many other species and elements of biodiversity also will be conserved" (Altman 1999).

Data is not available to analyze all the combination groups of forest conditions and habitat attributes. Habitat analysis will be conducted based on the four structural stages of forests and plant group combinations. See *Table 103 (Analytical groups of land birds with the planning area)* (Altman 1999, 2000a, 2000b). Eastside conifer forests are composed of the true fir, Douglas fir, conifer/hardwood, and mixed conifer plant groups in the Klamath Falls Resource Area of the Lakeview District. Westside conifers are comprised of all plant groups with the exception of junipers and hardwoods.

Table 103. Analytical groups of land birds within the planning area

Plant Group	Habitat Feature or Conservation Focus	Focal Land Bird Species
Structurally Complex Forests		
Eastside conifer	Large trees	Brown creeper
	Large snags	Williamson's sapsucker
	Multi-layered dense canopy	Hermit thrush
Westside conifer	Large snags	Vaux's swift
	Large trees	Brown creeper
	Conifer cones	Red crossbill
Mature Forests with Multilayered Canopies		
Westside Conifer	Large snags	Pileated woodpecker
	Large trees	Brown creeper
	Conifer cones	Red crossbill
	Closed canopy	Hermit warbler
	Deciduous canopy trees	Pacific-slope flycatcher
	Mid-story tree layers	Varied thrush
	Open mid-story	Hammond's flycatcher
	Deciduous understory	Wilson's warbler
	Forest floor complexity	Winter wren

Plant Group	Habitat Feature or Conservation Focus	Focal Land Bird Species
Young Forests (young stand initiation and pole stem exclusion*)		
Westside Conifer	Closed canopy	Hermit warbles
	Deciduous canopy trees	Pacific-slope flycatcher
	Open mid-story	Hammond's flycatcher
	Deciduous canopy trees	Black-throated gray warbler
	Deciduous understory	Wilson's warbler
	Forest floor complexity	Winter wren
	Deciduous subcanopy and understory	Hutton's vireo
Stand Establishment Forests		
Westside conifer	Residual canopy trees	Olive-sided flycatcher
	Snags	Western bluebird
	Deciduous vegetation	Orange-crowned warbler
	Nectar-producing plants	Rufous hummingbird

*Altman's seral stages (Altman 1999).

Habitat objectives from the land bird conservation strategies of the Oregon/Washing Partners in-Flight for the eastern Oregon forests include (Altman 2000a):

- "no net loss" of habitat;
- maintenance of existing large diameter trees; and
- maintain existing structurally complex forests.

Habitat objectives from the land bird conservation strategies of the Oregon/Washing Partners in-Flight for the western Oregon forests include (Altman 1999):

- retain existing old-growth forest;
- manage for more than 15% of the landscape to be comprised of old-growth forest;
- manage mature forests in the same manner as the landscape targets;
- maintain 20 to 40% of the landscape in a combination of pole and young forest structures;
- maintain 20 to 40% of the landscape in an early successional stage.

These objectives provide "benchmarks for measuring the success of management actions" in providing for land birds (Altman 1999).

Deer and Elk

Deer (*Odocoileus sp.*) and elk (*Cervus elaphus*) occur across the planning area. Two species of deer (Columbian white-tailed deer (*Odocoileus virginianus leucurus*) and mule and black-tailed deer (*Odocoileus hemionus*)) occur within the planning area. This includes two subspecies of *Odocoileus hemonius*. Columbian black-tailed deer (*Odocoileus hemionus columbianus*) occur west of the crest of the Cascades and mule deer (*Odocoileus hemionus*) occur east of the Cascades (ODFW 2003a; Verts and Carraway 1998). Two subspecies of elk are found within the planning area. Roosevelt elk (*Cervus elaphus roosevelti*) occurs west of the Cascades and Rocky Mountain elk (*Cervus elaphus nelsoni*) are found east of the Cascades (ODFW 2003b; Verts and Carraway 1998). For management purposes, the Oregon Department of Fish and Wildlife divides the range of the two subspecies along State Highway 97 (ODFW 2003b).

There are two populations of Columbian white-tailed deer in Oregon—one along the Columbia River in the Clatsop, Columbia, and Multnomah counties, and a second population in Douglas County (Verts and Carraway 1998; Federal Register 2003, 54647; USDI, USFWS 1983). These populations were one of the first species listed under the Endangered Species Act. In 2003, the U.S. Fish and Wildlife Service determined that (Federal Register 2003, 43658):

- the Columbia River and Douglas County populations were “distinct population segments,” and
- the Douglas County population had reached recovery goals and no longer warranted listing.

The Columbia River population is still listed as a federally endangered species (Federal Register 2003, 43658).

All subspecies of elk and of mule and black-tailed deer are classified as game animals by the state of Oregon.

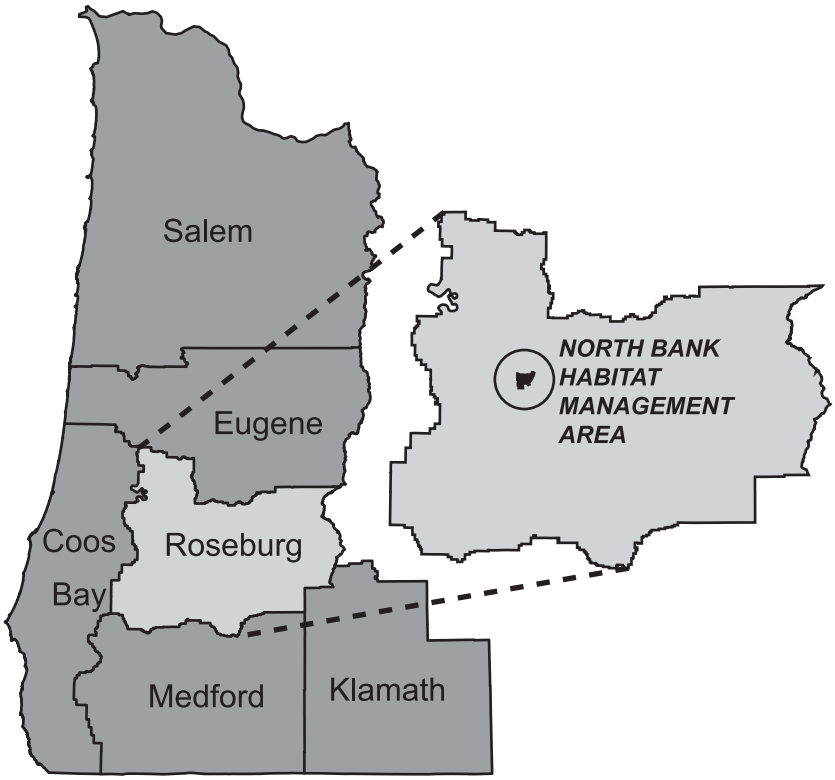
Columbian White-tailed Deer

White-tailed deer inhabit more mesic habitats (Smith 1987; Verts and Carraway 1998). White-tailed deer in the Columbia River population are found on the islands of the Columbia River and on the bottomlands that are adjacent to the river (USDI, USFWS 1983). Preferred habitats are plant communities that provide both forage and cover, including the park forest community (Suring 1975; Suring and Vohs 1979; USDI, USFWS 1983). White-tailed deer in Douglas County are found in habitats that are associated with riparian areas (Ricca 1999; Ricca 2003; Smith 1987; USDI, USFWS 1983). The U.S. Fish and Wildlife Service (1983) suggests that the oak woodland/grassland ecotone is very important to white-tailed deer in Douglas County. Open areas, oak savannah, and grasslands are important for feeding (Ricca 1999, 2003).

White-tailed deer in both populations consume a variety of forbs, shrubs, grasses, and other plants (in order of preference) (Federal Register 2003, 43647; Whitney 2002).

The BLM manages 6,100 acres of Columbian white-tailed deer habitat on the North Bank Habitat Management Area, in the Roseburg District. See *Figure 76 (North Bank Habitat Management Area in the Roseburg District)* (USDI, BLM 2001a). This area was acquired in 1994 with the expressed purpose of providing secure habitat (habitat managed primarily for the Columbian white-tailed deer).

Figure 76. North Bank Habitat Management Area in the Roseburg District



Mule/Black-tailed Deer

Mule deer occur across a broad range of habitat types from the Coast Range and Cascade Mountains to the desert shrublands, generally occupying open habitat types (Verts and Carraway 1998; ODFW 2003a). Black-tailed deer prefer dense communities early in the forest sere (Verts and Carraway 1998; Brown 1961; Bender et al. 2004). Hanley (1984) found that where black-tailed deer overlapped elk, they preferred the more xeric habitat. During summer, both mule and black-tailed deer may be found at higher elevations—migrating to lower elevations in the fall and winter (McCullough 1960 (Verts and Carraway 1998); ODFW 2003a). In the Coast Range, where winters are less severe, seasonal migration does not occur. Cover is an important habitat component for each subspecies and is found in stands of dense vegetation (Kremsater and Bunnell 1992; ODFW 2003a).

Both subspecies are characterized as browsers, which forage in the younger seral stages

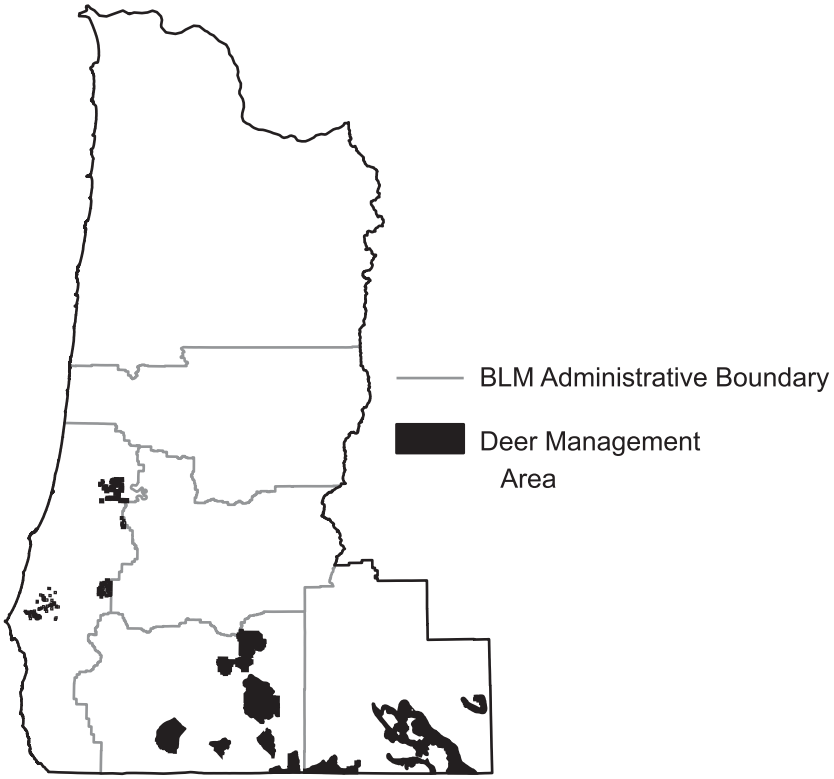
(Hanley 1984; Verts and Carraway 1998; Anderson and Wallmo 1984). Forbs are an important component of the summer diets of mule deer. In winter, sagebrush (*Artemisia sp.*), bitter-brush (*Purshia tridentata*), rabbit-brush (*Chrysothamnus sp.*), juniper (*Juniperus* sp.), mountain- mahogany (*Cercocarpus sp.*), and winterfat (*Eurotia lanata*) are common components (Verts and Carraway 1998).

Winter range and associated forage are important components for those mule and black-tailed deer herds that migrate (ODFW 2003a). The BLM has identified 193,000 acres of winter range to be managed with consideration for deer. See *Table 104 (Deer management areas within the planning area)* and *Figure 77 (Deer habitat management areas on BLM lands within the planning area)*. Threats to deer include loss of forage habitat, loss of cover, and unregulated road use. Unregulated road use also causes an increase in deer vulnerability during hunting seasons, increases the potential for illegal kills, and provides opportunities for other disturbances to foraging, fawning, breeding, and resting habitat.

Table 104. Deer management areas within the planning area

BLM Districts	Deer Habitat Management Areas	Season of Concern	Gross Area (acres)	BLM (acres)
Coos Bay	Camp Creek	Summer	12,554	12,518
	Edson Butte	Summer	4,113	4,079
	Millicoma Tree Farm N Edge	Summer	607	601
	Millicoma Tree Farm NE Edge	Summer	6,112	6,095
	Rock Creek	Summer	6,865	6,834
Klamath Falls Resource Area (Lakeview District)	Bly	Winter	17,461	4,513
	Bly Mt	Winter	46,008	6,311
	Hogback	Winter	17,998	2,311
	Horton Windy	Winter	24,973	7,952
	Keno Worden	Winter	8,393	557
	Lorella	Winter	14,585	4,070
	South Bryant	Winter	7,768	2,718
	South Gerber	Winter	41,370	4,893
	Stukel	Winter	12,506	1,812
	Swan Lake	Winter	20,789	6,549
	Topsy Pokegama	Winter	30,578	13,485
Medford	DHMA Ash Deer Winter Little Applegate	Winter	14,244	11,094
	DHMA Ash Deer Winter Little Butte Creek South3	Winter	83,911	25,662
	DHMA BFRA Burnt Peak	Winter	3,602	1,771
	DHMA BFRA Elk Creek	Winter	43,036	19,039
	DHMA BFRA Salt Creek	Winter	40,813	17,487
	DHMA BFRA Shady Cove West	Winter	17,239	7,673
	DHMA Camel Hump	Winter	14,107	8,892
	DHMA -GP-Williams-Important Deer Area	Winter	55,341	29,188
	DHMA Monument East	Winter	16,605	10,355
	DHMA Monument West	Winter	6,460	6,422
		Totals	**568,038**	**222,880**

Figure 77. Deer habitat management areas on BLM lands within the planning area



Elk

Elk are found across a wide range of habitats within the planning area. The dominant factors for elk occurrence are the availability of forage and access to cover (Harper et al. 1987; Verts and Carraway 1998). Early seral habitat provides important foraging habitat (Verts and Carraway 1998; Witmer and Wisdom 1986; Hanley 1984). Like deer, elk will migrate from high elevation summer habitat to low elevation winter range in areas with harsh winter conditions. However, elk in the Coast Range do not display this migratory behavior (Verts and Carraway 1998; ODFW 2003b).

Elk forage on grasses, forbs, shrubs, and trees (ODFW 2003b; Hanley 1984; Verts and Carrawy 1998; Findholt et al. 2004). Forage value decreases with distance from cover (Witmer and Wisdom 1986; ODFW 2003b). Cover was originally thought to provide both a hiding function and to ameliorate the effect of harsh weather (ODFW 2003b). Recent work in northeastern Oregon has shown that this is not the case (Cook et al. 1998). No positive effects of thermal cover were demonstrated. In fact, possible negative effects may occur (Cook et al. 1998). Cook et al. (2004) reviewed three other studies that looked at the effects of thermal cover and all studies failed to find any benefits.

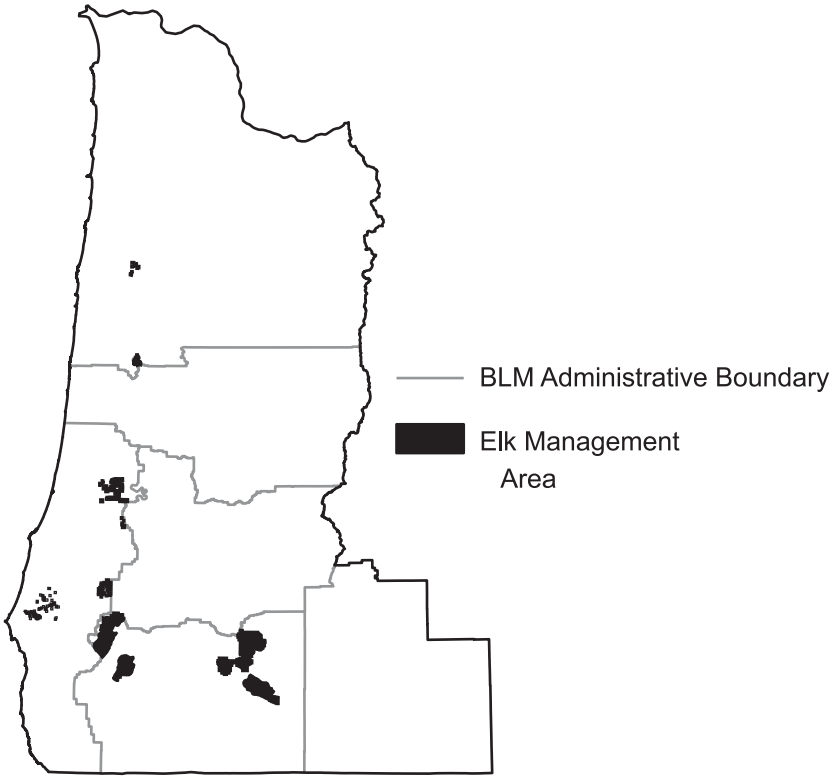
Threats to elk include loss of forage habitat, loss of cover, and unregulated road access. Unregulated roads also cause an increase in elk vulnerability during hunting seasons, increases the potential for illegal kills, provides opportunities for other disturbances during critical calving periods and winter, and causes elk to move away from available forage (ODFW 2003b; Rowland et al. 2000; Wisdom et al. 2004; Rowland et al. 2004; Cole 1996; Cole et al. 1997).

The BLM has identified 118,000 acres of winter range to be managed with consideration for deer and elk. See *Table 105 (Elk management areas within the planning area)* and *Figure 78 (Elk habitat management areas on BLM lands within the planning area)*.

Table 105. Elk management areas within the planning area

BLM Districts	Elk Habitat Management Areas	Season of Concern	Gross Area (acres)	BLM (acres)
Salem	Bummer Ridge Elk Emphasis Area	General	3,647	3,641
	Luckiamute Elk Emphasis Area	General	1,977	1,968
Coos Bay	Camp Creek	Summer	12,554	12,518
	Edson Butte	Summer	4,113	4,079
	Millicoma Tree Farm N Edge	Summer	607	601
	Millicoma Tree Farm Ne Edge	Summer	6,112	6,095
	Rock Creek	Summer	6,865	6,834
Medford	Ehma Bfra Burnt Peak	Winter	3,602	1,771
	Ehma Bfra Camel Hump	Winter	14,107	8,892
	Ehma Bfra Elk Creek	Winter	43,036	19,039
	Ehma Bfra Salt Creek	Winter	41,593	17,479
	Ehma Bfra Shady Cove West	Winter	17,239	7,673
	Ehma Glendale Mule Creek Important Elk Area	Winter	20,882	19,372
	Ehma-Gp-Far Out-Important Elk Area	Winter	9,323	8,869
	Ehma-Gp-Peavine-Important Elk Area	Winter	27,447	26,303
	Glendale Elk Valley Important Elk Area	Winter	24,220	14,266
		Totals	**237,325**	**159,400**

Figure 78. Elk habitat management areas on BLM lands within the planning area



Fish

Key Points

- There are eight anadromous fish populations and two resident fish population segments that occur on BLM-administered lands within the planning area that are listed as threatened or endangered under the Endangered Species Act. Habitat degradation is a factor of decline for most of these populations, and is a major risk factor that continues to threaten all of the population segments.
- Large wood, stream temperature, sediment, and water flow have the greatest influence on the ability of aquatic habitat to support fish populations.
- The abundance and survival of salmonids is often closely linked to the abundance of large woody debris in stream channels. The current amount of large woody debris in streams is low and is hindering the recovery of salmonid populations.
- The fine sediments that are in the streams on BLM-administered lands are generally at levels that would not reduce the availability of fish-spawning habitat.
- The past land use practices that most severely degraded fish habitat—splash damming and stream cleaning—no longer occur. Additionally, improvements in road construction and grazing practices have reduced or eliminated adverse affects to fish habitat on BLM-administered lands.

Aquatic ecosystems within the planning area include (USDA, USDI 1994):

- large river systems (e.g., the Rogue, Umpqua, and Columbia rivers)
- small headwater streams originating from glaciers in the Cascade Range
- coastal rain-influenced streams
- lakes and ponds
- wetlands

Past management activities have degraded aquatic and riparian conditions and contributed to declines in fish populations. Improvements have been made, but additional opportunities exist across the landscape to continue improving conditions and further contribute to restoring the impaired ecological processes. The BLM's ability to contribute to reducing the threats to fish species and improving habitat conditions varies with the amount and location of BLM land ownership. The BLM is rarely the predominant landowner within a fifth-field watershed. Therefore, threats to listed species may continue regardless of the BLM's contribution to improving habitat trends because of the other influences on the populations and their habitat.

The analysis in this section focuses on the current condition of listed fish species. There are also several nonlisted fish species that are identified by the BLM as special status species (the Oregon coast coho salmon, Columbia River/Southwest Washington coastal cutthroat trout, Jenny Creek sucker, and Jenny Creek redband trout). Habitat for these special status fish species is affected by the same processes that affect the listed fish species. Therefore, the description of current conditions for listed fish species provides a sufficient description of conditions for the special status fish species. (There is also some specific discussion and data presented related to Oregon coast coho because of the wealth of information available on this species.)

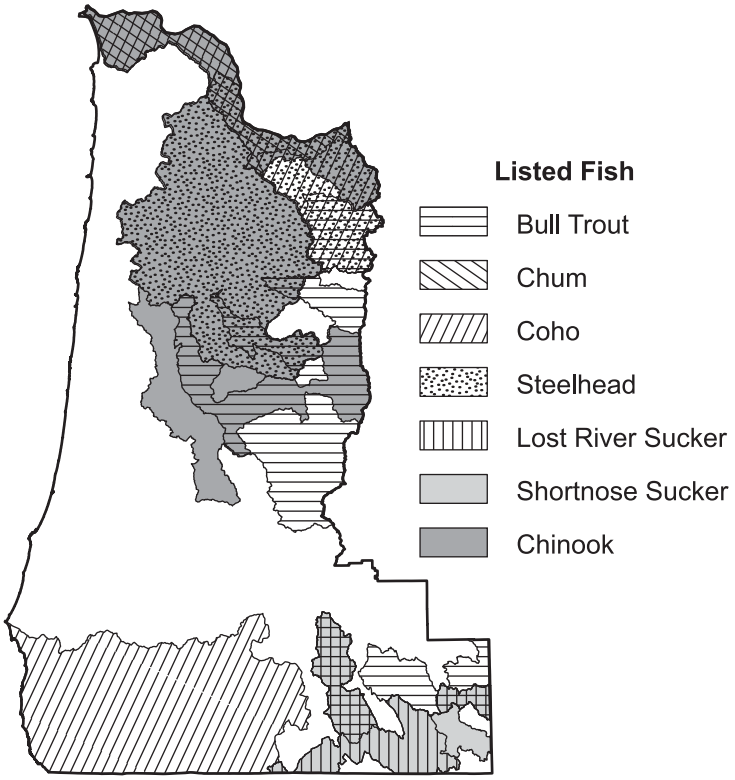
Within the planning area, there are eight anadromous fish population segments that are listed as threatened or endangered under the Endangered Species Act. There is less than one stream mile with bull trout on BLM-administered land. There are two resident fish populations that are listed as threatened or endangered under the Endangered Species Act that are unique to the Klamath Basin (the Lost River sucker and the shortnose sucker). The Oregon chub is a resident species that is listed as threatened or endangered and occurs within the planning area, but it occurs only on private land.

Evolutionary significant unit

A population of an organism that is considered distinct for the purposes of conservation under the Endangered Species Act. Such a distinct population can be a species, subspecies, variety, geographic race, or population.

See *Figure 79(Listed fish populations and evolutionary significant units within the planning area)* for the evolutionary significant unit boundaries within the planning area. See *Appendix H. Fish*.

Figure 79. Listed fish species and evolutionary significant units within the planning area



Fish populations are cyclic by nature and trends can be driven by a variety of factors. Those fish species within the planning area that have been listed as threatened or endangered have been listed as a result of the following factors (Good et al. 2005):

- habitat degradation and loss,
- hydropower development,
- overharvest, and
- hatchery propagation.

Currently, the shortnose sucker and the Lost River sucker occupy only a fraction of their historic range and are restricted to a few areas in the Upper Klamath Basin (i.e., the drainages of the

Upper Klamath, Tule, and Clear lakes). Poor water quality, reduced suitable habitat for all sizes and ages, and the impacts of nonnative fishes continue to threaten remaining shortnose sucker and Lost River sucker populations (USDI, USFWS 2003d). Although a number of factors have contributed to the decline of these species, habitat degradation is considered the primary cause. Streams, rivers, and lakes have been modified by channelization and dams. Grazing in the riparian zone has eliminated streambank vegetation, and has added nutrients and sediment to river systems (USDI, USFWS 2003d).

A biological review team, consisting of scientists from the National Marine Fisheries Service and the Southwest Fisheries Science Centers, updated biological information for the listed salmon and steelhead evolutionary significant units and made conclusions regarding the current and future major risk factors for each evolutionary significant unit. See *Table 106 (Major risk factors by evolutionary significant unit)*.

Table 106. Major risk factors by evolutionary significant unit

Evolutionary Significant Unit (species)	Major Risk Factors
Bull trout	• Barriers • Habitat degradation
Lower Columbia River chinook salmon	• Habitat degradation • High hatchery production
Lower Columbia River chum	Unknown
Lower Columbia River coho	• Habitat degradation • High hatchery production
Lower Columbia River steelhead	• Dams • Habitat degradation • High hatchery production
Shortnose and Lost River suckers	Freshwater habitat degradation
Southern Oregon and northern California coho	Freshwater habitat degradation
Upper Willamette River chinook salmon	• Dams • Habitat degradation • High hatchery production
Upper Willamette River steelhead	• Dams • Habitat degradation

Habitat degradation is a factor of decline for all the listed fish species and is a major risk factor that continues to threaten fish populations.

Recovery plans have been established for populations of the bull trout (draft recovery plan), the Lost River sucker, and the shortnose sucker. Recovery plans are in progress for the other population segments.

Critical habitat is designated for the following fish species within the planning area (Federal Register 2005d):

- Lower Columbia River Chinook salmon (threatened)
- Lower Columbia River steelhead (threatened)
- Columbia River chum salmon (threatened)
- Upper Willamette River Chinook salmon (threatened)
- Upper Willamette River steelhead (threatened)
- Southern Oregon and northern California coast coho salmon (threatened)

This analysis determines the effect of each alternative on fish habitat using current fish distribution data. The fish distribution is greater than the critical habitat distribution; therefore, the designated critical habitat is included for this analysis.

The BLM can contribute to improving fish habitat, but the BLM within the planning area is rarely the predominant landowner in a fifth-field watershed. Therefore, limiting factors (habitat and nonhabitat) for listed species may continue regardless of the BLM's contribution to improving habitat trends because of the other influences on the populations and their habitat.

Survival traits of fish (Reeves et al. 1995) include:

- straying of adults
- multiple life histories
- high fecundity
- mobility of juveniles

The BLM can contribute to the survival of anadromous salmonids. For example, replacing culverts can increase fish distribution by improving mobility.

Some streams have a higher potential than others to provide high-quality habitat for salmonids. High intrinsic potential is a scientific, topographical approach used to determine the potential of a stream to provide high-quality habitat for salmonids. See *Appendix H. Fish*. The Coastal Landscape Analysis and Modeling Study developed intrinsic potentials to prioritize stream reaches throughout the Coast Range province for restoration and protection (Coastal Landscape Analysis and Modeling Study). Using attributes of topography and flow, streams are ranked by their intrinsic potential to provide habitat for chinook, coho salmon, and steelhead. High intrinsic potential streams have not been determined for bull trout, Lost River suckers, or shortnose suckers.

The BLM's ability to influence aquatic habitat and fish populations depends not only on the overall amount of land ownership in a watershed, but also on the location of the ownership relevant to areas that can influence high intrinsic potential streams. See *Figure 80 (Percentage of miles of fish-bearing streams on and off BLM lands within the planning area)* and *Figure 81 (Percentage of miles of high intrinsic potential streams on and off BLM land per evolutionary significant unit within the planning area)*. Analysis from the Coastal Landscape Analysis and

Modeling Study also revealed that high-quality steelhead streams are located primarily on federally managed lands (Forest Service and BLM), whereas the majority of the best potential habitat for coho salmon is on private lands that are managed for such uses as agriculture and urbanization (Burnett et al. 2007).

Figure 80. Percentage of miles of fish-bearing streams on and off BLM lands within the planning area

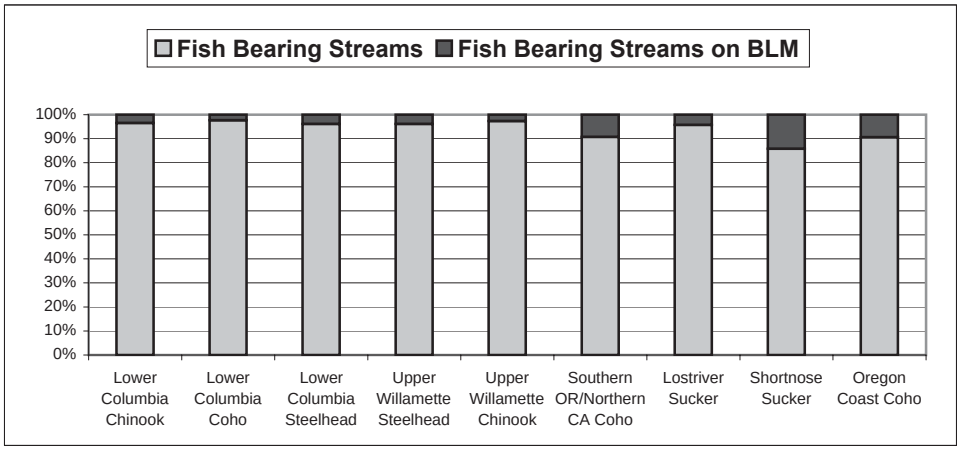
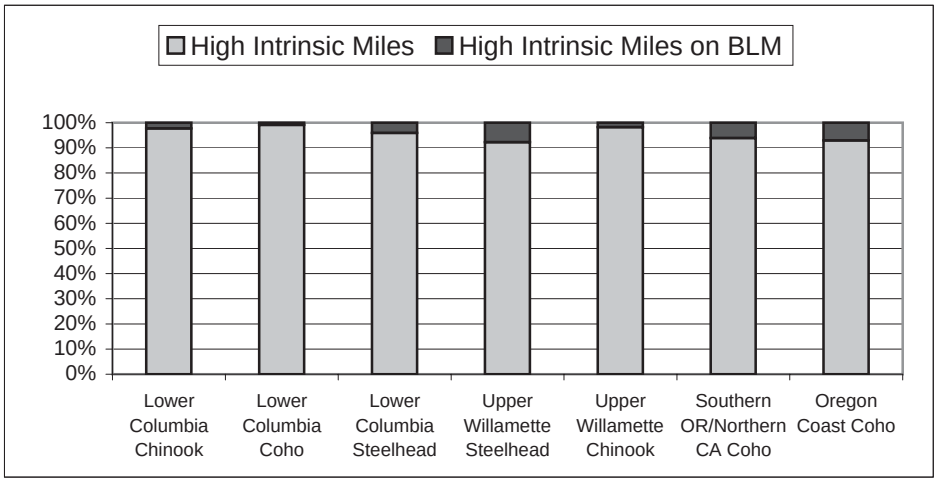


Figure 81. Percentage of miles of high intrinsic potential streams on and off BLM land per evolutionary significant unit within the planning area



Aquatic ecosystems are dynamic environments and change over time from natural disturbances. The recognition that such dynamic processes as periodic large disturbances can have large impacts on aquatic ecosystems represents a relatively new perspective (Naiman et al. 1992). This perspective implies that aquatic ecosystems and their conditions vary because of such periodic events as wildfires and large storms, and the subsequent floods, hillslope failures, landslides, and debris flows (Haynes et al. 2006). This analysis focuses on the key ecological processes that shape fish habitat over time, rather than static conditions at one point in time.

The following are examples of key ecological processes that shape aquatic and riparian habitat in the planning area:

- tree growth and mortality, which affect stream shade and large wood delivery
- hydrology (water flow and temperature)
- sediment routing

Large wood, stream temperature, sediment, and flow have the greatest influence on the ability of aquatic habitat to support fish populations (Meehan 1991; OWEB 1999). In forested landscapes, the important delivery mechanisms of large wood and sediment to stream channels are landslides, debris flows, and floods. In nonforested landscapes, the important processes are water flow, water temperature, and sediment routing.

Large Wood

Past management practices throughout the Pacific Northwest have reduced the abundance of large woody debris in channels throughout the region. Historically, large wood source areas did not produce large wood all the time, but rather fluctuated both spatially and temporally. Natural disturbances like fires, wind, and floods do not affect all of the landscape equally. Because of the dynamic spatial effects of natural disturbance regimes, large wood loading and stream habitat features across natural landscapes vary greatly. At any one time, some stream channels may have large amounts of large wood and highly complex habitats, but other channels, even in the same watershed, may lack wood and have simplified habitats (Reeves et al. 1995). Prior to the twentieth century, large channels and large rivers, like the Willamette River as described by Sedell and Froggatt (1984), were full of wood or blocked by wood jams and accumulations.

Wood loading in large Pacific Northwest rivers has generally declined to 1/100th of historical amounts (Sedell and Froggatt 1984). Rivers were cleared of large wood during settlement to improve access for transportation. Large wood was later removed from rivers and streams as a stream-cleaning regime, because log jams were believed to obstruct fish migration. Smaller streams were cleared through a splash-damming process in which a dam-break flood was induced to transport trees. These torrents scoured sediment and wood from streambeds and banks and left many channels scoured to bedrock (Sedell and Luchessa 1984; Montgomery et al. 2003).

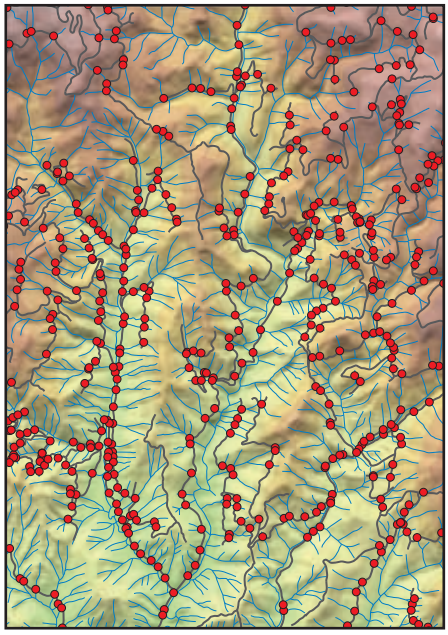
The decline in beaver populations from trapping also reduced the large wood found in streams and consequently reduced the complexity of aquatic habitats. Dam building by beavers provides accumulations of large wood and pools, which are an important component of high-quality habitat for fish species (ODFW 2005b; Pollock et al. 2003; Nickelson et al. 1992). By 1900, trapping had nearly extirpated beaver in the Pacific Northwest (Naiman et al. 1998). The decline in beaver populations resulted in incised channels, loss of riparian and wetland areas, and loss of channel complexity, which is important to fish and invertebrate production. For example, the greatest reduction in the productive capacity of coho smolt has been associated with the extensive loss of beaver ponds (ODFW 2005b). A 94% reduction in smolt production potential in a western

Washington basin is attributed to the loss of beaver pond habitat (ODFW 2005b).

In the twentieth century, mining, urbanization, agriculture, and logging began to change the physical and biological characteristics of streams by removing trees from upland and streamside areas, which increased sedimentation from ground disturbances and road construction and directly altered stream channels. Large fires and the subsequent salvage logging, such as the Tillamook Burn, removed both upland and riparian forests, which reduced stream shading, reduced future sources of large wood, and increased sedimentation.

Roads were often constructed along stream channels in the past. See *Figure 82 (Number of road and stream crossings in the Evans Creek Watershed)*.

Figure 82. Number of road and stream crossings in the Evans Creek Watershed



Large wood is an important component of aquatic habitats from headwater channels to estuaries in forested ecosystems (Dolloff and Warren 2003). Large wood accumulation within stream channels is necessary for many functions including:

- providing cover for fish
- sediment storage for food supply and spawning grounds
- nutrient retention
- pool formation
- formation of off-channel habitat

Woody material of all sizes from tiny fragments to intact trees plays a role in stream systems. Because decay rate and probability of displacement are a function of size, larger pieces have a greater influence on habitat and physical processes in stream channels than small pieces (Dolloff and Warren 2003). In general, pieces greater than 24 inches in diameter and 50 feet in length are considered large wood west of the Cascade Mountains, while pieces greater than 12 inches in diameter and 35 feet in length are considered large wood east of the Cascade Mountains (Foster et al. 1999; USDC, NOAA, NMFS 1996). For this analysis, trees greater than 20 inches in diameter are considered large wood because the structural stage classification of forests uses the density of trees greater than 20 inches in diameter as a threshold for the definition of mature&structurally complex forests (see the *Ecology* section of *Chapter 3*).

For many aquatic organisms, particularly fish, large wood is an important factor in creating and maintaining deep water or pool habitat. See *Figure 83 (Example of deep pool and habitat diversity caused by large wood)* and *Figure 84 (Example of a stream with high wood volume)*. Salmonids inhabit pools as refuges from high water velocities. Juvenile salmonids use pools and side channels created by wood as overwintering habitat. Large wood can capture and store sediment, which provides spawning habitat (Dolloff and Warren 2003). Large wood is also an important source of cover, which makes fish harder for predators to see. Stream complexity is important for many fish, particularly aggressive species like salmonids, which do not tolerate close proximity to each other. Wood partitions the habitat and visually isolates fish, which allows more fish per unit of available space (Dolloff 1986).

Figure 83. Example of deep pool and habitat diversity caused by large wood

Source: Roger Peters, USFWS

Figure 84. Example of a stream with high wood volume

Source: Gallo et al. 2005

One of the most important factors that can influence fish populations is the quantity of high-quality habitat (Nickelson 2001). The abundance and survival of salmonids is often closely linked to the abundance of large woody debris, particularly during winter (Meehan 1991). In general, streams with high amounts of large wood and complex habitats tend to have more fish species and higher populations than those lacking complexity (Dolloff and Warren 2003). It is generally accepted that improved habitat complexity correlates to improved fish survival and production (Hartman et al. 1996, 237, 243, 248; Reeves et al. 1993, 314; Bustard and Narver 1975, 684, 686; Tschaplinski and Hartman 1983, 452; Murphy et al. 1986, 1526; Hartman and Brown 1987, 262). Researchers have documented an increase in the density of salmon following the addition of wood to stream reaches. Roni (2000) reported a 180% increase during summer and 332% increase during winter in the density of juvenile coho following the addition of wood to 30 streams in Washington and Oregon. Similarly, Cederholm et al. (1997) showed a twentyfold increase in juvenile coho during winter in response to the addition of wood. Reeves et al. (1997) found that the number of steelhead did not increase in response to wood additions but that smolts were significantly larger.

Large wood is delivered to stream channels through a variety of complex ecosystem processes (Benda et al. 2003). The amount of large wood in stream channels is dependant on the amount of trees available on the landscape that can be delivered to a stream channel. Not all areas across the landscape have the potential to deliver trees to stream channels. Large wood source areas are defined as those areas on the landscape that are capable of delivering wood to stream channels, such as:

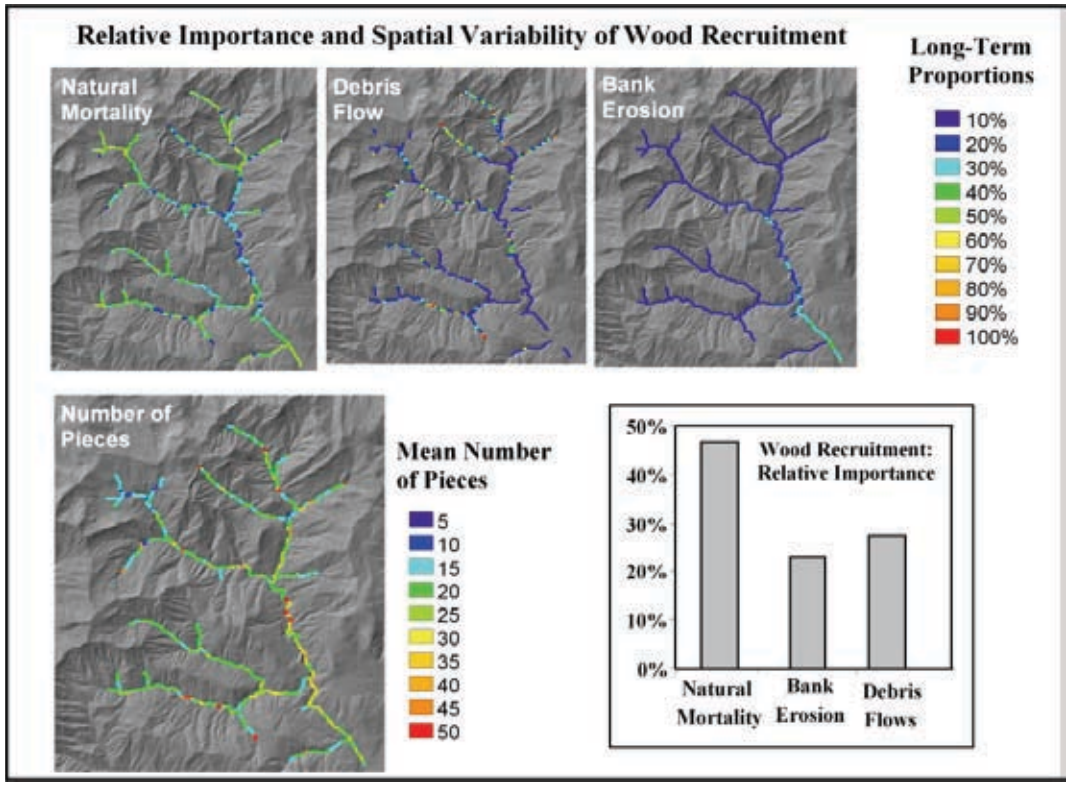
- streamside areas within a distance of one site potential tree height from the channel,
- valley floors and floodplains as streams migrate, and
- landslide and debris-flow prone intermittent channels.

Wood delivered from forests to stream channels occurs from both chronic and episodic events (Naiman et al. 2000).

- **Chronic events.** Events that occur frequently, such as tree mortality along stream banks. Trees eventually fall over, and, if they are close enough to a stream channel, land in the channel (McDade et al. 1990). Trees along stream edges are also undercut as a result of bank erosion and eventually fall into the stream. The majority of wood that falls into stream channels from adjacent forests occurs within a distance of one tree height away from the channel (FEMAT 1993, V-27).
- **Episodic events.** Events that typically occur sporadically and infrequently, such as landslides, debris flows, and floods. Although these events occur infrequently, they can deliver large amounts of wood to stream channels (Bilby and Bisson 1998; Benda et al. 2003; Naiman et al. 2000).

The relative importance of each delivery process varies by province, stream channel, riparian vegetation, position in the landscape, and time (Bilby and Ward 1989). Episodic processes deliver large amounts of wood during infrequent events (windstorms or mass movements), while chronic processes (suppression mortality and bank erosion) consistently provide small amounts of wood over extended time periods. Wind throw, debris flows, landslides, and avalanches are the primary delivery mechanisms in steep headwater channels (Bilby and Bisson 1998). Bank erosion and delivery from upstream sources contributes the majority of large woody debris in larger unconfined channels (Murphy and Koski 1989). See *Figure 85 (Relative importance and spatial variability of wood recruitment processes)* for the relative rates of wood recruitment from each process in the Coast Range province (Reeves et al. 2006).

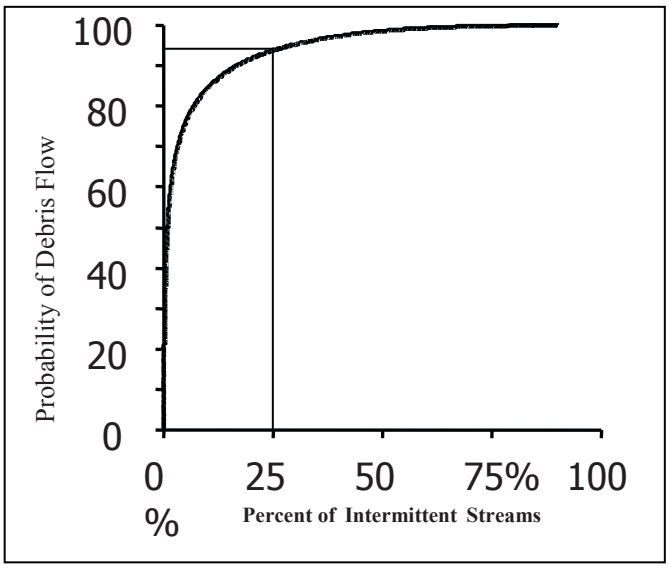
Figure 85. Relative importance and spatial variability of wood recruitment processes



Source: Benda et al. 2003

Headwater streams differ in susceptibility to debris flows. See *Figure 86 (Probability of debris flow from intermittent streams)* for an illustration of intermittent channels that are more likely to deliver large wood to fish-bearing stream channels.

Figure 86. Probability of debris flow from intermittent streams

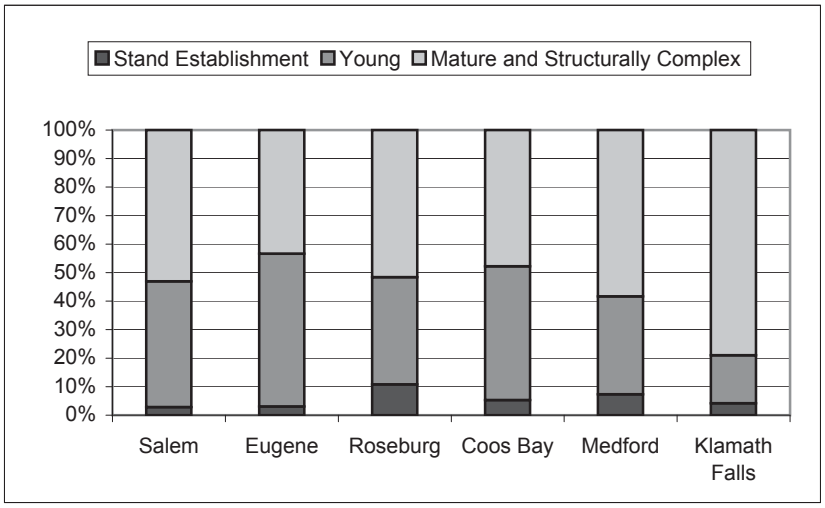


Analysis from the Coastal Landscape Analysis and Modeling Study indicates that a small portion of the headwater stream network is important in producing landslides and debris flows that can provide large wood to streams (Miller and Burnett, in press).

Despite the high variability in the natural levels of large wood in streams, the amount of large wood in rivers and streams within the planning area is currently far outside the historic range and is hindering the recovery of wild salmonids (IMST 1999). Watershed monitoring completed within 55 watersheds in the area of the Northwest Forest Plan in 2004 concluded that large wood levels are below benchmark values in nearly 70% of the sample (Gallo et al. 2005).

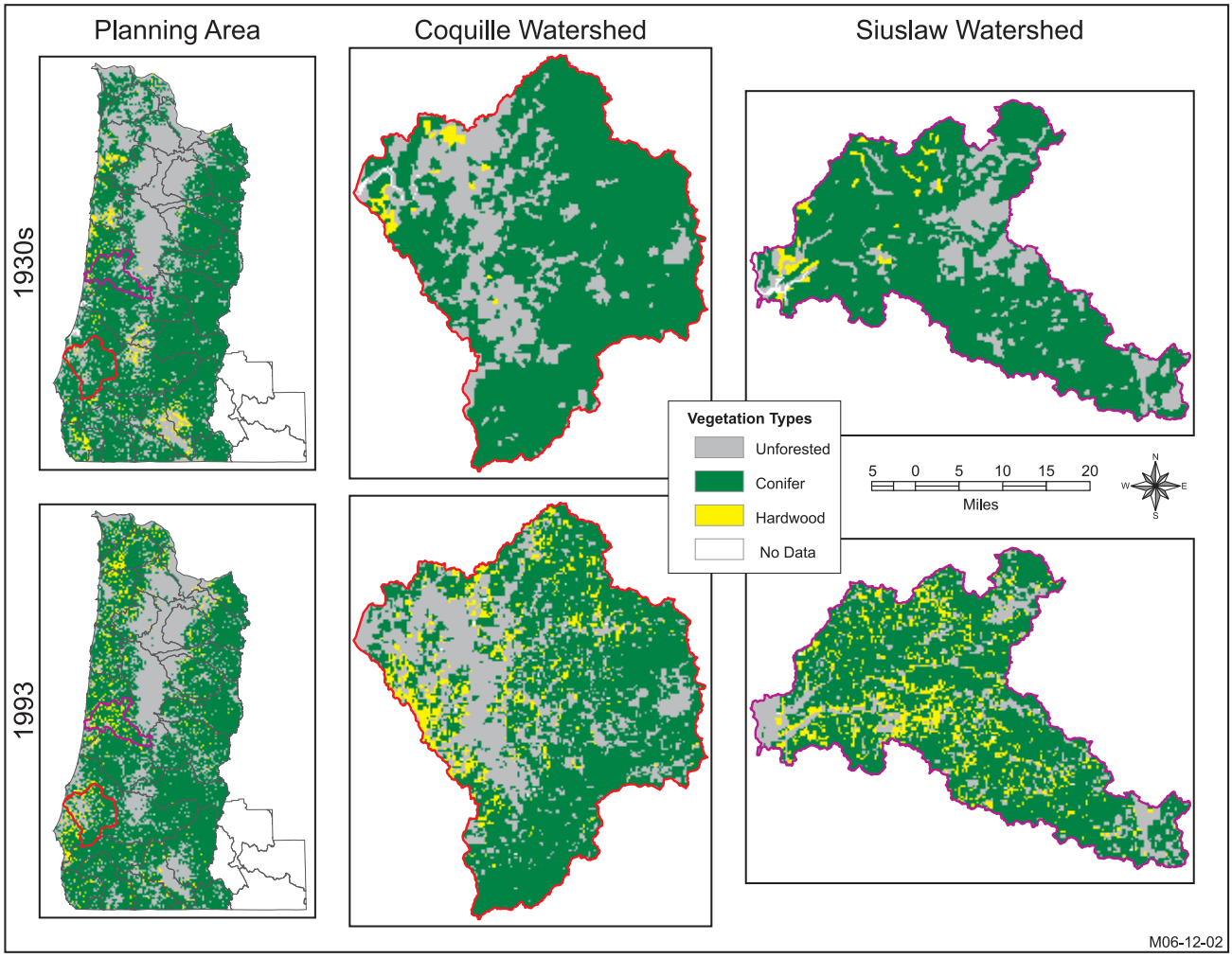
Most riparian areas have been harvested at least once over the last 150 years (Dolloff and Warren 2003), and the trees in the resultant second-growth forests are generally too small to provide large wood to streams. The stand establishment and young structural stage classes generally have few trees greater than 20 inches in diameter. Trees in the mature&structurally complex structural stage class contain trees that are large enough to provide large wood. See *Figure 87 (Current riparian conditions by BLM district)* for the current riparian condition on BLM lands within the planning area. Within the riparian reserves that are allocated under the No Action alternative, 52% are in a mature&structurally complex structural stage class and 48% are in the stand establishment and young structural stage classes.

Figure 87. Current riparian conditions by BLM district



Red alder is an important source of nutrients for macroinvertebrates, and, subsequently, for fish (Romero et al. 2005). However, red alder stands in the Coast Range have increased in abundance since the 1930s (see the *Ecology* section in *Chapter 3*). Large conifer trees must also be available in the stream channel to trap and store the nutrients from the alder input (Findlae et al. 1973). During the same time period that alder have increased in the Coast Range, the amount of large conifers in stream channels and the amount available from riparian areas have declined. A lack of conifers along streams can contribute to simplified aquatic habitat, which is a limiting factor for many listed salmonids. Red alder cannot provide large, persistent stream structure as well as conifers can. Red alder that fall into streams are more likely to be broken down and transported out of the streams than are conifers (Hyatt and Naiman 2001). See *Figure 88 (Changes in western Oregon vegetation types)* for the difference in the abundance of hardwoods in the Coast Range from the 1930s to 1993.

Figure 88. Changes in western Oregon vegetation types

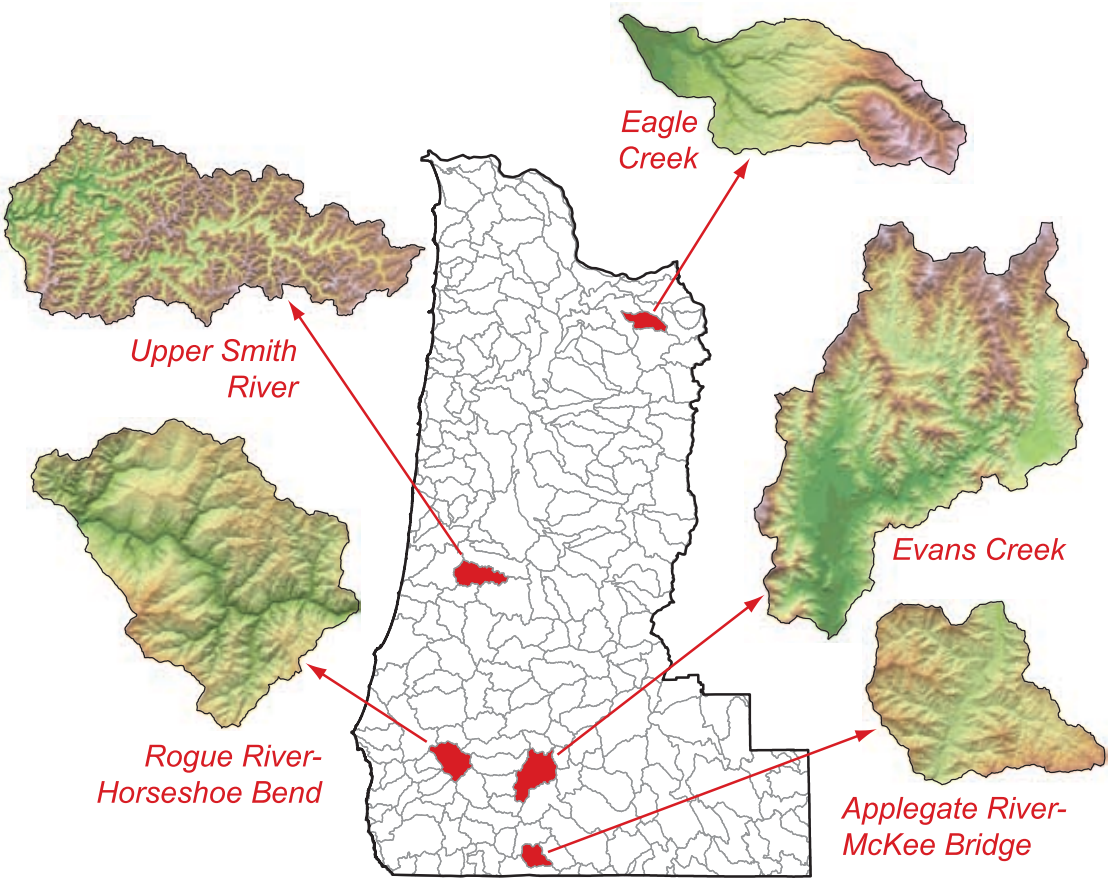


The BLM is rarely the predominant landowner within a fifth-field watershed within the planning area, and therefore the potential for large wood contribution from BLM-administered lands is generally less than from other land owners. To show the typical large wood contribution from BLM and non-BLM-administered lands, fifth-field watersheds were selected that represent a range of BLM ownership patterns and physiographic provinces. Of the 260 fifth-field watersheds within the planning area, 84 have no BLM-administered land. See *Table 107 (BLM land ownership patterns and representative watersheds)* and *Figure 89 (Representative watersheds)* for the range of BLM ownership in the watersheds that have some BLM-administered land and the representative watershed selected for that range.

Table 107. BLM land ownership patterns and representative watersheds

Land Ownership Categories	Watersheds (number)	Representative Watershed (actual percentage of BLM ownership)	Province	BLM District
Less than 1/3 BLM (0 to 33%)	138	Eagle Creek (6%)	Western Cascades	Salem
1/3 to 2/3 BLM (34 to 66%)	30	Applegate-McKee Bridge (34%)	Klamath	Medford
		Evans Creek (41%)	Klamath	Medford
		Upper Smith River (59%)	Coast Range	Coos Bay
Greater than 2/3 BLM (67 to 100%)	3	Rogue-Horseshoe Bend (93%)	Klamath	Medford

Figure 89. Representative watersheds



This analysis uses a large wood model to determine the maximum potential large wood contribution to fish-bearing streams from BLM-administered lands in the representative watersheds. The model uses topographic characteristics from the 10 meter digital elevation models to identify all debris-flow initiation points across the landscape (Benda and Miller 2003; Miller and Burnett, in press). See *Appendix H*. Fish for a complete description of the large wood model.

The model ranks all initiation points by their probability of initiating and transporting a debris flow to a fish-bearing channel. The model calculates a mean annual large wood contribution, which can be used to compare alternatives and can be compared against a maximum potential large wood contribution. The maximum potential large wood contribution is the maximum biological potential of the watershed to provide large wood to streams. It is calculated as the number of pieces of large wood per year that could be delivered to a fish-bearing stream in a fifth-field watershed if all forested acres in the watershed were capable of delivering large wood.

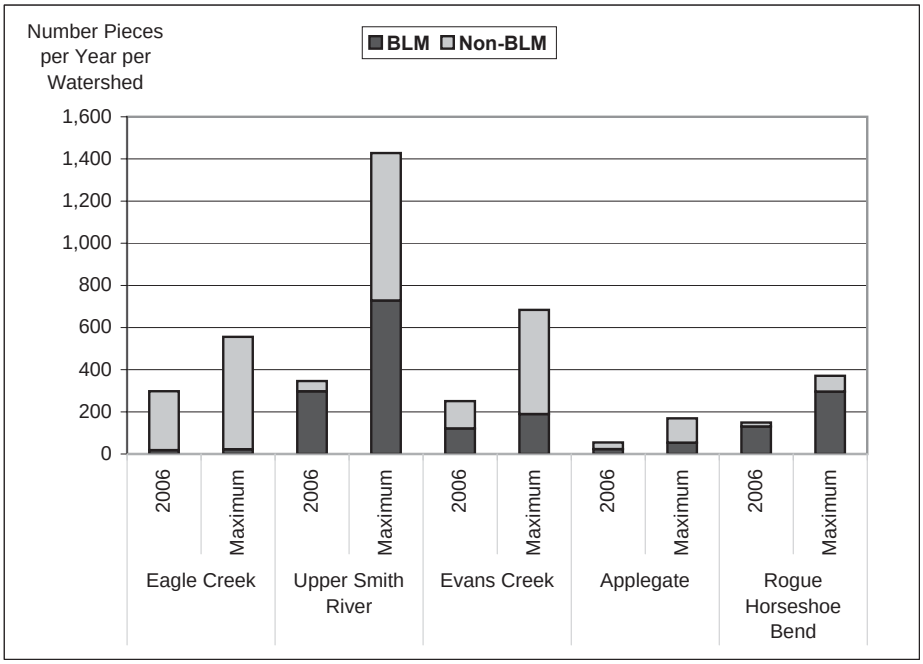
The maximum potential large wood contribution reflects a maximum biological potential, and does not necessarily reflect average historic conditions. The average historic conditions at the province scale ranged from 79% in a mature&structurally complex structural stage class in the Coast Range and Western Cascades provinces to 45% in a mature&structurally complex structural stage class in the Eastern Cascades province (see the *Ecology* section in *Chapter 3*).

However, at the scale of an individual fifth-field watershed, the variability in historic amounts of mature&structurally complex structural stage class would have been extremely high, likely with long periods of time in which the watershed was nearly all in the mature&structurally complex structural stage class (Wimberley et al. 2000). These periods of time in which a fifth-field watershed would be nearly all in the mature&structurally complex structural stage class, which would correspond to the maximum large wood contribution calculated in the model, would represent the maximum potential for large wood delivery.

Periodic large disturbance events, such as wildfires, large storms, and the subsequent floods, hillslope failures, landslides, and debris flows, would deliver large wood to stream channels and alter the structural stage abundance of the forest. Delivery from disturbance events when the watershed would be nearly all in the mature&structurally complex structural stage class would provide accumulations of large wood in streams that would last longer than it would take the watershed to return to the mature&structurally complex structural stage class after the disturbance.

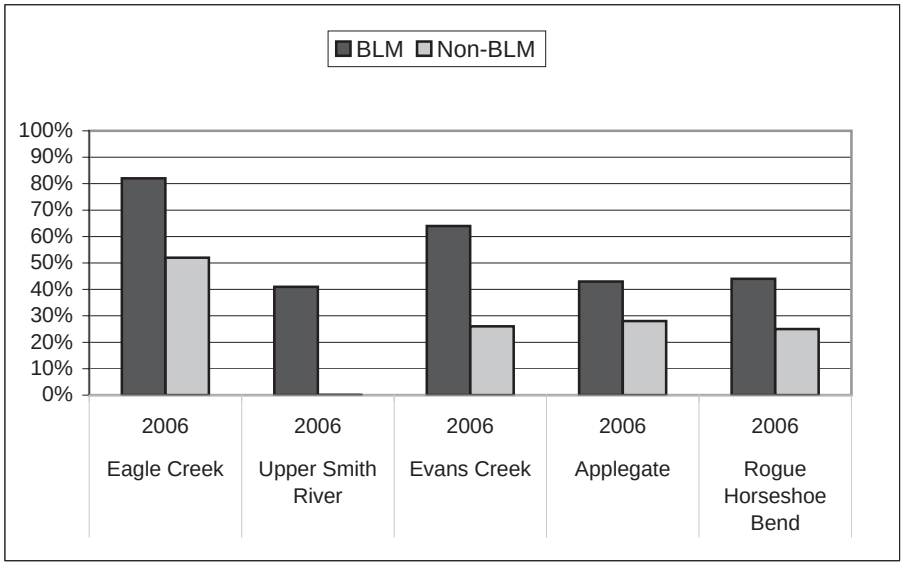
The model output of mean annual large wood contribution is not a prediction of actual instream conditions at a specific point in time. The mean annual large wood contribution cannot be directly compared to large wood benchmarks that have been developed by the Oregon Department of Fish and Wildlife. The mean annual large wood contribution represents a potential contribution to instream wood based on forest conditions over time, whereas the large wood benchmarks are based on actual reference instream conditions. The model cannot predict actual instream conditions, because large wood input is episodic (delivery events are stochastic and unpredictable) and cumulative (large wood accrues over time). Therefore, this analysis summarizes large wood contribution in terms of the proportion of the maximum potential large wood contribution instead of a comparison with large wood benchmarks. See *Figure 90 (Current and maximum large wood contribution by ownership)* for the current mean annual large wood contribution and the maximum potential large wood contribution.

Figure 90. Current and maximum large wood contribution by ownership



In all representative watersheds, the current large wood contribution is lower than the maximum potential, because not all forests that are capable of delivery to streams are currently in the mature&structurally complex structural stage class. See *Figure 91 (Proportion of current large wood contribution compared to maximum potential)*. The proportion of current large wood contribution from BLM-administered land compared to the maximum potential from BLM-administered land varies widely (e.g., from 37% in Upper Smith River to 85% in Eagle Creek). In each watershed, the proportion of current large wood contribution of the maximum potential is higher on BLM-administered lands than non BLM-administered lands, which varies from 1% in Upper Smith River to 57% in Eagle Creek.

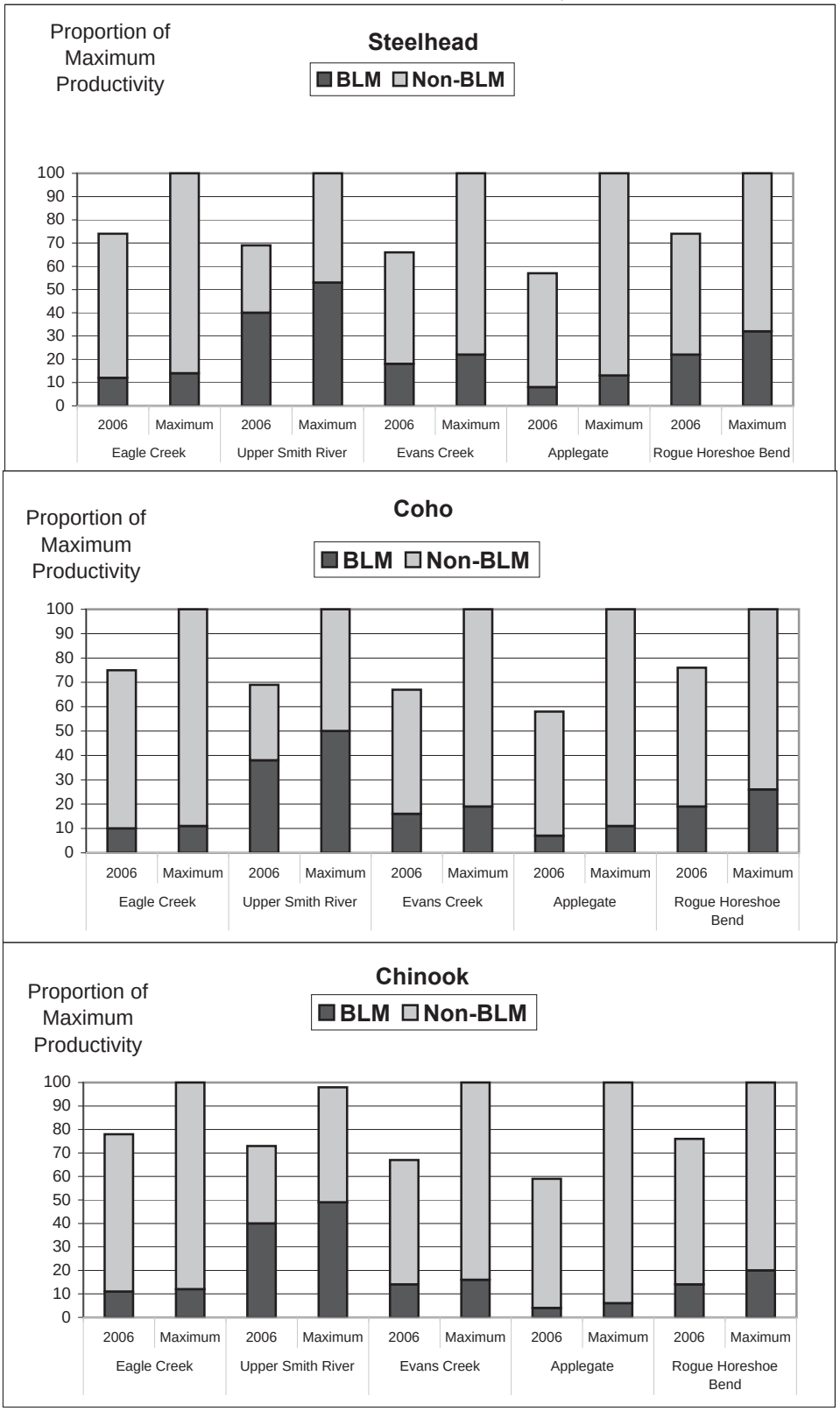
Figure 91. Proportion of current large wood contribution compared to maximum potential



In order to determine how the large wood contribution effects fish productivity, a fish productivity index approach was developed for this analysis. The analysis uses the mean annual large wood contribution to determine fish productivity using a population model developed for coho salmon by Lawson et al. (2004). This modified model provides the best information to evaluate the effects of large wood on fish productivity in the absence of species-specific population models. The linkage of mean annual large wood contribution with the fish population model allows for comparative analysis of the effects of the alternatives. However, it is an index and is not a prediction of the absolute population numbers and should be interpreted with caution, because other limiting factors for listed species, such as ocean conditions, fish harvesting, and hatcheries, continue to influence populations.

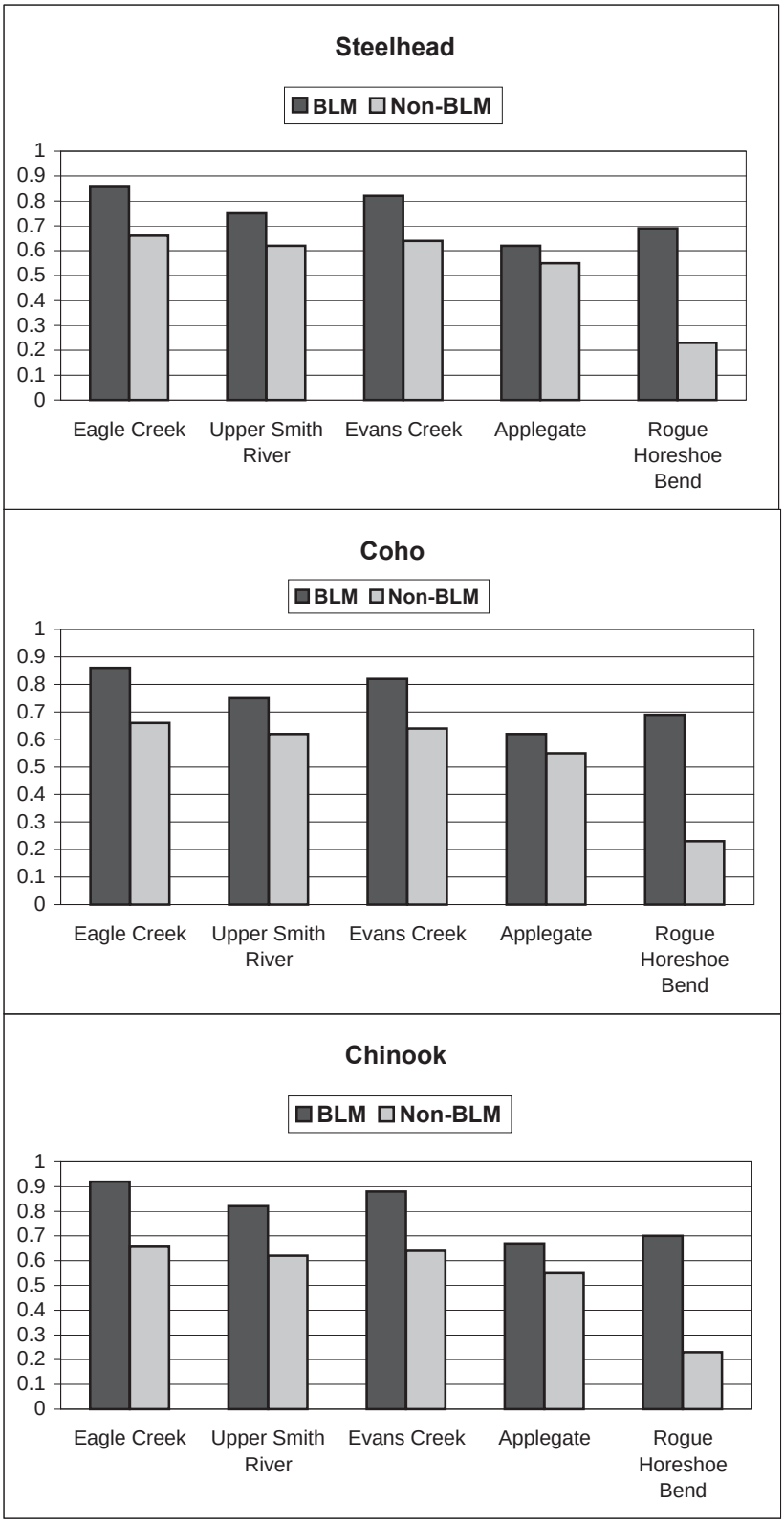
For this analysis, the fish population model is modified to be dependant on large wood contribution. For each watershed, the fish productivity index is estimated based on the surface area of the available stream habitat weighted by the intrinsic habitat potential value. The intrinsic habitat potential is based on topographical attributes of each stream reach including valley width, channel width, and channel gradient. This provides a comparison of potential fish production between BLM and other ownerships. As the proportion of the large wood contribution changes compared to the maximum potential large wood contribution, the fish productivity index would be modified based on the proportion. See *Figure 92 (Current and maximum potential fish productivity index)* for the current potential fish productivity from BLM-administered lands and non-BLM-administered lands compared to the maximum potential fish productivity for each watershed.

Figure 92. Current and maximum potential fish productivity index



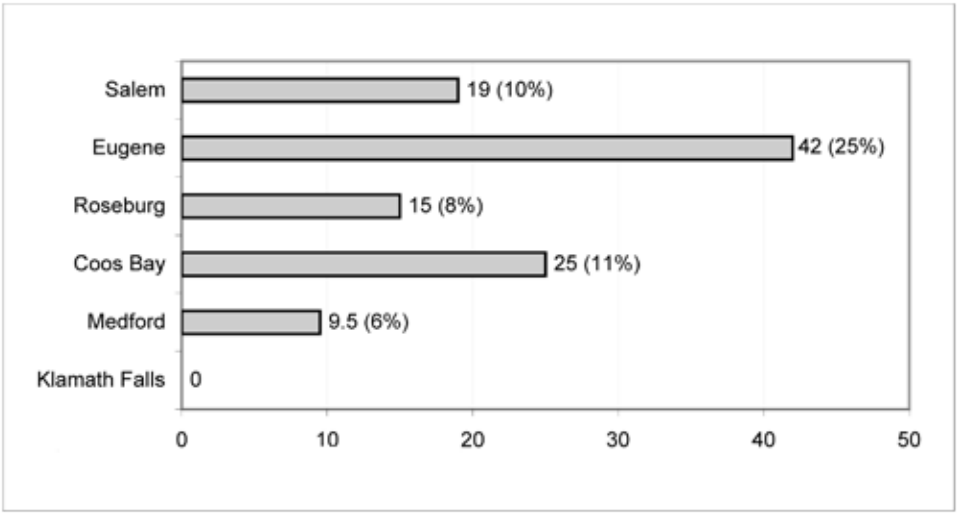
In all of the representative watersheds, the current potential fish production is below the maximum potential fish production. See *Figure 93 (Proportion of current fish production compared to the maximum potential)*. Unlike the mean annual large wood contribution, the current fish production on non-BLM-administered lands is higher than on BLM-administered lands in Eagle Creek partly because non-BLM-administered lands include most of the high intrinsic potential streams in the watershed.

Figure 93. Proportion of current fish production compared to the maximum potential



Since 1995, the BLM has implemented instream habitat projects on 110 miles of streams with anadromous and listed fish within the planning area to improve stream complexity. See *Figure 94 (Miles of treated anadromous or listed fish streams by the BLM districts within the planning area)* for the total stream miles that have been treated by the BLM districts within the planning area and the percent treated of the total miles of anadromous or listed fish-bearing streams.

Figure 94. Miles of treated anadromous or listed fish streams by the BLM districts within the planning area



* Percentages are based on total "known" anadromous and/or listed fish stream miles that need in-stream treatment

Sediment

Streamside vegetation provides organic matter to stream channels when leaves, needles, and woody debris fall into the stream channel. The supply of organic material determines the amount of food produced for fish species in forested ecosystems. The effectiveness of riparian forests to deliver leaf and other particulate organic matter declines at distances that are greater than approximately one-half a tree height (59 to 112 feet) away from the stream channel (FEMAT 1993, V-27). The input and processing of organic material is better served by a heterogeneous landscape with varying amounts of forest cover, species composition, and age classes than by the creation of a single forest type across the landscape (IMST 1999). It is unknown what is the current condition and thresholds for the amount of organic input that would be adequate to maintain food supplies for fish.

There are 27 miles of stream listed by the Oregon Department of Environmental Quality as turbidity impaired that occur on BLM-administered lands. Fine sediment was measured in 55 sample stream channels as part of the watershed monitoring that was completed for the Northwest Forest Plan 10-year review in 2004. Sediment levels in nearly 64% of the sampled reaches were considered low (less than 11% embeddedness) and were not reducing fish-spawning or rearing habitat.

Fine sediments (sand, silt, and clay at less than 2 mm) enter and leave river channels naturally, but increased suspended sediment (turbidity) and sedimentation (embeddedness) can adversely affect fish (Anderson et al. 1996).

Increased concentrations of suspended sediment can have direct effects on fish behavior, physiology, and growth (Anderson et al. 1996). Sigler et al. (1984) found that turbidities of 25 nephelometric turbidity units caused a reduction in juvenile steelhead and coho growth. Fish may avoid high concentrations of suspended sediment and at lower concentrations cease feeding (Hicks et al. 1991). Bisson and Bilby (1982) found that juvenile coho salmon avoided water with turbidities that exceeded 70 nephelometric turbidity units.

Increases in sedimentation or embeddedness can reduce fish-spawning and rearing habitat, fish egg and fry survival, and food availability (Chamberlin et al. 1991; Hicks et al. 1991). Infiltration of fine sediment can reduce fish emergence from spawning beds. Generally, fine sediment levels that exceed 20% of the stream bed are considered detrimental to fish species (Everest et al. 1987; USDC, NOAA, NMFS 1997; Shelton and Pollock 1966; Cooper 1977). Cederholm et al. (1981) documented up to a 3.4% decrease in fish survival for each 1% increase in fine sediment.

The timing of the sediment inputs relative to the biological vulnerability of each fish species is more important than the absolute quantity of sediment. In most streams, there are periods when the water is relatively turbid, and this sediment is generally mobilized during large storms (Everest et al. 1987). Larger juvenile and adult salmonids and trout species appear to be little affected by ephemerally high concentrations of suspended sediments that occur during most storms (Cordone and Kelley 1961; Sorenson et al. 1977). If sediment is introduced to streams in the absence of a runoff event, then sediment deposition may create localized adverse impacts (Everest et al. 1987). The tolerances of fish species to sediment vary seasonally. For example, Noggle (1978) demonstrated that the tolerance of juvenile coho salmon to suspended sediment was highest in the fall when increased suspended sediment normally occurs in streams.

There is no model that can predict the exact mechanism of sediment delivery and instream routing. Therefore, it is not possible to quantify or accurately predict the affects that sediment delivery has on fish species. Fish species have the ability to cope with some level of sediment at various life stages. However, thresholds beyond which impairment occurs in the field have not been established, despite scientific efforts to quantify the relationship between fine sediment and fish species. This analysis assumes that a 3.4% decrease in fish survival could potentially occur for every 1% increase in fine sediment from management activities. This may be an overestimate of the actual effects to fish species, because:

- Fine sediment can be cleaned from the stream bottom gravel by scouring during peak flows. High velocity flows tend to carry sediment rapidly out of the drainages, particularly in the Coast Range province. Within the planning area, the amount of fine sediment stored and routed through stream channels is highly variable, and some aquatic systems may function with high background

levels of fine sediment. For example, in Evans Creek, a tributary to the Rogue River, a viable salmonid population exists even though the stream has a high sediment load.

- Spawning salmonids can improve their chances of reproductive success through behavioral adaptations (Everest et al. 1987). During redd construction (e.g., digging nests in the stream bottom) fish can remove large amounts of fine sediments from the gravel (Everest et al. 1987). Everest, Meehan, and Lotspeich found that chinook salmon in Evans Creek reduced fine sediments from 30% prior to spawning to 7.2% after spawning. Secondly, when a female salmonid has completed spawning and burying eggs, the redd is left with a large pit on its upstream perimeter and a mounded tailspill downstream that contains the eggs. The pit acts as a natural settling basin for fine sediments and may capture up to 0.25 cubic meters of sediment before they reach the tailspill where the eggs are buried (Everest et al. 1987).

Temperature

The water temperature in streams can affect the biological cycles of fish. See *Table 108 (Temperature standards for fish species)* for the temperature standards for several species within the planning area (ODEQ 2004).

Table 108. Temperature standards for fish species

Species	**7-Day Average Maximum Temperature Standard** (degrees Fahrenheit (°F))
Bull trout spawning and juvenile rearing	53.6
Lahontan cutthroat trout or redband trout	68.0
Salmon and steelhead spawning	55.4
Salmon and trout rearing and migration, shortnose and Lost River suckers	64.4

When stream temperatures rise above these levels fish become stressed. Food availability can decrease and the ability of fish to absorb oxygen decreases. There are currently 569 stream miles on BLM-administered lands (4% of all listed stream miles in Oregon) that are listed by the Oregon Department of Environmental Quality for temperature.

Stream Flow

Stream flow is an important element of fish habitat. Stream flow is highly variable in mountainous areas within the planning area and is strongly influenced by the form of precipitation (e.g., rain, snowmelt, or rain on snow) (Naiman and Bilby 1998). For fish species, flow affects many components of the aquatic system including:

- migration
- rearing
- sediment routing and deposition

The 2-year, 24-hour peak flow is typically the channel-forming flow for streams in mountainous areas within the planning area (Lisle 1981). When 5-year flows begin to occur at the 2-year, 24-hour interval, stream channels become unstable and streambank erosion increases (Harr 1992).

Water

Key Points

- Watersheds and subwatersheds (10 to 200 square miles) are the most relevant scale to include in the range of stream development and to describe hydrologic processes and the cumulative effects of forest management.
- The BLM typically manages only a small percentage of the land and streams within any particular fifth-field watershed.
- Streams that occur on BLM lands are mostly smaller, headwater streams that are important to determining the condition of larger streams and rivers.
- Stream temperature is the most common 303(d) water quality listing on BLM lands.
- Landsliding and road runoff are the primary routes of sediment delivery to stream channels.
- Changes to peak flows may occur through the removal of forest vegetation and the changes to infiltration and runoff caused by forest roads. Current studies indicate that forest management and road building interactions are complex, but generally have little to do with enhancing peak flows at a fifth-field watershed scale.

There are 143,044 miles of streams and rivers within the planning area. See *Table 110 (Miles of streams with BLM ownership within the planning area)*. They occur in a variety of landscapes from coastal rain-influenced streams to snowmelt-influenced streams in the Cascades Mountains and in eastern Oregon near Klamath Falls. Within this distribution, there are 20,407 miles of streams and rivers and 218,199 acres of lakes, ponds, and wetlands on BLM land. These water features support aquatic ecosystems under varying conditions according to past disturbance, topography, geomorphology, elevation, and physiographic province.

Large river basins are a mosaic of smaller watersheds linked by stream, riparian, and subsurface networks. Within basins, links among headwater tributaries and downstream channels are important paths for water, sediment, and disturbances.

The causes of changes to hydrologic processes include the removal of forest vegetation and changes to infiltration and the flow of surface and subsurface water. Changes in hydrologic processes are manifested in such water quality parameters as temperature, sediment, and water quantity.

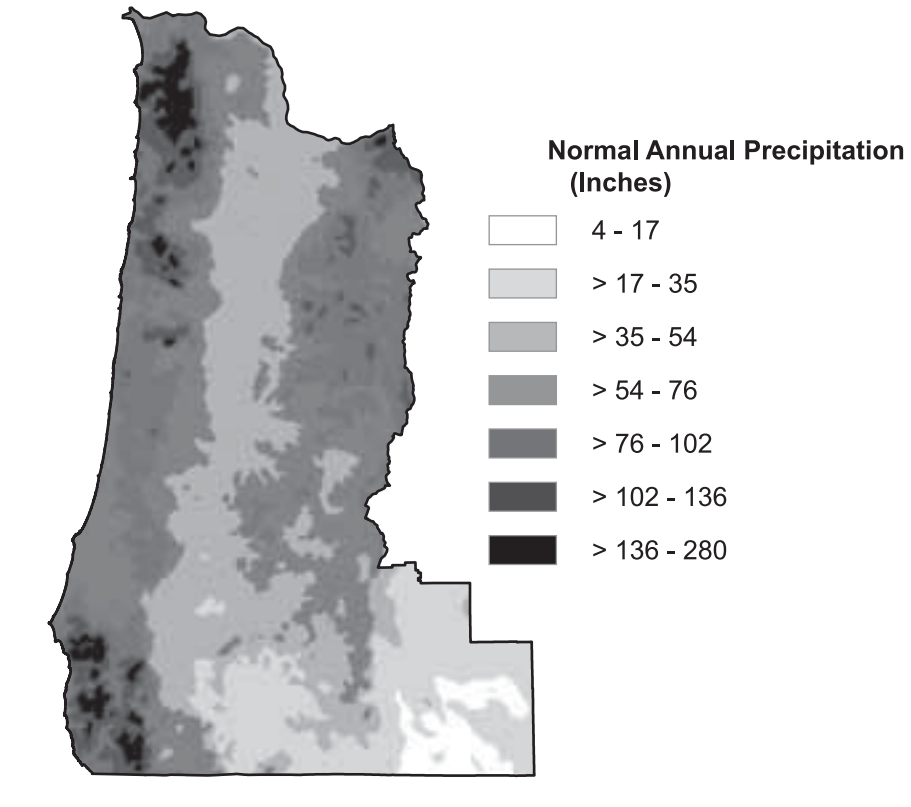
Hydrologic features, including stream patterns, stream density, stream relief, stream bed and bank characteristics, and natural streamflow response, vary by physiographic province (FEMAT 1993, Appendix V-G). Riparian vegetation community types also reflect differences in geology, landforms, aspect, soil mineralogy and development, and influencing hillslope processes.

Climate factors, such as precipitation and temperature, interact with physiography to provide the setting for hydrologic processes and disturbance events.

There is great variation in the precipitation and temperature regimes within the planning area. See *Figure 95 (Normal annual precipitation)*. Typically, moisture-laden maritime fronts move onshore from the west. As these fronts move east they drop moisture as they encounter mountains. Temperatures vary with proximity to the ocean, changes in elevation, and latitude.

- The Coast Range provide intense rapid lift and receive annual precipitation depths varying from 40 to greater than 180 inches. Heavy precipitation amounts, combined with steep landforms, concave headwalls, thin soils, weak bedding planes, and weathering contribute to high landslide frequency. Snowfall seldom occurs in the Coast Range but, when it does, it is usually transitory and above 2,000 feet of elevation.
- The Willamette Valley has less precipitation because storm fronts have dropped much of their moisture as they moved over the Coast range. The mildness of the Willamette Valley and other western Oregon inland valleys causes snow to be rare even though moisture is relatively abundant.
- The western Cascades Mountains and eastern Cascade Mountains see an increase in precipitation as fronts gain moisture because they move over the valley. In the Cascade Mountains, temperatures are lower and moisture is still abundant, so snow is more frequent. Intermittent snow accumulation occurs in the western Cascade Mountains between 1,500 to 3,500 feet in the north and 2,000 to 4,500 feet in the south. Winter snow pack occurs in the eastern Cascade Mountains.
- Once over the Cascade Mountains, precipitation diminishes rapidly to less than 15 inches on the eastern edge of the planning area near Klamath Falls. Eastern Oregon receives a significant percentage of its winter precipitation in the form of snow, although the lower annual precipitation makes the actual snowfall amounts much lower than in the Cascade Mountains.

Figure 95. Normal annual precipitation



A drainage basin is an area of land that catches precipitation that falls within its perimeter, and moves the precipitation down slope as surface or subsurface flow under the influence of gravity to a creek, stream, or river, until the water drains into an ocean.

Hydrologic units (HUC) are a way of classifying drainage basins (Seaber et al. 2007) so as to nest them into a multilevel hierarchical drainage system.

- The largest hydrologic unit of classification divides the nation into 21 major geographic regions with an average size of 177,000 square miles. These geographic areas contain either the drainage area of a major river or the combined drainage areas of a series of rivers.
- The smallest hydrologic unit is called a subwatershed with a size range of 10 to 40 square miles in size.
- An intermediate unit is called a watershed. They are generally 20 to 200 square miles in size. There are 260 watersheds in the plan area. Of these, 176 watersheds contain BLM ownership.

See *Table 109 (Major river basins within the planning area)* for the major river basins within the planning area and the number of BLM watersheds within each basin province.

Table 109. Major river basins within the planning area

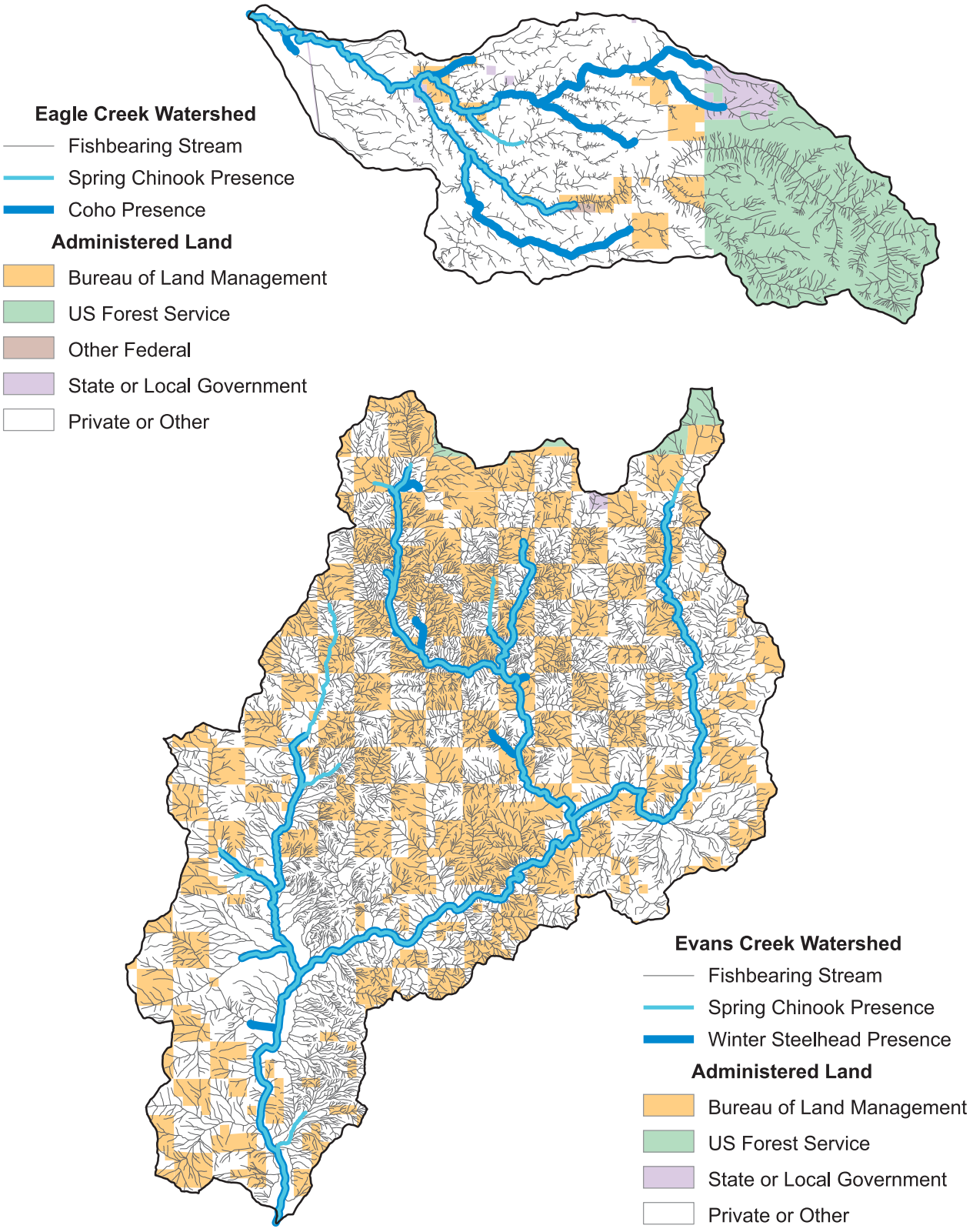
Hydrologic Unit Code (HUC)	**River Basin**	**Total Area** (square miles)	**Proportion within the Planning Area**	**Number of Watersheds**
170800	Lower Columbia: The drainage into the Pacific Ocean including downstream tributaries including the Sandy River (Oregon)	6,250	22%	24
170900	Willamette	11,400	12%	48
171002	Northern Oregon Coastal: The drainage into the Pacific Ocean from the Columbia River Basin boundary to the Umpqua River Basin boundary	4,312	100%	34
171003	Southern Oregon Coastal: The drainage into the Pacific Ocean from and including the Umpqua and Rogue River basins to the Smith River Basin boundary (California and Oregon)	12,582	100%	72
180102	Klamath: The Klamath River Basin (California and Oregon)	15,500	32%	23

Dunne et al. (2001) have proposed that watersheds and subwatersheds are the most relevant for describing hydrologic processes and the effects for cumulative watershed effects analysis.

- Geographic areas must be large enough to capture an assemblage of small source areas within mountainous terrain with varying forest environments. These headwater source areas contribute to a range of stream channels from juvenile steep gradient channels that are confined by hillslopes to more well-developed, low-gradient alluvial types with associated floodplains (Montgomery and Buffington 1997). Typically, the watershed scale is necessary to typify the complexity of stream development.
- In mountainous areas, streams gain size in a downstream direction and become perennial at a high enough watershed area and difference in relief where the water table stays above the surface.
- Downstream mainstem streams at the lower end of watersheds are normally low gradient, except for geologic disconformities, and are the receptors of the combination of nonpoint source pollution (e.g., temperature and sediment) that are associated with management activities. Typically, within the planning area, these mainstem streams involve less than 40% of the total stream network and are in areas where a cumulative effect upon water would occur.

The BLM typically manages only a small percentage of the land and stream miles within any particular watershed. See *Figure 96 (Contrasting BLM ownership in the Evans Creek and Eagle Creek watersheds)*. The combined actions across all ownerships determine the total impacts to the physical, chemical, and biological condition of downstream rivers. The intermingled land ownership pattern within the planning area can also make it difficult to separate out the amount of impact caused by any particular owner.

Figure 96. Contrasting BLM ownership in the Evans Creek and Eagle Creek watersheds



Stream type and size are important because:

- BLM lands are more heavily concentrated in headwaters, typified by small, typically steep gradient high-energy streams.
- Forest roads cross small streams more frequently, which are potential sediment delivery points.
- Many small streams on BLM lands do not flow continuously by late summer.
- Small streams are important in determining the condition of larger streams and rivers.
- Floodplains are associated with larger streams.
- The BLM often manages a small percentage of the riparian areas along larger streams.

See *Table 110 (Miles of streams with BLM ownership within the planning area)* for the miles of streams within the planning area by stream periodicity. See *Table 111 (Stream type descriptions)* for the primary stream type descriptions and their relative proportion within the planning area.

Table 110. Miles of streams with BLM ownership within the planning area

Stream Periodicity	Planning Area Streams (miles)	BLM Streams (miles)	BLM Stream Miles (%)
Perennial[a]	57,626	6,728	12
Intermittent[b]	85,418	13,679	16
Totals	143,044	20,407	14

[a]Perennial streams have varying but continuous discharge year round. Their base level is at or below the water table.

[b]Intermittent streams have a dry period, which is normally for three months or more. Their base level is above the water table.

Table 111. Stream type descriptions

Primary Stream Types	Gradient (feet/feet)	Confinement	Valley Bottom Type	Relative Proportion within the planning area
Cascade	> 20%	Confined	None	60%*
Steep	4 to 20%	Confined	None	
Step-pool	2 to 3.9%	Moderately confined	None or narrow ,and occasional floodplain feature	40%
Pool-riffle	< 2%	Unconfined	Narrow to wide and floodplains present	
Braided	< 4%	Unconfined	Wide and floodplains present	
Flat	< 2%	Confined	Narrow to wide	

*ODEQ estimates 85% in this category for 1 to 3 order streams (ODEQ 2004b).

Water Quality

High-quality water is essential for consumptive use and survival, growth, reproduction, and the migration of individuals that comprise aquatic and riparian communities (FEMAT 1993, V-14). This includes an abundance of cool (generally, less than 68°F), well-oxygenated water that is present at all times of the year, and is also free of excessive amounts of suspended sediments (Sullivan et al.1987) and other pollutants (Cordone and Kelley 1961; Lloyd et al. 1987).

The Clean Water Act (§ 101(a)) was intended to restore and maintain the physical, chemical, and biological integrity of the nation's waters. The Oregon Department of Environmental Quality is responsible for developing water quality standards and determining where there is impairment of Oregon's streams and lakes as outlined in DEQ's 2004/2006 integrated report. By agreement with the Oregon Department of Environmental Quality, the BLM is recognized as a designated management agency for implementing the federal Clean Water Act (as amended by the Water Quality Act of 1987) on BLM-administered lands in Oregon. This includes the selection of appropriate best management practices to maintain water quality for the variety of ongoing forest activities.

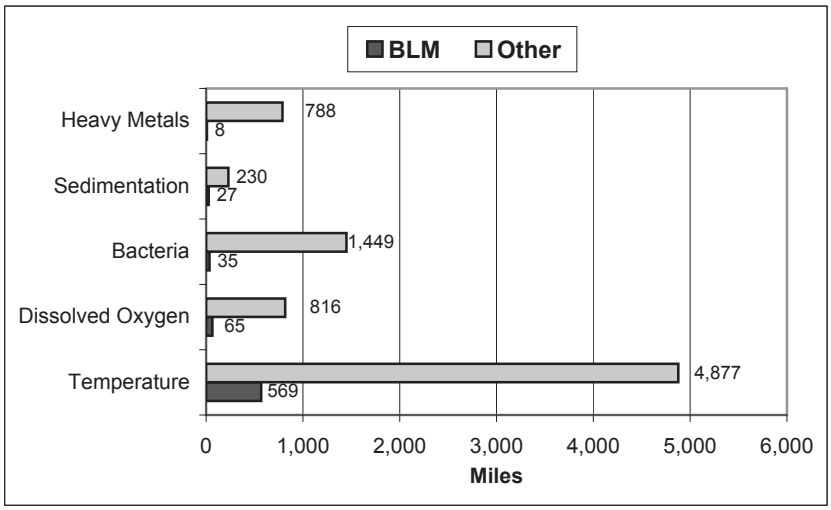
Of the 143,044 miles of streams and rivers within the planning area, there are 10,611 miles of streams within the planning area that are listed as impaired (303(d) listed) for at least one water quality measure. Of these, 704 miles (7%) occur in watersheds with BLM ownership. See *Table 112 (Miles of BLM streams on the Oregon Department of Environmental Quality 303(d) list)* and *Figure 97 (303(d) Listed Streams in the Plan Area)*. The most common listing on BLM lands is for water temperature.

Table 112. Miles of BLM streams on the Oregon Department of Environmental Quality (ODEQ) 303(d) list

ODEQ 303(d) Listing	Stream Impairment Identified on BLM Streams (miles)	Affected BLM Fifth-Field Watersheds (number)
Temperature	569	81
Dissolved Oxygen	65	23
Bacteria	35	17
Sediment	27	5
Heavy Metals	8	2

Note: Based on ODEQ's 2002 303(d) list.

Figure 97. 303(d) listed streams within the planning area



Stream Temperature

Highly shaded streams often experience cooler stream temperatures due to the reduced input of solar energy (Brown 1969; Beschta et al. 1987; Holaday 1992; Lee et al. 2004). Increased stream temperatures can result from the removal of shade-producing riparian vegetation along fish-bearing streams and along smaller tributary streams that supply cold water to the fish-bearing streams (Beschta et al. 1987; Bisson et al. 1987).

The key factors that produce highly shaded streams include:

- The trees that are closest to a stream channel, including overhanging branches, provide the most shade.
- Narrower riparian areas with closely spaced trees have nearly the same shading effect as wider riparian areas with broadly spaced trees.
- There is little shade gained from trees that are more than 100 feet away from a stream's edge.
- The majority of riparian forests that are along perennial streams on BLM land are 40 to 150 years of age, and so are tall enough to offer shade.

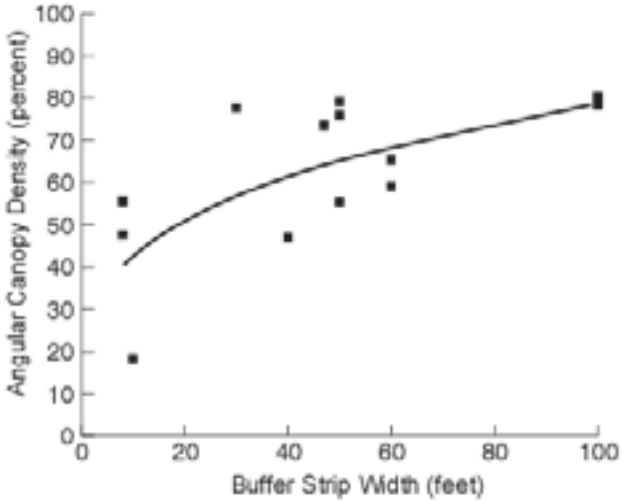
Stream morphology, flow, climate, and geographic location also influence stream temperature.

Solar radiation is the most important source of radiant energy affecting stream temperature (Brown 1969; Beschta 1997). Effectiveness of streamside vegetation to provide shade varies with geomorphology, topography, orientation, extent of canopy opening above the channel, and forest structure (USDA, USDI 2005b).

Forest trees near stream channels and dense stands can block solar radiation and cast shadows across the stream. Angular canopy density is the measure of canopy closure as projected in a straight line from the stream surface to the sun,

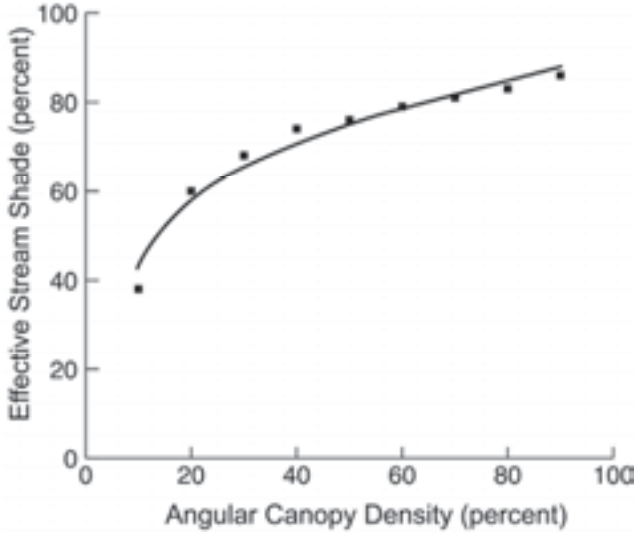
as it varies through the day. The angular canopy density value for a given buffer depends on the spacing of forest crowns. As vegetation becomes more open through wider spacing, more width of vegetation is needed to achieve the same angular canopy density for the similar vegetation with closer spacing. Higher angular canopy density is achieved with lower sun angles and higher canopy density. See *Figure 98 (Angular canopy density and buffer widths for small streams within the planning area)* (Brazier and Brown 1972) for how angular canopy density varies with riparian area width.

Figure 98. Angular canopy density and buffer widths for small streams within the planning area



Angular canopy density is also related to the effective stream shade. See *Figure 99 (Angular canopy density and stream shade)* (Park 1991).

Figure 99. Angular canopy density and stream shade



Effective shade is the total solar radiation blocked from reaching the stream over a 24-hour period (USDA, USDI 2005b).

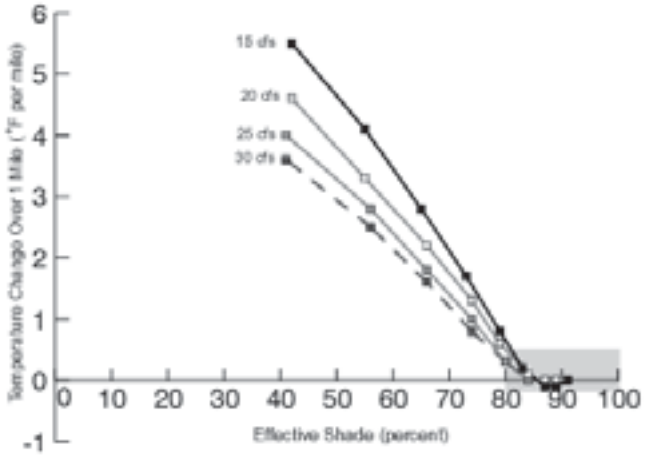
Effective shade is defined as:

$$\frac{\text{Total Solar Radiation} - \text{Total Solar Radiation Reaching the Stream}}{\text{Total Solar Radiation}}$$

Effective shade is influenced by slope steepness, vegetation species composition, tree height vegetation density, tree distance from the stream bank, and stream width. Thus, although riparian vegetation is a physical barrier between the stream and incoming solar radiation, only a portion of the riparian canopy contributes to effective shade (USDA, USDI 2005b). The relationship and interplay of the variables that affect effective shade can be simplified, to some degree, using geometry and computer models that simulate shade (Boyd 1996; Park 1993).

See *Figure 100 (Stream shade and change in water temperature)* for an illustration of the results of modeling to represent the downstream change in water temperature relative to effective shade (USDA, USDI 2005b). The figure illustrates that as effective shade increases beyond 40% there is a corresponding reduction in stream temperature to a point (e.g., approximately 80%) beyond which further reduction in stream temperature as a function of shade is not measurable (Boyd 1996). Furthermore, as was shown in *Figure 100,* for this 80% effective shade level, there is marginal improvement in shade for riparian areas wider than 100 feet, because the variables of total solar radiation reaching a stream is diminished by the blocking ability of a tree's canopy.

Figure 100. Stream shade and change in water temperature



One way these riparian management areas can be described is by assigning average primary and secondary shade zone distances. See *Table 113 (Shade zones)* for the primary and secondary shade zone distances of riparian trees as a function of tree height and slope steepness.

The period of greatest solar heating occurs between 10 AM and 2 PM. Vegetation that intercepts solar radiation between these hours is critical for providing stream shade (USDA, USDI 2005b). This vegetation constitutes the primary shade zone. During the morning and afternoon hours, trees outside the primary shade zone can also provide stream shade (USDA, USDI 2005b). This area is referred to as the secondary shade zone. See *Figure 101 (Relationship of primary and secondary shade zones)* for an illustration of these two shade zones (USDA, USDI 2005b).

Figure 101. Relationship of primary and secondary shade zones

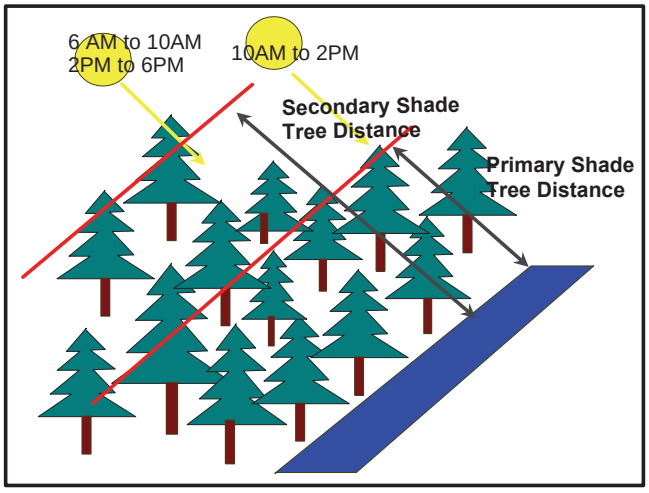


Table 113. Shade zones

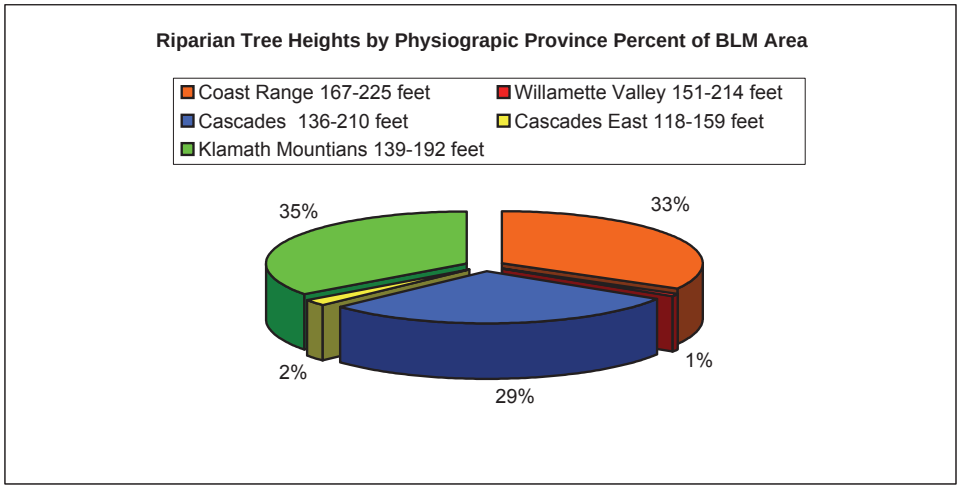
Shade Zones	Height of Riparian Tree	Shade Zone Distance from Edge of Stream		
		Slope < 30%	Slope 30 to 60%	Slope > 60%
Primary	< 20 ft.	12 ft.	14 ft.	15 ft.
	20 to 60 ft.	28 ft.	33 ft.	55 ft.
Secondary	> 60 to 100 ft.	50 ft.	55 ft.	60 ft.

Source: USDA, USDI 2005b

Site potential tree heights vary among tree species with mature conifers being substantially taller than mature hardwoods. Soil quality, aspect, elevation, and physiographic province are also important in determining site potential tree height capability. See *Figure 102 (Riparian tree heights by physiographic province and percent of BLM area)* for the range of tree heights for site potential conifers by each physiographic province within the planning area.

Both the young and mature structural stage classes of forests have tree heights and crown areas that provide effective shading. This is because the tree heights are tall enough to cast shadows from 20 to 100 feet and the stand density is normally higher than in older forests. Higher density leads to greater sun blocking ability and greater shade quality. Forests provide the most shade when tree crowns grow closed and somewhat less shade through stand competition and individual tree mortality as the trees mature over time.

Figure 102. Riparian tree heights by physiographic province and percent of BLM area



Disturbance plays an important role in the ecology of riparian forests. Climate variation, windstorms, landslides, floods, and insect and disease infestations are normal disturbance agents within the planning area. Natural fire has been suppressed during the last century and human-caused (prescribed) fire interacts with the landscape in different ways. These small and large disturbances over time have influenced the trajectory of forest stands. The historical percentage of old growth forest at a given time within the planning area ranged from 35 to 80% (Agee 1993).

The composition and pattern of riparian forestland varies within the planning area. In prelogged riparian forests in the Coast Range, less than 45% of riparian areas were in old forests (Ripple et al. 2000). Sample plots show that historic crown closure was greater than 70% with stands consisting of:

- 49% conifer,
- 30% conifer-dominated mixed stands,
- 19% hardwood-dominated and mixed stands, and
- 2% nonforest.

Nierenberg and Hibbs (2000) found that 52% of riparian areas on streamside terraces had no trees. This suggests that the floods and depositional materials control the dominance and the seral stage of vegetation close to the stream. With increasing distance from streams, the amount of hardwoods and nonforest decreases. This is evidence that hardwoods and shrubs are the largest contributing limiting factor to conifer growth in or near stream areas.

Although infrequent, large-scale natural disturbances do occur within riparian areas. From the sampled plots in the Coast Range, five disturbances occurred in the last 100 years for each mile of stream since a stand replacing fire (Nierenberg and Hibbs 2000).

Harvesting practices during the forest development period from the 1950s to 1980s often removed much of the standing marketable timber from riparian areas

along larger streams. This is because transportation systems were first developed along ridge tops and valley bottoms before more difficult midslope roads were attempted. During the 1970s, there was a large salvage program within riparian areas because the breaking up of debris jams was thought to be beneficial to fish migration. This thinking was reversed by the early 1980s, but much of the long-lasting stream structural forming large wood, such as western red cedar and Port Orford cedar, had been removed.

The Northwest Forest Plan 10-year monitoring report titled *Northwest Forest Plan – The First 10 Years (1994-2003): Synthesis of Monitoring and Research Results* (Haynes et al. 2006) reported that condition scores for 161 of the 250 sampled watersheds improved from 1994 to 2003. The change in watershed condition scores was attributed primarily to changes in the riparian vegetation; specifically, the number of large trees in the riparian areas. The number of large trees increased an estimated 2 to 4% during this time, which was most likely the result of tree growth into the greater than 20 inch diameter at breast height category (Gallo et al. 2005).

Shade in the riparian areas along perennial streams on BLM lands continues to improve, because there has been no regeneration harvesting (other than limited species conversion) in riparian areas in the last 20 to 30 years. The majority of thinning treatments along perennial streams in the past 10 years have left retention areas adjacent to waterbodies. This area beyond 100 feet has little effect on the increased shading of streams—particularly when a thinned forest stand is left to provide additional tree shading.

Dissolved Oxygen

High loading of fine organic matter, such as tree branches and needles, when combined with sediment and increased water temperature can deplete dissolved oxygen in small mountain streams (Wringler and Hall 1975). However, these streams are often steep with high turbulence, which quickly replenishes the dissolved oxygen (Ice 1978). A review of the oxygen requirements of aquatic organisms does not attribute changes in intergravel dissolved oxygen to management activities in the Pacific Northwest (Chapman and Mcleod 1987).

The growth and respiration of attached algae cause day and night fluctuations in dissolved oxygen concentrations. Algae photosynthesis releases oxygen into the water during the day and respiration consumes oxygen at night, which contributes to a dissolved oxygen depression. This cyclic process is limited to low-gradient river systems where nutrient inputs have caused extensive algae growth on the stream bottoms. It is most apparent during low flows, which may be aggravated by organic inputs and higher stream temperatures.

Bacteria

In forested and rangeland settings, the total coliform and fecal coliform bacteria are monitored depending on the extent of human and animal use. Many coliform bacteria include an array of aerobic and anaerobic bacteria, many of which are nonpathogenic or associated with human waste. Fecal coliform are bacteria that are found in the gut of warm-blooded animals. A variety of diseases may be spread by these bacteria. The presence of coliform bacteria in the water on BLM lands is associated with wild animals, concentrated livestock use, or poor waste disposal by recreation users. Dispersing activities away from water normally solves bacteria concentrations, because soils act as a filtering system.

Sediment

On-site soil loss is a natural weathering process. Fragmental rock, soil, and organic material that are detached can be redistributed by gravity, wind, and water. When this material arrives at, is eroded from, or is transported in a waterbody, it is known as sediment. Sediment moves in water when water velocities are great enough to cause suspension and entrainment (i.e., mobilization). Sediment moves as a suspended load in a water column or as larger particles rolling along the stream bottom. Sediment is freely transported through high-gradient stream reaches, and is deposited on bars and channel margins in low-gradient streams. Natural rates of sediment yield vary with rock and soil resistance to weathering, landslope and shape, ameliorating effects of vegetation, soil surface organic matter, and roughness. Seasonal climatology, particularly large storms, may trigger landsliding—the largest portion of the annual sediment budget.

Natural rates of sediment yields within the planning area vary greatly depending on physiographic area, topography, vegetation, and climate. The high annual variability of sediment yields extends to watersheds. For example, Flynn Creek Experimental Watershed, which served as a control in the Alsea study in the Coast Range, reported annual sediment yields of 59 to 1,237 tons per square mile per year (Brown and Krygier 1971).

Various studies show that average annual sediment yield from natural and anthropogenic sources in the Coast Range province vary from 200 to 800 tons per square mile per year compared to the Western Cascades province, which vary from 100 to 500 tons per square mile per year (Swanson et al. 1982; Stallman et al. 2005). In one study, sediment input from roads accounted for 67% of the total annual sediment budget (Swanson et al. 1982).

Forest management activities, including road building and timber harvesting, can lead to accelerated rates of erosion and sediment yield (FEMAT 1993, V-16). Fine sediment (particle sizes less than 2 mm) is of most interest, because it is more easily mobilized and capable of traveling the distances necessary to reach a water body.

As follows, road networks physically alter hill slopes as well as change the surface and subsurface flow of water:

- Flood flows and debris can plug culverts causing fill failures.
- Road construction on steep and unstable ground can also lead to accelerated rates of erosion in a watershed (Swanston and Swanson 1976; Reid and Dunne 1984), and are the most important source of management-accelerated delivery of sediment to anadromous fish habitats within the planning area (Ice 1985; Swanson et al. 1985).
- Road segments that have stream connection pathways, such as roadside ditches, have potential to deliver surface eroded sediment to streams (Wemple 1998; Jones et al. 2000).
- Road segments that are not connected to streams by ditch lines or gullies, or have more than 25 to 100 feet of filtering forest floor duff and vegetation (depending on the slope, soil properties, and surface roughness) between them and a stream, are usually not at risk of delivering sediment to streams. Rashin et al. (2006) found that when erosion features are further than 33 feet from streams, sediment delivery is unlikely unless sediment is routed by concentrated drainage water.

Road runoff and landsliding are the primary routes of sediment delivery to stream channels. Road parent material, location, design, use, and density can be important in affecting the extent and magnitude of road-related sediment impacts (Reiter et al. 1995).

Roads differ in their inherent erodibility, or erosion potential, due to the geology of a parent material on which they are constructed. See *Figure 103 (Geology within the planning area)* (Walker and King 1969) and *Table 114 (Basic erosion rates for roads based on the underlying geology)*. Sediment yields by erosion from older roads with undisturbed ditches are much smaller than sediment yields from newer roads or roads with disturbed ditches. Frequent road maintenance of ditchlines can increase sediment yields.

Figure 103. Geology within the planning area

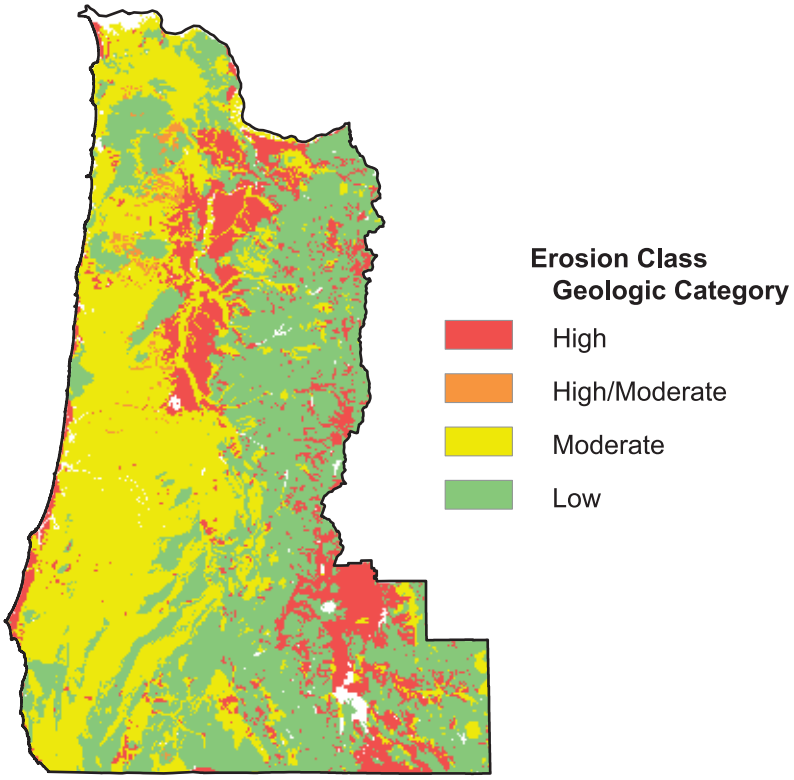


Table 114. Basic erosion rates for roads based on the underlying geology

Erosion Category	Geologic Parent Material	Erosion Rates (tons/acre/year)	
		New Roads (0 to 2 years)	Old Roads (> 2 years)
High	• Mica schist • Volcanic ash • Highly weathered sedimentary rock	110	60
High/Moderate	• Quartzite • Course-grained granite	110	30
Moderate	• Fine-grained granite • Moderately weathered rock • Sedimentary rocks	60	30
Low	• Competent granite • Basalt • Metamorphic rocks • Relatively unweathered rocks	20	10

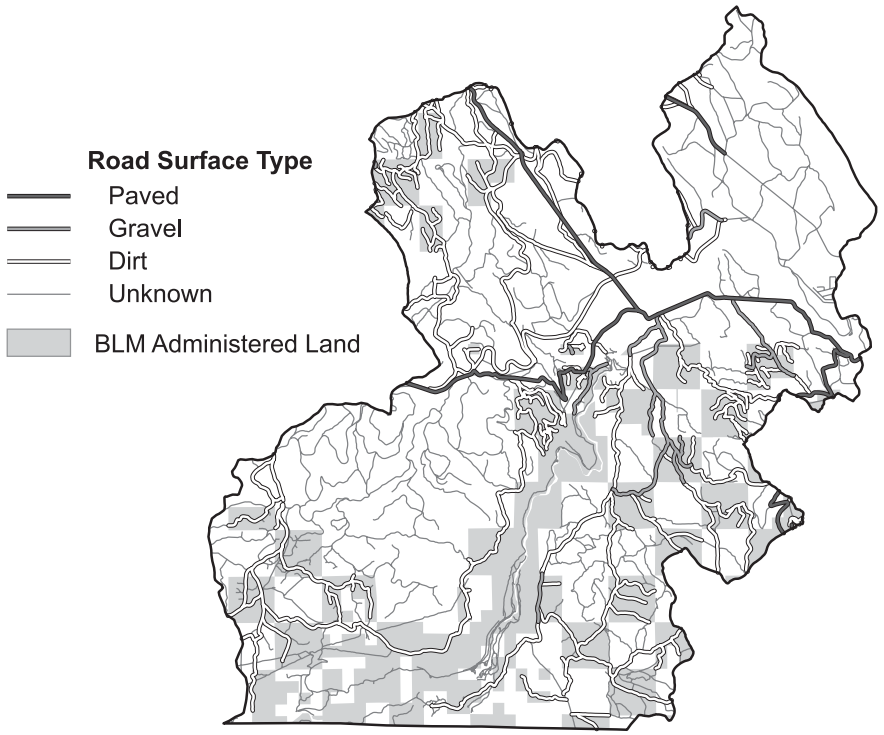
Note: Basic erosion rates (tons per acre per year) are an estimate of erodibility, which is based on the geologic parent material. This rate is for bare ground and is further reduced depending on road surface type, vegetation of cut and fillslopes, and traffic level.

Sources: Kochendorfer and Helvey 1984; Hayden et al. 1991; Megahan and Kidd 1972; Reid and Dunne 1984; Sullivan and Duncan

Primary road sediment sources include:

- Exposed surfaces, including the road tread (particularly native road surfaces), along with cuts and fills. Erosion may result by overland flow from rainwater or snowmelt, or concentrated flow in ditches. The BLM controls approximately 14,000 miles of road within the planning area. Less than 7% of these road miles are native surface roads. Much of the road network is on ridgetops or traversed areas well away from stream channels. See *Figure 104 (Road distribution in a representative watershed)*.
- Inadequate ditch relief culverts, resulting in elevated ditch flow that can mobilize sediment.
- Stream crossings that have undersized pipes or that traverse debris-flow streams.
- Roads in upland areas cross small seasonal streams more frequently, and so incur the greatest risk for failure.
- Road fill failures; particularly if they are within the slide out range of a stream channel.
- Midslope roads, with steep and unstable road cuts and deep fills, pose the highest risk for landslides.
- Older roads that were sidecast constructed, built on fills with organic material, or crossed slide prone ground that have not yet failed are also at higher risk. In the Western Cascades province, road fill failures were found to represent the most frequent cause of debris flow initiation (Swanson et al. 1982).

Figure 104. Road distribution in a representative watershed



Modeling was used to determine the effects of the alternatives on fine sediment delivery within the stream influence zone. The model was based on the concept of using reference roads. (Refer to *Appendix B – Surface Erosion* of the 1997 4.0 version of the *Washington Department of Natural Resources Forest Practices Watershed Analysis Manual*.)

Although there are 260 fifth-field watersheds within the planning area, only the 185 watersheds with BLM-administered lands were included in the analysis. A 200 foot sediment delivery buffer was created around all stream channels in all ownerships. The BLM roads data layer, which includes roads on all lands, was clipped with the sediment delivery buffer data layer. Road segments that crossed streams were selected since they are most likely to deliver fine sediment to streams. The amount of potential fine sediment delivery was calculated for thousands of these road segments. Factors used to estimate the amount of fine sediment included road erodibility, road surfacing, and vegetation on road cut and fill slopes. Traffic level was assumed to be moderate. The effect of road maintenance was not evaluated.

See *Table 115 (Potential fine sediment delivery from existing roads)* for the potential fine sediment delivery for the existing condition. Approximately 36% of all roads on BLM-administered lands are within the likely sediment delivery distance (5,096 miles out of 14,273 total BLM miles). When considering all roads, the highest yield is from natural surface roads, which average 9.61 tons per square mile per year. The lowest yield is from paved roads, which average 1.58 tons per square mile per year.

Table 115. Potential fine sediment delivery from existing roads

Existing Roads[a]	Roads Within Fine Sediment Delivery Distance (miles)[b]		Potential Fine Sediment Delivery (tons/year)[c]		Watershed Potential Fine Sediment Delivery (tons/mile²/year)[c]	
	BLM	Other	BLM	Other	BLM	Other
Natural	1,738	15,874	23,050	233,054	0.86	8.75
Aggregate	2,590	22,938	28,938	30,765	1.09	1.15
Paved	767	2,436	8,277	33,807	0.31	1.27
Totals	**5,096**	**21,249**	**60,265**	**297,626**	**2.26**	**11.17**

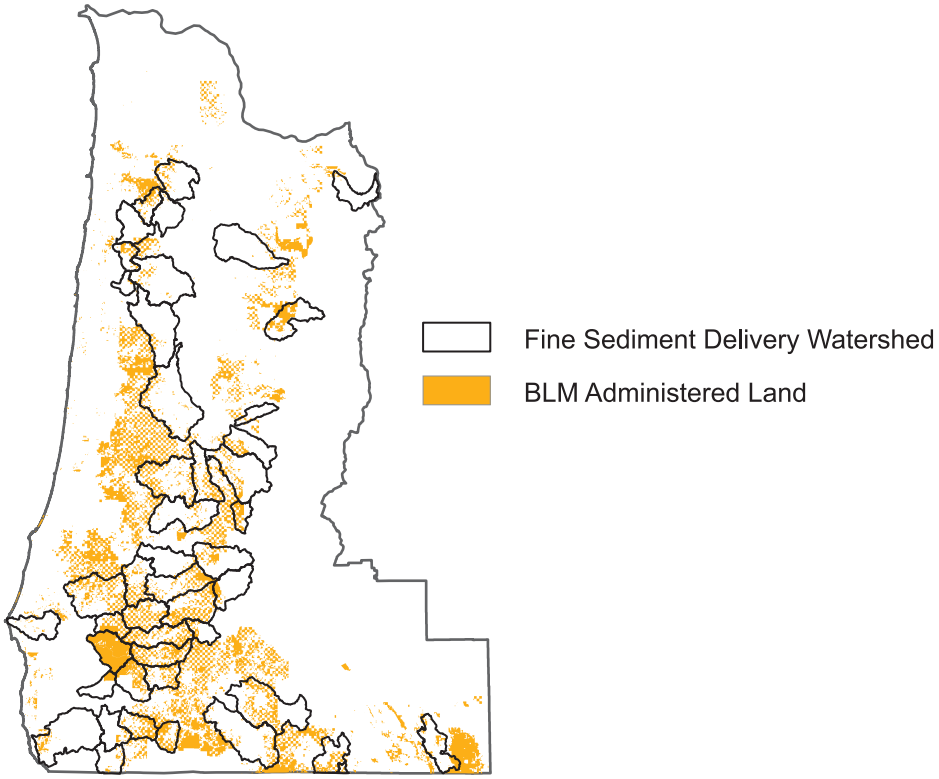
[a]Includes BLM-controlled roads and private roads within the planning area from BLM GIS GTRN (roads) coverage.

[b]Includes road segments within 200 feet of a stream channel where ditch flow carrying fine sediment could enter streams.

[c]Planning criteria estimate in which calculations are calculated by surface type for each fifth-field watershed and summed for the planning area.

See *Figure 105 (Watersheds with the highest fine sediment delivery from roads)* for the highest (25%) fine sediment delivery watersheds that contain BLM-administered lands. Sediment delivery to stream channels within these watersheds range from 34 to 77 tons per mile per year and averages 43 tons per mile per year. Elsewhere, sediment delivery to stream channels range from 0 to 43 tons per mile per year and averages 17 tons per mile per year. The Klamath and Coast Range provinces contain the highest number of these sensitive watersheds. This is likely due to underlying geology and landforms.

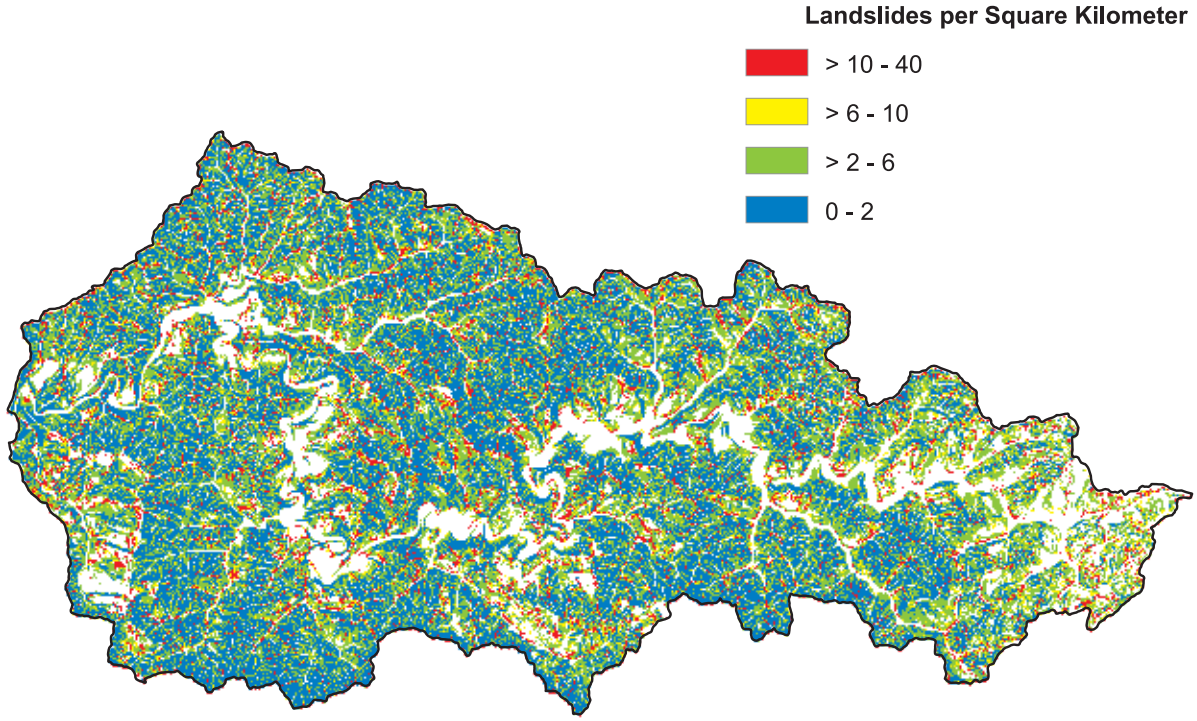
Figure 105. Watersheds with the highest fine sediment delivery from roads



Timber harvesting activities can result in shallow colluvial landsliding, mass failures, and debris torrents depending on harvest location, type of harvest, design, and operation.

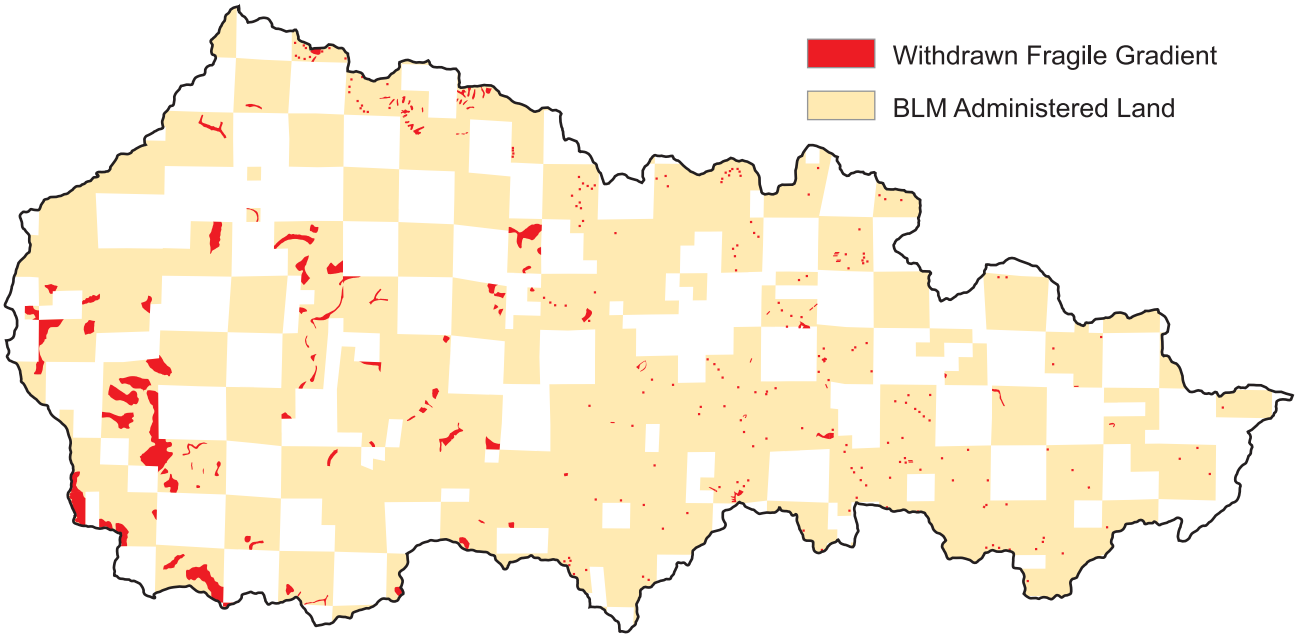
Miller (2003) and Miller and Benda (2005) have developed a GIS-based mass wasting hazard model for western Oregon to estimate the susceptibility to shallow colluvial landsliding. The model was calibrated using landslide inventories from the Coast Range, Western Cascades, and Klamath provinces. Landslide density was determined for topographic attributes from the 1996 storms. Of particular importance is the steepness of slope, watershed convergence, and source area. The density of landsliding for a set of stochastic events (1996 storms) was determined by calibration and set onto the landscape by topographic indicators. See *Figure 106 (Relative landslide susceptibility in a representative watershed)* for the relative landslide susceptibility mapping for a representative watershed.

Figure 106. Relative landslide susceptibility in a representative watershed



The BLM uses the timber productivity capability classification (TPCC) to screen for low forest productivity timberlands and landslide prone areas, and withdraws them from general forest management. This classification is done by silviculture and soil specialists from the interpretation of aerial photography and ground review. Over 89,937 acres of BLM-administeral lands (3.5% of BLM administered lands) is withdrawn due to forest capability or land stability concerns. See *Figure 107 (Timber productivity capability classification withdrawn areas in a watershed)* for an example of a representative watershed with these withdrawals.

Figure 107. Timber productivity capability classification withdrawn areas in a watershed



Most landsliding occurs during severe storms when soils are fully saturated. Landsliding factors include:

- steepness of slope
- soil depth and texture
- underlying rock bedding planes
- forest cover
- water runoff pathways

In western Oregon, the highest hazard for landslides occurs on steep slopes over 70 to 80% (ODF 1999). Basal area retention of forest trees can be important in preventing landslides on unstable terrain. Retention trees transpire water and live roots increase soil strength, both of which increase stability. Weaver and Hagans (1996) found that 71% of observed landslides in western Oregon from the February 1996 storms were initiated from recent regeneration harvests, while no slides were reported from partial cuts. For the same storm, landslide densities and size in the Coast Range were the highest for regeneration harvests that were 0 to 9 years old, lower for mature forests, and lowest for forested areas between 10 to 100 years (ODF 1999).

Streamside forested areas protect the integrity of streambanks, provide excellent filtration, and capture of disturbed sediments. Riparian areas normally include higher vegetative cover, root masses that bind soils, and decomposing organic material that protects the soil surface. As follows, filter strip widths that prevent chronic sediment delivery within the planning area vary by physiographic province and geologic parent material:

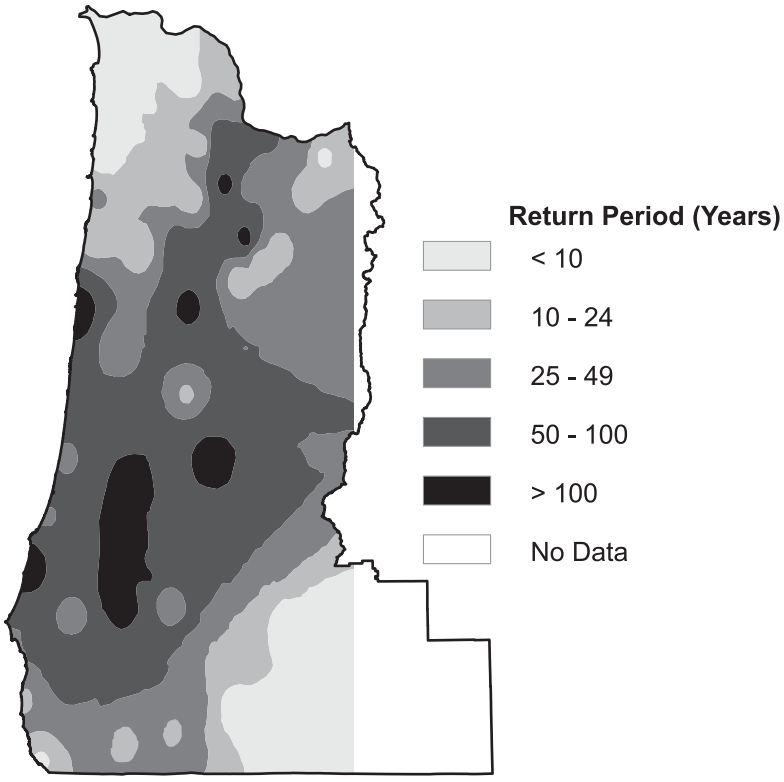
- Swift (1986) measured travel distances through forest litter on 47% slopes. The maximum travel distance was 314 feet and the average distance was 65 feet. On a burned forest floor at a 42% slope, the maximum travel distance was 198 feet and the average was 96 feet.
- On basalt derived soils, Packer (1967) reported protective strip widths needed to contain 83.5% of the number of flows ranged from 35 to 127 feet depending on herbaceous vegetation and spacing between obstructions.
- On soils derived from gneiss and schist, Burroughs and King (1989) found that sediment flows below road fill slopes traveled less than 88 feet.
- In a recent study in the Pacific Northwest, filter strips have been found to be 95% effective at 33 feet in width (does not include burned areas) without the application of any other best management practice (Rashin et al. 2006).

Postfire sediment yields vary, depending on fire severity, frequency, climate, vegetation, and geomorphic factors such as topography, geology, and soils (Swanson 1981). Soil erosion after fires can vary from 0.4 to 2.6 tons per acre per year in prescribed burns, while more intense wildfires can create soil erosion that is an order of magnitude higher (Megahan and Molitor 1975). Recovery rate is rapid as grass, forbs, and shrubs occupy the site.

Many older roads on poor locations (i.e., with inadequate design and maintenance) pose high risks of erosion and sedimentation to stream channels and habitats from mass failure (FEMAT 1993, V-16).

The three largest floods in the last 50 years are the 1953 flood, the 1964 flood (both long-duration, high-intensity rain-on-snow events), and the February and November 1996 floods (separate long- and short-duration, high-intensity rain events). See *Figure 108 (November 1996 precipitation return period for western Oregon)* for the return period for daily precipitation for western Oregon for the November 1996 storm.

Figure 108. November 1996 precipitation return period for western Oregon



Observed landslides from an aerial reconnaissance survey of 83 watersheds in the Coast Range and Western Cascades provinces from the February 1996 storm revealed that 36% of the observed landslides were associated with roads, and 65% of all landslides resulted in stream torrents (Weaver and Hagans 1996). Based on samples in wildland Forest Service watersheds, failed stream crossings from the 1996 floods depended on the size of the storm events with more debris torrents occurring during the larger February 1996 event (Furniss et al. 1997). In the Furniss study, the most common failure mechanism in the Western Cascades was debris torrents, while sediment slugs were the most common failure mechanism in the Coast Range. Woody debris obstructions and culvert capacity exceedance were also important failure mechanisms.

Currently roads damaged from flooding, where rebuilt, are designed to higher standards than in the past. For example, the BLM abandoned sidecasting of waste material in the 1980's and planned lower fill heights over culverts at stream crossings. A road inventory in Washington found that roads constructed in the last 15 years had minimal damage rates from large storms compared to roads constructed earlier (Toth 1991). The Oregon Department of Forestry observed for the 1996 storms that road-related landslides were fewer and smaller than in previous studies and concluded that current improved road management practices were responsible (ODF 1996).

With the development of road networks in the early twentieth century, valley bottom roads along streams were constructed to salvage riparian timber and

access upper watershed areas. There was often little regard for riparian areas. Streams were sometimes straightened and protected with boulders so that roads could use floodplain terraces. Many of these arterial roads still remain and most are surfaced with few stream crossings. Road systems associated with forest management have been constructed on ridges and across middle slopes (between valley bottoms and ridge tops). There are many more road crossings in these upper watershed areas. There are minimal miles of roads within riparian areas along streams in these upper watershed areas.

Approximately 3,800 miles (25%) of the BLM road system are maintained in a given year. See *Figure 139 (Miles of road maintenance)* in the *Lands, Realty, Access, and Transportation* section of *Chapter 3*. Maintenance reduces sediment delivery by road surface grading and replacement, pavement maintenance and replacement, slough and slide removal, and culvert clearing and replacement.

Road closure and decommissioning has led to a net decrease of 700 miles (5%) of roads on BLM lands within the planning area since 1994. These road closure segments were scattered with most being outside of the riparian reserves.

The Northwest Forest Plan 10-year monitoring effort regarding watershed condition found that the condition scores of watersheds as influenced by roads generally did not change significantly since the Northwest Forest Plan was implemented (Gallo et al. 2005). The amounts of roads removed from any given watershed may have been relatively small and insufficient to change the watershed condition. There were 3,324 miles of roads decommissioned from 1995 to 2002 on U.S. Forest Service and BLM lands while there were an estimated 354 miles of new roads constructed during the same period (Baker et al., in press).

Using a random survey design across the region, ODEQ assessed four western Oregon physiographic provinces for fine sediment (Willamette Valley, Coast Range, Western Cascades, and Klamath). See *Table 116 (Fine sediment and ODEQ probabilistic stream surveys for third-order or less streams from 1994 to 2001)* for the assessment results. Because of the mix of land uses (forestry and agricultural) and different land management practices under different regulatory authorities within the watersheds, it is unclear how these survey results apply to BLM lands.

Table 116. Fine sediment and ODEQ probabilistic stream surveys for third-order or less streams from 1994 to 2001

Physiographic Province	Good Condition (%)	Fair Condition (%)	Poor Condition (%)	Confidence
Coast Range	42	17	41	± 7
Willamette Valley	7	3	90	± 22
Cascades	71	18	11	± 11
Klamath	65	14	22	± 19

Source: ODEQ 2004b

Heavy Metals

Heavy metals in streams and rivers in forested and rangeland areas are normally associated with natural sources, agricultural runoff and mine drainage. Natural sources may be increased by land erosion rates. Urban and industrial point sources, such as manufacturing, storm water runoff and landfills, provide additional inputs. Heavy metals may assimilate near the point source or in large rivers outside the majority of BLM ownership. Mercury is the most common heavy metal of concern.

Water Quantity

Aquatic organisms require adequate flows during migration, spawning, and rearing to satisfy the requirements of various life stages (FEMAT 1993, V-19). The timing, magnitude, duration, and spatial distribution of peak flows must be sufficient to create and sustain riparian and aquatic system habitat, and to retain the patterns of sediment, nutrient, and wood routing (FEMAT 1993, V-19).

Timber harvesting and associated activities in maritime mountainous watersheds alter the amount and timing of peak flows by changing site-level hydrologic processes (Keppeler and Ziemer 1990; LaMarche and Lettemmaier 1998; Wemple and Jones 2003; Wright et al. 1990). These hydrologic processes include changes in the amount of snow and snowmelt rates, roads intercepting surface and subsurface flow, and changes in soils infiltration rates and soil structure.

Changes in hydrologic processes affecting peak flows can be grouped by the following primary forest management actions:

- Reduction in forest vegetation through harvesting.
- Construction of forest access roads.

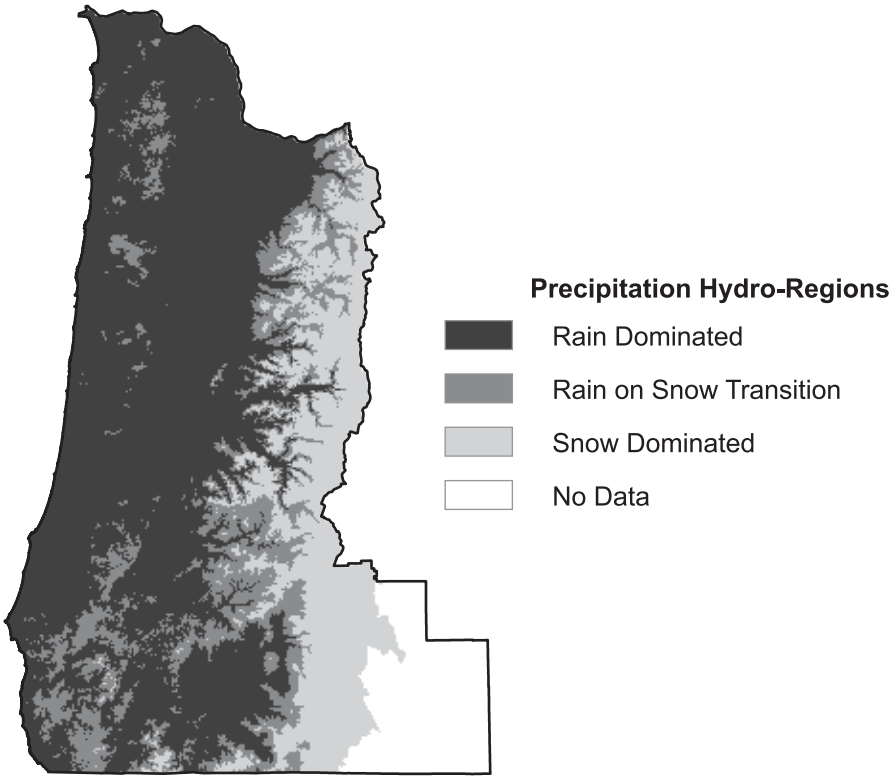
Reduction of forest vegetation through harvesting can affect processes that control snow accumulation in tree canopies and on the ground. Snowmelt can be accelerated where wind with warm air temperatures cross forest openings.

Low intensity winter precipitation of various durations is common within the planning area. Some of this precipitation falls as rain or snow, depending on the prevailing storm air temperature and watershed elevation. Snow acts as stored water within the mountainous watersheds. Lower valleys are below the snow line, except for extreme cold fronts. Snow comes and goes within the intermediate elevations, while higher elevations have a winter permanent snowpack. These precipitation zones are displayed as hydroregions. See *Figure 109 (Precipitation hydroregions within the planning area)*. The use of hydroregions helps to distinguish how peak flows would be affected by different-sized openings in areas that mimic regeneration harvested and stand establishment conditions.

Hydroregions

Hydroregions are a means for classifying the dominant precipitation type of a region as either rain or snow. With regards to snow, hydroregions also distinguish the depth of winter snow and the longevity of accumulated snow.

Figure 109. Precipitation hydroregions within the planning area



A spatial analysis to determine susceptibility to peak flow increase from vegetative management was developed for the planning area for both rain-dominated and rain-on-snow-dominated areas. The analysis uses sixth-field subwatersheds (a USGS hydrologic unit), because they are small enough areas to capture the patterns of BLM forest lands and because tributary streams are more sensitive to vegetation and runoff-related changes. Subwatersheds are generally 10,000 to 40,000 acres in size and have a single outlet. There are 1,192 subwatersheds within the planning area. When separated by hydroregion, 635 subwatersheds are rain-dominated, 471 subwatersheds are rain-on-snow-dominated, and 86 watersheds are snow-dominated. Snow-dominated watersheds involve higher elevation, which is important for sustaining spring flows, but have minor contributions to the elevation of winter peak flows.

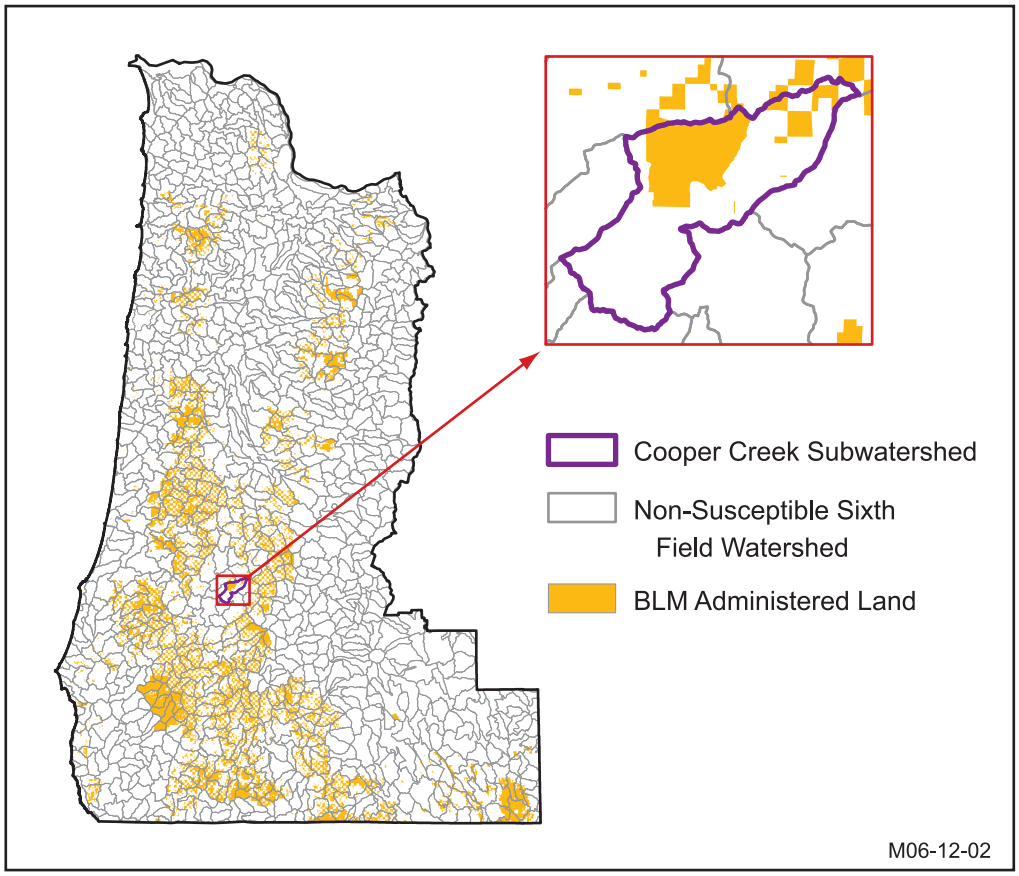
Within the rain-dominated hydroregion, the effect of increased peak flow is proportional to the area cut with the detection of effects set at 40% for small catchments and considerably higher for watersheds (Grant et al. 2007, in review). Patch size or arrangement is not a factor in explaining greater flow volume or timing. Ziemer (1981, 1995) found a nonstatistical (4%) increase in peak flow for 80 year old conifer stands that were harvested where 50% of the basal area was retained.

The analysis of the affect of the alternatives on peak flows used the vegetation projections derived from the OPTIONS modeling for the existing condition on the BLM-administered lands. The stand establishment structural stage (without legacy) was used as a surrogate for the removal of basal area. On other lands, vegetative crown closure was

classified using satellite imagery from the 1996 Interagency Vegetation Mapping Project. Areas of less than 10% crown closure were used as a surrogate for the removal of basal area. A basal area of 40% removed was set as a sixth-field watershed response level.

There is currently one sixth-field subwatershed (out of 635) that is susceptible to peak flow increase. See *Figure 110 (Subwatersheds that are currently susceptible to peak flows in the rain-dominated hydroregion)*. Two additional sixth-field subwatersheds would be susceptible when considering the management activity on all lands.

Figure 110. Subwatersheds that are currently susceptible to peak flows in the rain-dominated hydroregion



A rain-on-snow storm involves prolonged rainfall under warm and windy conditions. Rain-on-snow events are of particular interest because the melt of shallow snow packs can enhance storm runoff, and has been associated with landsliding and downstream flooding.

Large openings in a forest canopy (commonly in regeneration harvests or forest stand conversions) affect precipitation and snow interception and melt. The ablation of snow in large openings may occur before rain-on-snow storms in contrast to increased snow accumulation and melt during winter storms; when the freezing levels are initially low but subsequently rise.

Snowmelt can provide extra water for runoff. Regeneration harvests or forest conversions with large open areas will provide additional melt contributions under rain-on-snow

conditions (Harr 1981; Storck 1997). This is primarily due to more snow accumulation in the openings and increased wind speeds. In contrast, research suggests that forest thinning treatments maintain patterns of snow accumulation that are similar to mature forests and reduce turbulent air near the ground. Furthermore, it is concluded that thinning treatments have little effect on snowmelt rates during rain-on-snow events (Poggi et al. 2004).

A rain-on-snow empirical analytical technique was used to identify susceptible subwatersheds to peak flow increase within the rain-on-snow hydroregion. The procedure was patterned after the Washington State Department of Natural Resources' hydrologic change watershed analysis methodology (1997). This screening technique (with modifications) was converted to GIS spatial analysis. See *Appendix I. Water*.

An appropriate method of describing the peak flows of various exceedance probabilities for unregulated streams in ungauged watersheds is to use the basin characteristics regression analysis with gauged watersheds that have long-term records. The Harris and Hubbard (1979) flood frequency equations were chosen as reference points—because they cover the various hydrologic regions within the planning area and have long-term records (10 to 70 years). The base period of streamflow data for use in the analysis was collected prior to the maximum forest conversion in many watersheds (with much of the streamflow data being gathered before 1960). The base period data set may include some chance rain-on-snow events, but with considerably fewer forest openings. Rain-on-snow occurrences of interest correspond to a streamflow return period of 2 to 8 years where research has shown prelogging and postlogging regressions were significantly different (Harr 1992). The 2-year, 24-hour and the 5-year, 24-hour streamflows were calculated for each sixth-field subwatershed with these equations and serve as reference points for a rain-on-snow watershed response level.

Rain-on-snow areas, where shallow snow accumulations can come and go, have been reported by Harr (1981, 1992) to be in the elevation range of 1,200 to 3,600 feet in western Oregon and from 2,500 to 5,000 feet in the southern Cascades (Lindell, pers. comm.). Forest openings commonly receive greater snow accumulation (two to three times more snow water equivalent) than adjacent forests (Harr 1992). These openings also receive greater wind speeds and twice the amount of heat during rain-on-snow events, which provides greater melt compared to a mature forest (Harr 1981, 1992; Storck 1997). For BLM-administered lands, acres of stand establishment were taken from the OPTIONS model vegetation modeling for each alternative. Satellite imagery from the 1996 Interagency Vegetation Mapping Project was used to determine the forest cover on other lands.

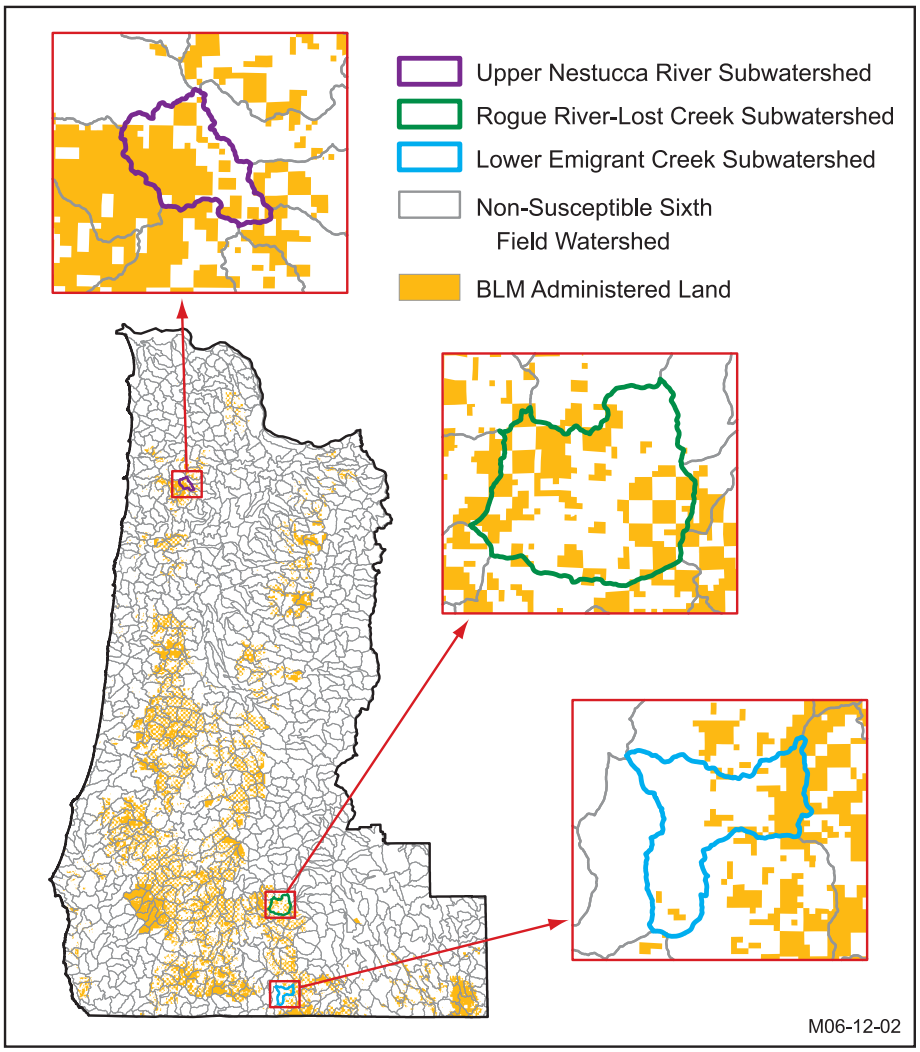
Published regression equations were used to generate a winter snowpack (Greenburg and Welch 1998) that relate to snow accumulation by elevation using the snow telemetry (SNOWTEL) data from the National Resources Conservation Service for January 1 snow accumulation. Large forest openings within the rain-on-snow hydroregion receive greater snow accumulation (two to three times more snow water equivalent) than adjacent forests (Harr 1992). Further adjustments for regeneration harvest areas (Brunengo, unpublished data) were used to estimate snow cover in openings.

Snowmelt equations from the U.S. Army Corps of Engineers (USACE 1956, 1998) were used to melt snow in the rain-on-snow elevation to approximate a 2-year, 24-

hour storm using average environmental conditions. The water from snowmelt for all vegetation cover types for each sixth-field subwatershed was averaged for the watershed and added to the precipitation for the 2-year, 24-hour storm. The water available for runoff (precipitation plus snowmelt) was rerun in the 2-year, 24-hour peak flow basin characteristics runoff equations. Water available for runoff was substituted as precipitation. The 2-year, 24-hour peak streamflow was then compared with a 5-year, 24-hour peak streamflow. Where it exceeded the 5-year, 24-hour peak streamflow, the watershed was considered susceptible to peak flow increase.

There are currently three sixth-field subwatersheds (out of 471) that are susceptible to peak flow increase in the rain-on-snow hydroregion on BLM-administered lands. See *Figure 111 (Subwatersheds currently susceptible to peak flows in the rain-on-snow-dominated hydroregion).* No additional sixth-field subwatersheds would be susceptible when considering management activity on all lands.

Figure 111. Subwatersheds currently susceptible to peak flows in the rain-on-snow-dominated hydroregion



Shown is the peak flow susceptibility for sixth-field watersheds where the 2-year, 24-hour bankfull channel forming peak flow is greater than the 5-year, 24-hour peak flow. Includes the current rate of harvest on private land from 1996 IVMP imagery.

The largest floods in the world are caused by sustained rates of rainfall or dam-break floods (Naiman and Bilby 1998). Within the planning area, warm subtropical air from winter storms with sustained rates of rainfall combine with snow on the ground to produce the largest floods. For example, the largest floods on record (1861, 1890, and 1964) were rain-on-snow events. Harr (1981) concluded that 23 of 25 of the largest annual peak flows of the Willamette River at Salem, Oregon between 1814 and 1977 were caused by rapid snowmelt during rainfall. Harr also concluded that the effect of these wet mantle floods overwhelmed the peak flow response to forest management.

Forest roads and landings change the infiltration of soil and the flow of surface and subsurface water in watersheds. These compacted areas are relatively impermeable and are a source of overland flow. The road and its cutslope can advance the timing of surface runoff, compared to slower, subsurface flow routes (Harr et al. 1975, 1979; Megahan et al. 1981, 1992; Wemple et al. 1996). During large storm events, roads intercept larger contributions of subsurface flow and route it to drainage ditches. This additional runoff contributes to rising flows where drainage ditches connect to streams. (Megahan 1972; LaMarche and Lettenmaier 2001; Luce 2002; Wemple and Jones 2003).

There are approximately 14,000 miles of BLM roads within the planning area. Many of these roads are crowned or insloped with a drainage ditch between the road shoulder and the backslope. This drainage ditch and stream connectivity effectively extends the stream channel network at stream crossings. However, where road drainage intersects ditch relief culverts, stream extension is appreciably reduced. Any remaining extension is short and is often terminated at the point of the first ditch relief culvert. Some surface runoff and interception of subsurface flow could enter stream channels below this juncture.

There has long been debate regarding the magnitude of floods caused by timber harvesting and road building.

Research from primary hydrologic study sites in the Cascades, Coast Range, and in northern California since the late 1950s show that a peak flow change from clear-cut harvesting is detectable at the catchment scale (less than 1,000 acres).

The greatest response is from the first stream flow peaks in the fall that can be increased up to 100%, or more, after logging (Harr 1976; Ziemer 1981). These early fall storms produce small peaks, which had little, if any, consequence on channel form because stream flow is very low at this time (Grant et al. 2007). This effect of logging at peak flow through the winter storm season is thought to diminish with each subsequent storm by a variable representing the percentage of the area logged divided by the sequential storm number (Ziemer 1981).

For peak flows from clear-cutting with no roads, where the return interval was less than 1 year, there was a significant increase in peak flows, but this diminished within 5 years (Jones and Grant 1996).

Large peak flows (those with return intervals of greater than 5 years) were not significantly affected by clear-cut logging in either the H. J. Andrews (Rothacher 1973)

or Alsea (Harr 1976) studies. These are the flows that can scour stream channels, modify floodplains, and carry tremendous quantities of sediment.

Ziemer (1981, 1995) found a nonstatistically significant increase (4%) in peak flow for 80 year old conifer stands that were harvested where 50% of the basal area was retained.

For roads, Jones and Grant (1996) found no statistical increase in peak flow for catchments that contained roads but no clear-cuts. They found peak flows increased 50% for all event sizes with 25% of the area in clear-cuts and roads. Increases in peak flow were found when roads and other impermeable areas occupied more than 12% of the catchment scale watershed (Harr et al. 1975; Harr 1976).

A recent literature review in which all northwest studies were arranged by hydroregion has concluded for watersheds with roads and large openings that within the rain dominated hydroregion there is no data supporting any increase in peak flow below 40% of a harvested watershed area. For basins within the rain-on-snow hydroregion, the detection threshold is 20% of a harvested watershed area (Grant et al. 2007).

Jones and Grant (1996) reported that peak discharges with a return interval of less than one year or greater have increased by as much as 100% in fifth- and sixth-field watersheds in the last 50 years. However, the data set was skewed toward smaller peak flows. Greater than 75% of the data set had a return period of less than one year and gauged areas were small catchments, which were not representative of the watershed-size basins. Further analysis of the same data set by others (Beschta 1997; Thomas and Megahan 1988) either could not detect any changes for the fifth- or sixth-field watersheds or were inconclusive.

Source Water Protection

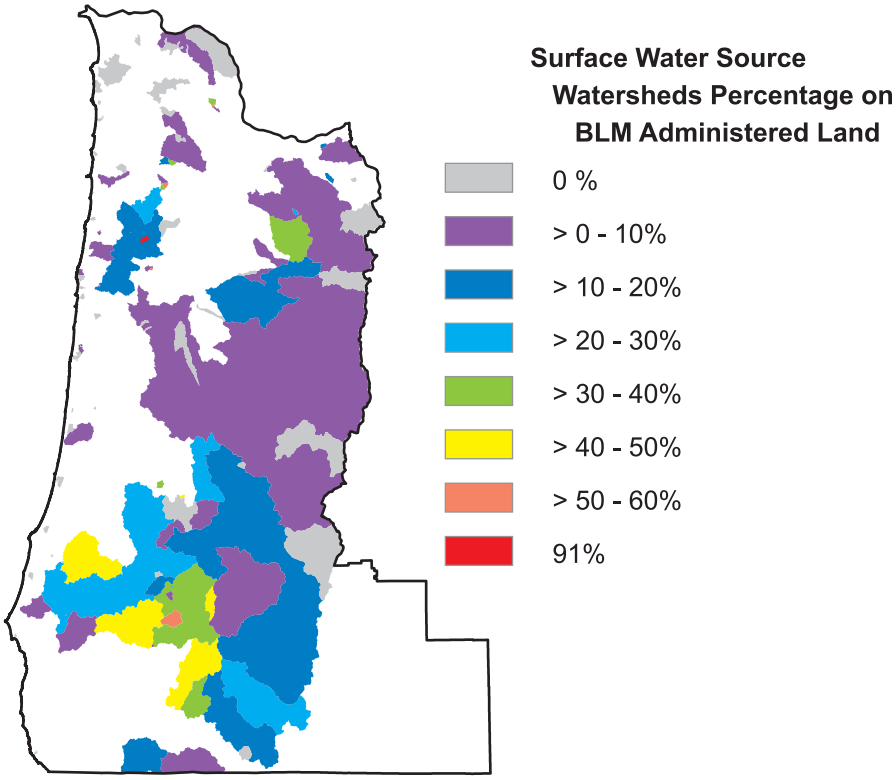
The 1996 Safe Water Drinking Act amendments require the identification and management of source water protection areas for public water systems. States are required to develop source water assessments for public drinking water supply systems that include surface water and groundwater sources. The assessments include mapping of the surface or groundwater area, an inventory of the potential sources of contamination, and an evaluation of watershed sensitivity. See *Table 117 (Potential contaminant sources affecting waterbodies within source water watersheds)* for the activities on BLM lands that could affect drinking water supplies.

Table 117. Potential contaminant sources affecting waterbodies within source water watersheds

Contaminant	Activity	Causal Mechanism
Temperature	Harvesting within riparian zones on perennial streams	Decrease in stream shade affected by canopy removal
Sediment	• Existing road network • New road construction	Sediment delivery near stream crossings of roads
	• Harvest areas • Recent burns • Cattle grazing	• Landslides and debris torrents • Erosion and dry ravel • Concentrated animal grazing in riparian areas leading to erosion or streambank collapse
Bacteria	• Recreation at campgrounds • Dispersed sites	• Failing sewage systems • Improper waste disposal
	Cattle grazing	• Cattle holding areas within riparian areas • On-stream watering
Nutrients	Forest fertilization	Fertilizer entering watercourses
	Recent burns	Mobilization from adjacent areas to streams
Pesticides	Forest pesticide application	Application to nontargeted areas by drift or runoff
Petroleum products	• Refueling of equipment • Transportation and fuel storage	Spills

See *Figure 112 (Source water watersheds percentage on BLM lands within the planning area)*. These watersheds are primarily in rural settings and do not involve industrialized contaminant sources. See *Appendix I. Water* for descriptions of specific community public water systems using surface water, population served, and land area affected for each district.

Figure 112. Source water watersheds percentage on BLM lands within the planning area



With the settlement of the Pacific Northwest in the late eighteenth and early nineteenth centuries, along with increasing populations, concerns arose about the quality of drinking water. Early focus centered on the characterization of disease-causing microbes in public water supplies and methods to immobilize or remove them.

As a matter of necessity, small cities in rural areas set up points of diversion from surface waters from federal lands. They generally enjoyed excellent water quality during most of the year with minimal treatment. During the 1950s and 1960s, timber harvesting and range activities increased. A water system survey conducted by the Public Health Service in 1969 showed that only 60% of the public water systems surveyed delivered water that met Public Health Service standards (EPA 2000). Small systems, such as those found in rural communities, were the most at risk. Deficiencies related more to water system equipment, including filtration, disinfection, and a safe distribution system, rather than surface water quality.

The height of road construction, harvesting, and rangeland use on BLM lands occurred in the 1950s through the 1980s. Watersheds have been generally on an improving trend during the last 15 years.

Fire and Fuels

Key Points

- The natural disturbance agent of fire differs in severity and frequency between the northern and southern BLM districts.
- Fire exclusion has increased the risk of high-severity fires in the Medford District and Klamath Falls Resource Area of the Lakeview District.
- Fire exclusion and vegetative ingrowth is a threat to fire resiliency in the Medford District and Klamath Falls Resource Area of the Lakeview District.

Fire Regimes

Fire is a natural disturbance agent that has played a major role in shaping the forests within the planning area. A natural fire regime is a general classification of how fire would behave in the absence of human intervention. See *Table 118 (Frequencies and severities of the natural fire regimes)* for the frequencies and severities of natural fire behavior.

Table 118. Frequencies and severities of the natural fire regimes

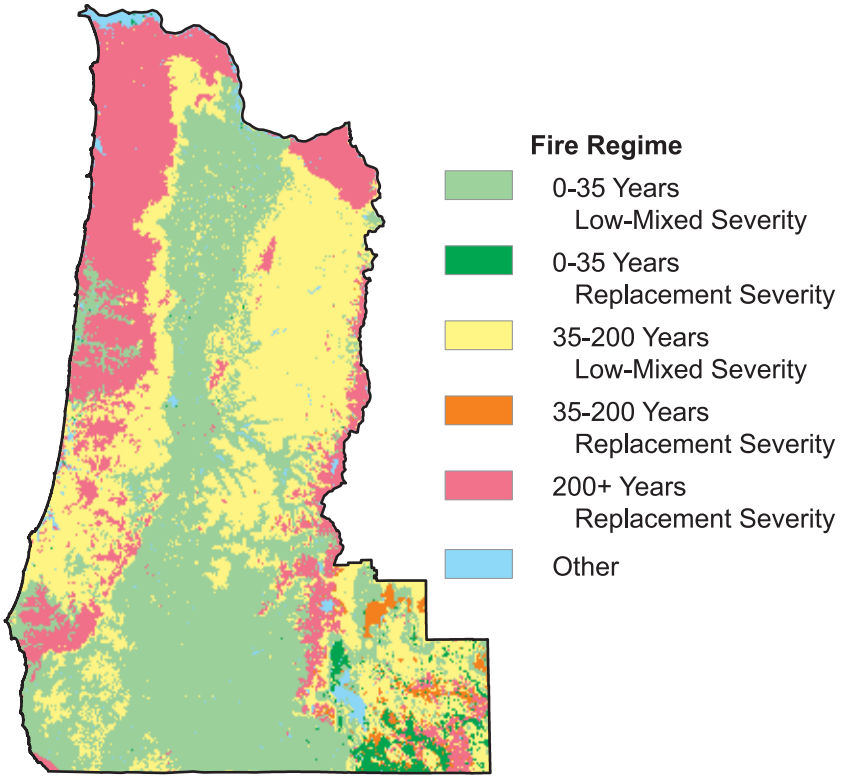
Natural Fire Regime	Frequency (years)	Severity
Fire Regime I	0 to 35	low to mixed (surface fires are the most common)
Fire Regime II	0 to 35	high (stand replacement fires)
Fire Regime III	35 to 100+	mixed
Fire Regime IV	35 to 100+	high (stand replacement fires)
Fire Regime V	200+	high (stand replacement fires)

Generally, the BLM districts within the planning area fall into the following fire regimes:

- Eugene and Salem fall mostly into Fire Regime IV and Fire Regime V.
- Roseburg is a transition zone of weather and the natural fire regimes.
- Coos Bay has a variety of fire regimes.
- Medford falls into Fire Regime I.
- Klamath Falls (a resource area in the Lakeview District) is a complex mix of fire regimes; however, all are dry site (i.e., xeric).

See *Map 31 (Fire regimes).*

Map 31. Fire regimes



The northern districts historically have had less frequent high-severity fire regimes. The southern districts, particularly the Medford District and the Klamath Falls Resource Area, have had less severe but more frequent fire regimes. These frequent low-severity fire events contribute to the fire resiliency of the forests of southern Oregon by removing understory vegetation, reducing ground and surface fuels, and reducing tree density.

There appears to be an emerging trend toward higher severity fires in the southern portion of the planning area (USDA, USDI 2004d). In the dry Douglas fir forests of southern Oregon, forests that currently would burn at a high severity level compose 50% of the landscape compared to 20% historically. This is a result of fire exclusion and harvesting practices that have fundamentally changed the historic fuel conditions (Peterson et al. 2005). These changes to the historic fuel conditions include:

Fire resilient forest

A forest that has characteristics that limit fire severity and increase the resistance of the forest to mortality (Brown et al. 2004).

- An increase in shade tolerant species, which are less fire resistant. Frequent, low-intensity fires control the establishment of fire intolerant species, which are more susceptible to mortality from bowl scorch and have increased the risk of crown fires due to lower canopy base heights.
- The lower height to live crown ratio of shade tolerant species increases ladder fuels.

- Increased tree stocking levels. Frequent, low-intensity fires maintained a higher proportion of low-density stands. Surface fuels accumulate over time as smaller trees crowd out and die.
- A decrease in canopy base height. Frequent, low-intensity fires pruned the lower limbs of the trees that survived and reduced the threat of crown fires.
- Ground fuels build up as duff and large woody material accumulate and decompose. This is a long-term process that occurs over decades. These fuels will not contribute to spread rates but will contribute heavily to fire severity.

The following management practices have increased the potential for uncharacteristic wildfires:

- Fire exclusion has created thickets of ladder fuels and increased fuel loadings.
- A lack of thinning and slash treatments has created higher density stands, understory vegetation, and fuels that favor large, high-severity fires.
- Harvesting practices have removed the more fire-resilient larger trees.
- Excluding areas (such as reserved areas) from the practices of thinning, prescribed burns, or fuel reduction activities makes them susceptible to wildfires of uncharacteristically high intensity and severity. This exclusion also makes them less fire resilient.

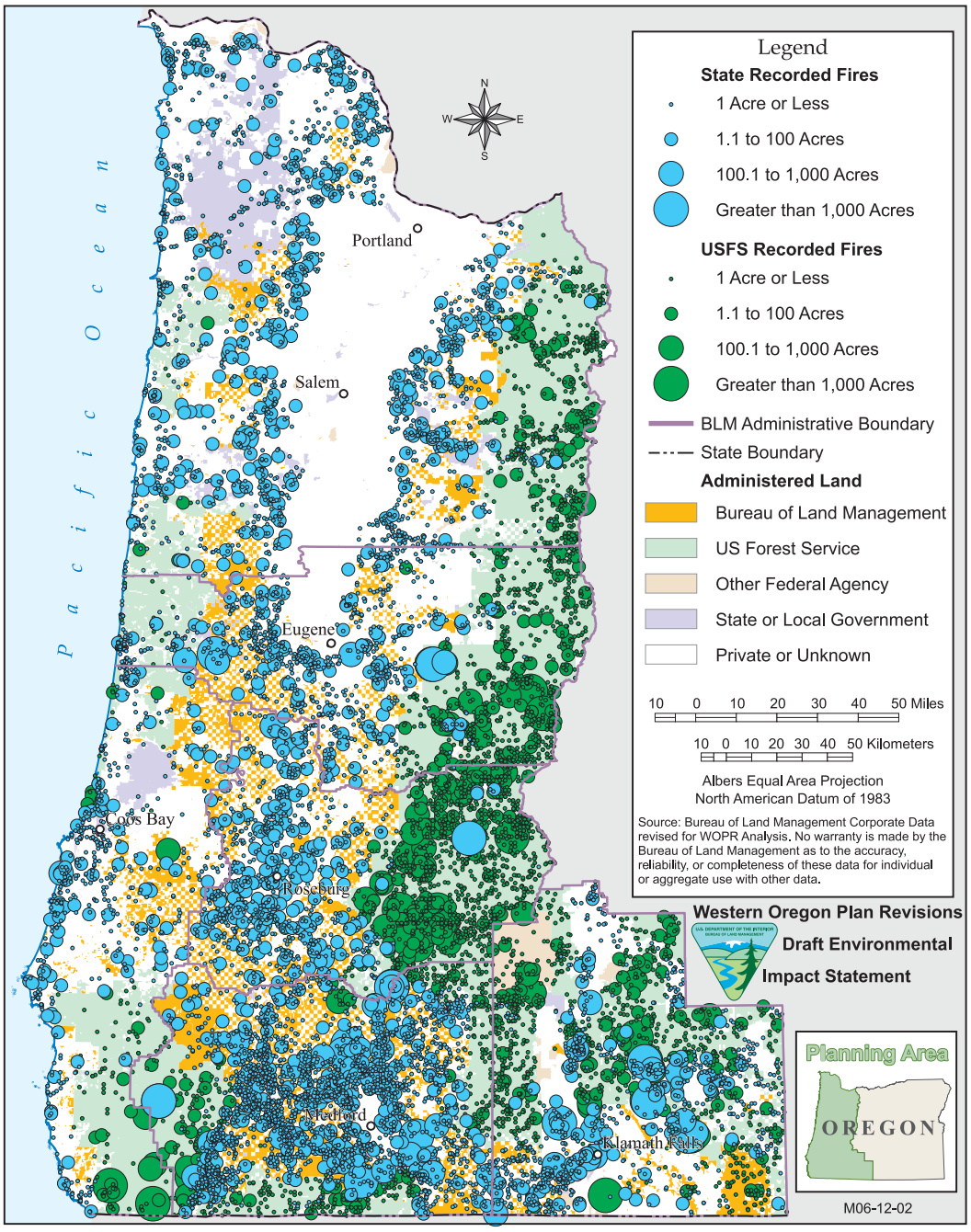
Fire exclusion is not a significant factor in fire severity in the northern portion of the planning area, which has a low return, high fire severity. The existing fuel loadings are likely consistent with the fire regime. In general, fires in the northern portion of the planning area are scattered and tend to be small. In the southern portion of the planning area, however, fire exclusion and harvesting practices have reduced fire resiliency. Research suggests that fire-resilient stands have the following characteristics:

- Reduced surface fuel loading (Cram et al. 2006; Brown et al. 2004; Peterson et al. 2005)
- Lower density and basal area (Cram et al. 2006; Brown et al. 2004)
- Maintain large trees of fire-resistant species (Brown et al. 2004; Cram et al. 2006; Noss et al. 2006)
- Increased diameter increases the probability of the survival of green trees (Brown et al. 2004)
- Increased height to live crown creates multistoried canopies with gaps (Brown et al. 2004; Peterson et al. 2005)

Legacy trees increase fire resiliency within a forest. Currently, 27% of the stand establishment and young stands in the Medford District contain legacy trees and 19% of the stand establishment and young stands in the Klamath Falls Resource Area contain legacy trees.

The Klamath province and the southern portion of the Western Cascades province have a greater abundance of fires. There are more large fires in those province areas. See *Figure 113 (Incidence of forest fires within the planning area between 1994 and 2004)*.

Figure 113. Incidence of forest fires within the planning area between 1994 and 2004



Fire Hazards

Weather plays a major role in assessing fire hazard. Weather can increase the number of days per season that fuels are capable of producing a significant wildfire.

Thunder storms are common in July and August, and more than half cause fires (Agee 1996). The area in western Oregon south of the Rogue-Umpqua divide generally has more severe and frequent thunderstorms with little precipitation. Storms tend to track up the crest and east side of the Cascade Range (Agee 1996).

The primary cause of large wildfire ignitions within the planning area is lightning. The secondary cause is humans. Lightning often produces multiple fire starts that overwhelm available suppression forces.

What is called the wildland urban interface encompasses a large portion of BLM-administered lands within the planning area. A wildland urban interface is an area where structures and other human development meet or intermingle with undeveloped wildland. As wildland urban interface areas continue to develop infrastructure, the sources of wildfire ignition increases also. In southwest Oregon, the primary ignition source of fires is now humans.

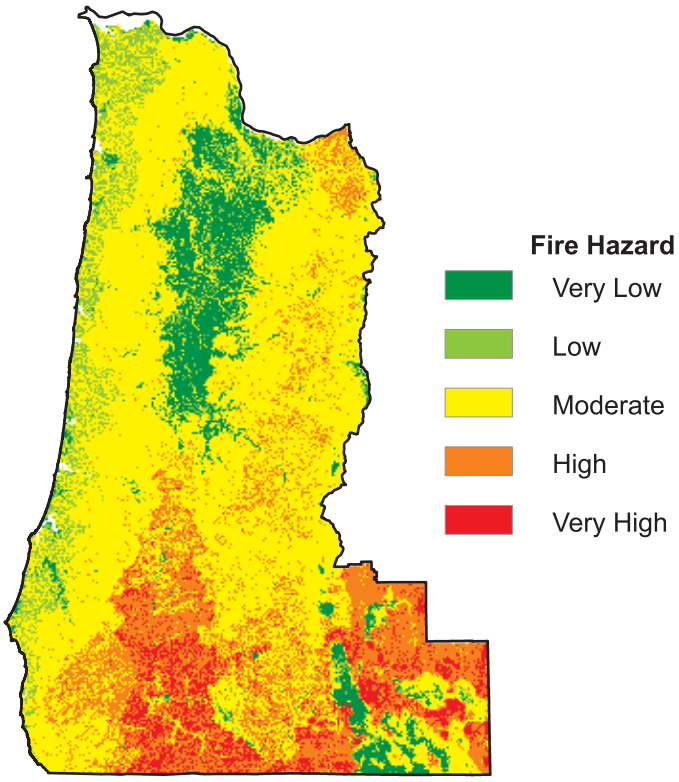
The complexity and difficulty of fire management is increased by the checkerboard land ownership pattern of the BLM lands within the planning area. These BLM lands are interspersed with a variety of other lands (including intensively managed private, industrial forests and residential areas where residents may not want active forest management). While the goal of rapid fire suppression may be common to all landowners, it is often difficult to proactively treat fuel loadings in mixed ownership situations. Rural residents are concerned about smoke and the potential for fire to escape from the prescribed burns that are designed to treat fuel loadings. Industrial landowners are more tolerant of smoke, but, they are also concerned about fire that may escape from prescribed burns. Therefore, the ability to do, and thus the effectiveness of, fuels treatments is often reduced by mixed land ownership.

Ground fuels that consume large amounts of woody fuels and organic soil horizons would produce disproportionately large amounts of smoke compared to fires that are generated from other types of fuels. Ground fires reduce the accumulation of organic material and carbon storage, and contribute to smoke production long after the flaming front of a fire has passed (Graham et al. 2004). Under drought conditions, these fires also damage and kill large trees by killing or damaging their roots and lower stem cambium (Graham et al. 2004). Because of the long duration of ground fires, they may result in greater heating than surface and crown fires with the potential for reducing organic material, volatizing nutrients, and creating a hydrophobic layer that contributes to soil erosion (Graham et al. 2004). Crown fires have the largest immediate and long-term ecological effects and the greatest potential to threaten wildland urban interfaces (Graham et al. 2004).

Fire hazard ratings consider slope, aspect, climate, elevation, fuel type, and crown fire characteristics. A fire hazard and risk assessment was completed in 2006 by the Oregon Department of Forestry. See *Figure 114 (Ratings of fire hazards within the planning*

area) for the district-specific breakdown for the ratings of the fire hazards within the planning area.

Figure 114. Ratings of fire hazards within the planning area



As follows, the general trend for the fire hazard ratings is for them to be lower in the northern portion of the planning area and higher in the southern portion of the planning area:

- About 92% of the lands in the northern districts (Salem through Coos Bay) have a moderate fire hazard rating. The exception is Roseburg where the percentage of lands in the moderate category drops to about 55%.
- About 48% of the lands in the southern portion of the planning area (the Medford District) have a high fire hazard rating along with very high ratings (17% and 33%) that are much higher than in the northern districts (0.1 to 9%).
- The exception to the general north to south trend is the Klamath Falls Resource Area in which the bulk of the lands have a moderate rating. The issue in this area is fire frequency with dry pine sites that are highly susceptible to fire exclusion.

See *Table 119 (Current fire hazard ratings by percent of land within the districts of the planning area)* and *Figure 115 (Current fire hazard ratings by percent of land within the Salem District)* through *Figure 121 (Current fire hazard ratings by percent of land within the Klamath Falls Resource Area of the Lakeview District)* for an illustration of these trends across the districts within the planning area.

Table 119. Current fire hazard ratings by percent of land within the districts of the planning area

BLM Districts	Fire Hazard Ratings (by % of land)			
	Very Low/ Low	Moderate	High	Very High
Salem	2.4	92.9	4.6	0.1
Eugene	0.9	91.5	7.4	0.1
Roseburg	0.1	55.6	35.4	8.8
Coos Bay	5.8	91.0	3.1	0.1
Medford (northern portion)	0.2	35.9	47.1	16.9
Medford (southern portion)	0.2	18.6	48.6	32.6
Klamath Falls Resource Area (Lakeview District)	2.0	73.0	13.0	12.0

Figure 115. Current fire hazard ratings by percent of land within the Salem District

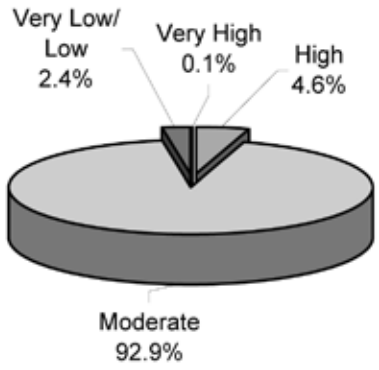


Figure 116. Current fire hazard ratings by percent of land within the Eugene District

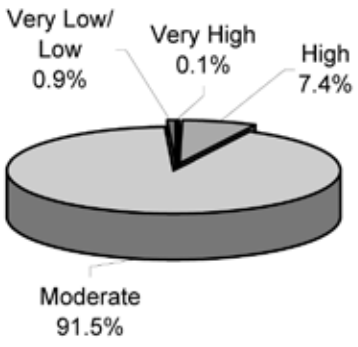


Figure 117. Current fire hazard ratings by percent of land within the Roseburg District

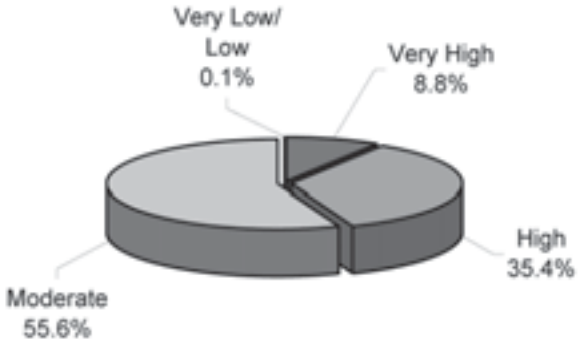


Figure 118. Current fire hazard ratings by percent of land within the Coos Bay District

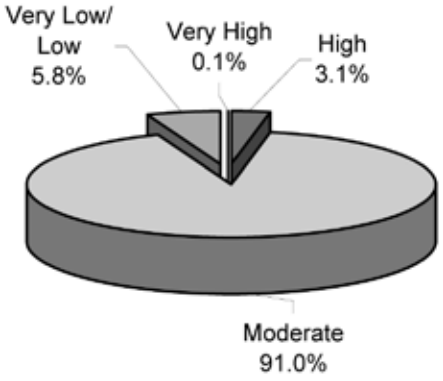


Figure 119. Current fire hazard ratings by percent of land within the northern portion of the Medford District

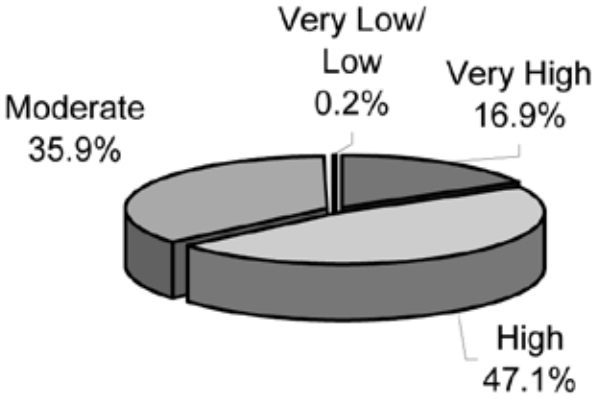


Figure 120. Current fire hazard ratings by percent of land within the southern portion of the Medford District

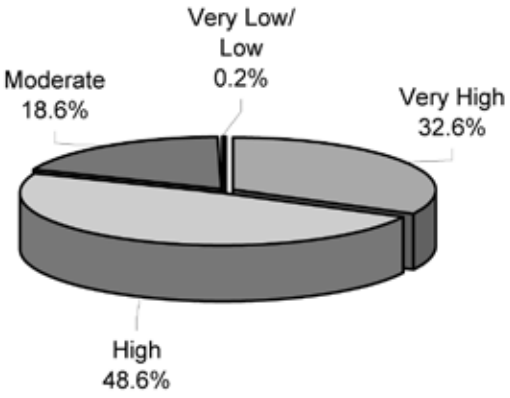
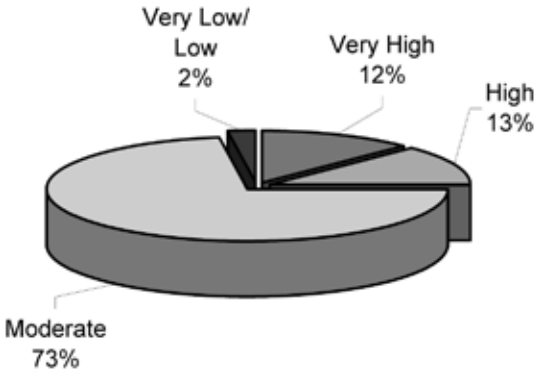


Figure 121. Current fire hazard ratings by percent of land within the Klamath Falls Resource Area of the Lakeview District



Air

Key Points

- Wildfires contribute large amounts of air pollutants in episodic events that often exceed air quality standards over vast areas.
- Prescribed burns contribute negligible amounts of air pollutants in smaller, controlled events that exceed air quality standards over smaller, controlled areas.

The standards for air quality are set by the Environmental Protection Agency under the authority of the Clean Air Act. There are two primary concerns regarding air quality—health standards and visibility.

Western Oregon has a history of air quality issues due to weather patterns and topography. Weather patterns are dominated in western Oregon by the Pacific high pressure system. This weather pattern creates inversions during the summer and late-winter months that causes air stagnation by trapping pollutants at the lower elevations for extended periods of time. Topography compounds this issue by forming topographic bowls with the valleys in western Oregon and Klamath County that create the need for moderately intense storms to move the inversions and to mix the air layers. Most prescribed burning is conducted in the spring and fall when the atmosphere is generally unstable, which allows the mixing of air and the transport of pollutants off-site. All prescribed burning in western Oregon is conducted under the Oregon Smoke Management Plan, which requires dispersion, dilution, and avoidance techniques to minimize smoke impacts on local communities and to direct smoke away from designated areas.

Inversion

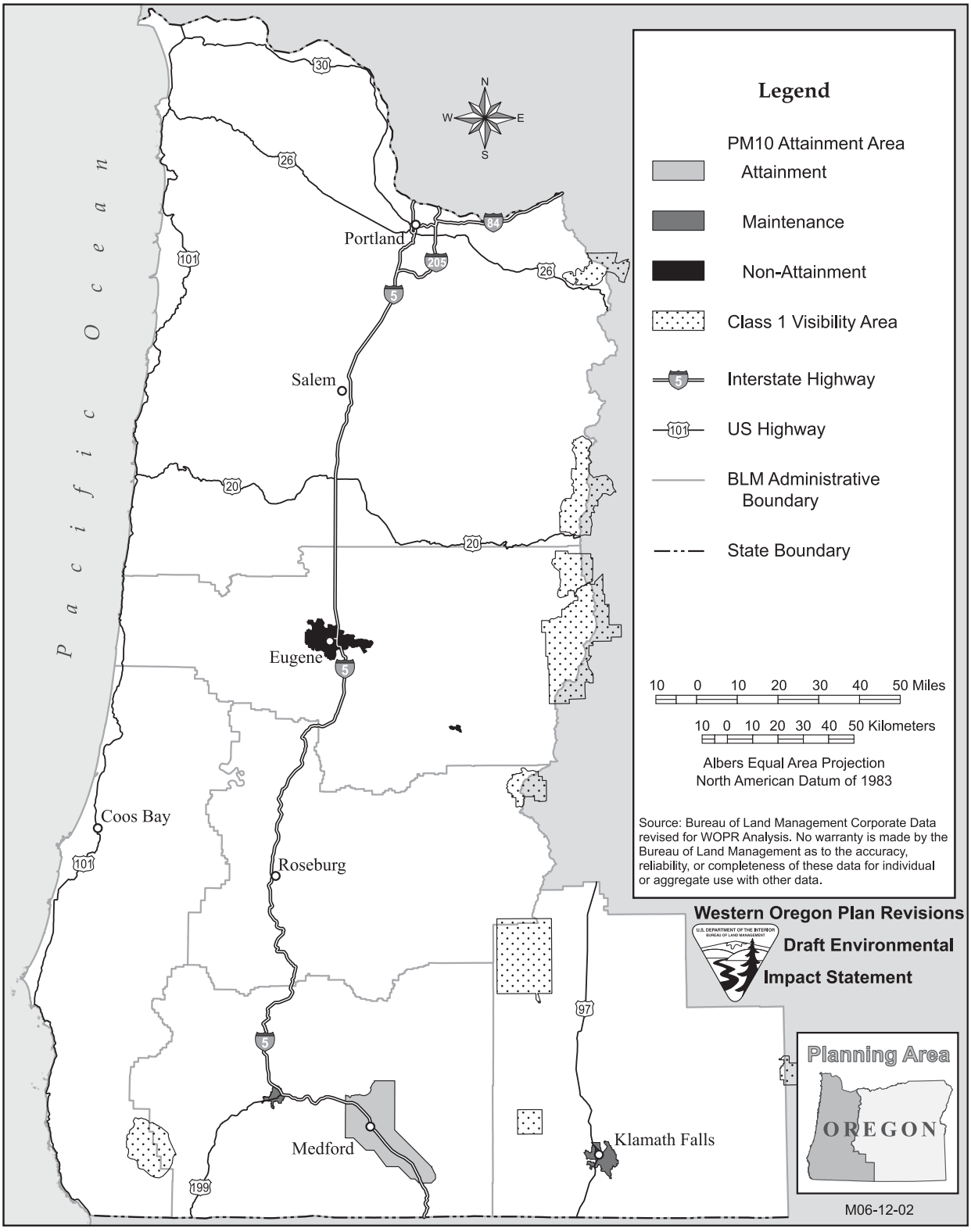
A layer of warm air that prevents the rise of cool air and traps pollutants beneath it.

There are four types of classifications used in Oregon for the designation of air quality areas.

- **Attainment.** Areas that meet air quality standards.
- **Class I visibility areas.** Areas that have very clean air and are subject to the tightest restrictions on how much additional pollution can be added to their airshed.
- **Nonattainment areas.** Areas that have consistently not met the national ambient air quality standards.
- **Maintenance areas.** Areas that have had a history of nonattainment but are now consistently meeting the national ambient air quality standards.

See *Figure 122 (Air quality management areas within the planning area)*.

Figure 122. Air quality management areas within the planning area



In Class I visibility areas, the primary concern is the protection of visibility. These areas are protected under the Oregon State Implementation Plan, which governs regional haze. The following sites in western Oregon and Klamath County are designated as Class I visibility areas:

- Mount Hood Wilderness
- Mt. Jefferson Wilderness
- Mt. Washington Wilderness
- Three Sisters Wilderness
- Diamond Peak Wilderness
- Crater Lake National Park
- Kalmiopsis Wilderness
- Mountain Lakes Wilderness
- Gearhart Mountain Wilderness

Particulate matter is measured by two diameter classes—10 micron (PM10) and 2.5 microns (PM2.5). Both classes contribute to regional haze and reduced visibility. Data from air monitoring stations has shown that wildfire has not been a predominant long-term source of visibility impairment in any Class I area, although emissions from fire are an important episodic contributor to visibility aerosols (Sandberg 2002).

There are currently six nonattainment areas in Oregon. Five are within the planning area.

- Eugene/Springfield Urban Growth Boundary (PM10 nonattainment)
- Lakeview (PM10 nonattainment; redesignation to attainment is pending EPA approval)
- Medford/Ashland (PM10 nonattainment; redesignation to attainment is pending EPA approval)
- Oakridge Urban Growth Boundary (PM10 nonattainment)
- Salem Keizer (carbon monoxide and ozone nonattainment)

There are currently six maintenance areas within the planning area that have been redesignated from nonattainment areas.

- Portland Air Quality Maintenance Area (ozone and carbon monoxide)
- Eugene/Springfield (carbon monoxide)
- Grants Pass Business District (carbon monoxide)
- Grants Pass Urban Growth Boundary (PM10)
- Klamath Falls Urban Growth Boundary (carbon monoxide and PM10)
- Medford Urban Growth Boundary (carbon monoxide)

Smoke from wildfires and smoke from hazardous fuels treatments are similar in composition; however, the amount of emissions from wildfire is roughly double that from fuels treatments (Huff et al. 1995).

In general, particulate matter from the smoke of wildfires and hazardous fuels treatments is the major pollutant of concern to health. Particulate is a general term for a mixture of solid particles and liquid droplets found in the air. Particulate from smoke tends to be very small (less than 1 micron in diameter) and, as a result, is more of a health concern than the coarser particles that typically make up road dust. Particulate matter from wood smoke has a size range near the wavelength of visible light (0.4-0.7 micron). This makes the particles excellent at scattering light and, therefore, excellent at reducing visibility.

Carbon monoxide (CO) is a colorless, odorless gas that is produced from incomplete combustion. It is produced in the largest amounts during the smoldering stages of a fire. Carbon monoxide is potentially one of the most dangerous components of smoke. Concentrations drop rapidly as the proximity to a fire decreases and are usually of concern only to firefighters.

Hazardous air pollutants, such as acrolein, benzene, and formaldehyde, are present in smoke, but in far less concentrations than particulates and carbon monoxide. Nitrogen oxides and volatile organic gasses combine to form ozone. Although not confirmed, there appears to be an indirect link between the large smoke plumes from wildfires and increased ozone levels. The data used to compile the totals of emissions in this document show that approximately 62% of total emissions are 2.5 microns or smaller in diameter.

Recreation

Key Points
• BLM management actions can affect the recreational setting of an area, which, in turn, influence the level and distribution of visitor use. • The growing popularity of off-highway vehicle use has resulted in a trend towards increased demand for this type of activity on BLM lands in western Oregon.

Recreation activities that take place in different settings produce different experiences for visitors. Certain settings are more conducive to certain types of activities and preferred by visitors who engage in them. This relationship between recreation activities and setting preferences can, in turn, influence visitor use patterns and levels across the landscape. If a management action changes the recreational setting of an area, it can cause corresponding changes in the public use of that area.

The recreational setting classification system is based on a combination of physical, administrative, and social setting characteristics. The combination of these characteristics determines the overall recreational setting for a particular area. These settings include:

- primitive
- backcountry
- middle country
- front country
- rural

Physical Setting Characteristics

Physical setting characteristics are directly affected by timber management activities. These features include:

- remoteness (i.e., proximity to roads and road types)
- naturalness (i.e., landscape quality, level of disturbance, forest structural complexity, and age)
- recreational developments (e.g., campgrounds, day-use areas, trails, and other facilities)

The remoteness and naturalness are best suited for measuring the affects of timber management on the recreational setting. Management actions that require road building or decommissioning directly affect the level of remoteness of an area. Those actions that affect forest stand structure and age directly influence an area's level of naturalness.

Recreational developments are also considered characteristics of the physical setting. Timber management actions generally do not directly affect these areas. However, recreational developments directly influence the level and distribution of visitor use.

The BLM's functional road classification system is used to assign road types within middle country, front country, and rural settings in order to determine levels of remoteness. The system is based on traffic volume, vehicle speed, trip distance, travel mobility, and property access. Road types consist of arterial, collector, local, and resource roads (USDI, BLM 1996b, updated 2002). Primitive and backcountry settings are assigned to areas based on their proximity away from all of these road types. See *Table 120 (Classification of recreational settings by remoteness)* for the classification of recreational settings from primitive to rural by levels of remoteness.

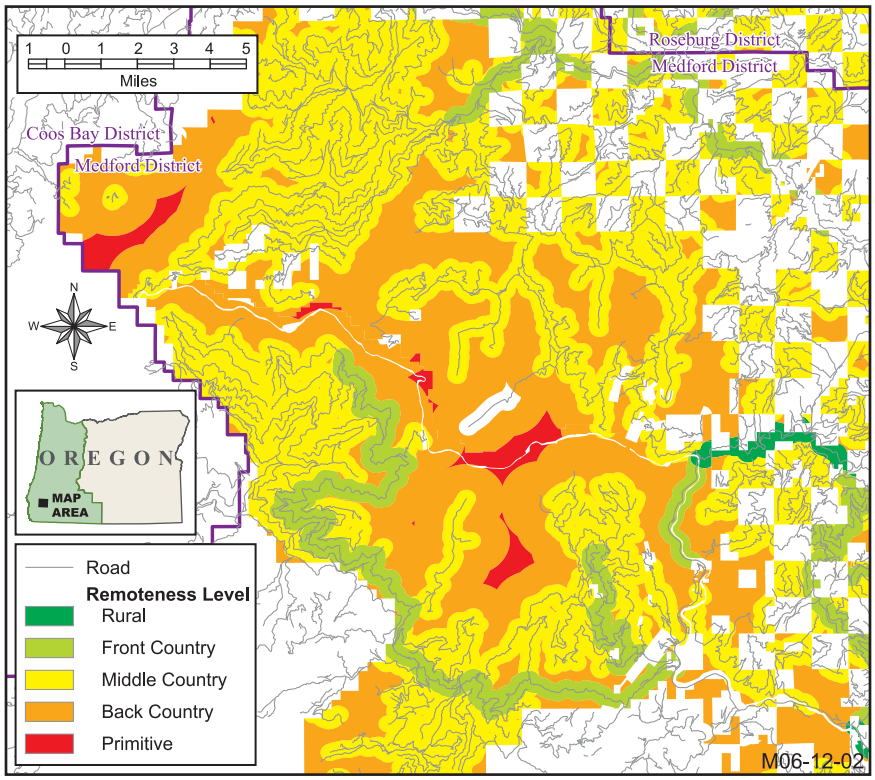
Table 120. Classification of recreational settings by remoteness

Recreational Setting Classifications	Level of Remoteness
Primitive	Greater than 1 mile from any class of road, excluding those that are permanently closed or decommissioned
Backcountry	0.25 to 1 mile from any class of road, excluding those that are permanently closed or decommissioned
Middle country	Within 0.25 mile of local* or resource* roads
Front country	Within 0.25 mile of collector* roads
Rural	Within 0.25 mile of arterial roads or highways

Note: Collector, local, and resource are functional classifications of roads in the BLM road system. For details, see *Transportation* in *Chapter 3* under *Lands, Realty, Access, and Transportation*.

See *Figure 123 (Remoteness levels for a portion of the Klamath Falls Resource Area of the Lakeview District)* for the remoteness levels that exist across a portion of the BLM's land base in the Klamath Falls Resource Area of the Lakeview District.

Figure 123. Remoteness levels for a portion of the Klamath Falls Resource Area of the Lakeview District



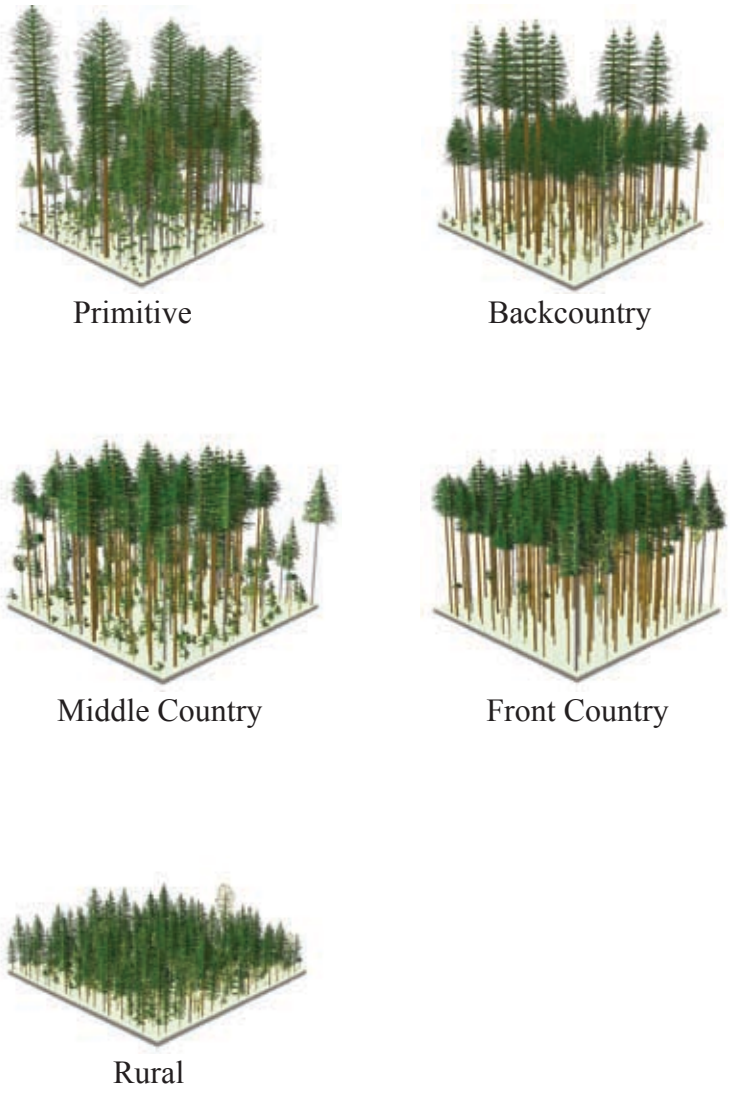
Forest structural stage classifications describe the development of forest stands over time. These structural stage classes are used to classify naturalness levels for each recreational setting. See *Table 121 (Classification of recreational settings by naturalness)* for the classification of recreational settings from primitive to rural by levels of naturalness.

Table 121. Classification of recreational settings by naturalness

Recreational Setting Classifications	Level of Naturalness
Primitive	• Undisturbed natural landscape • Structurally complex forest with existing old or very old forest
Backcountry	• Natural appearing landscape having modifications not readily noticeable • Mature forest with a single or multiple canopies
Middle country	• Natural appearing landscape having modifications that do not overpower natural features • Young, high-density forest with structural legacies; or, young, low-density forest with or without structural legacies
Front country	• Partially modified landscape with more noticeable modifications • Young, high-density forest without structural legacies
Rural	• Substantially modified natural landscape • Stand establishment forest with or without structural legacies

See *Figure 124 (Stand visualizations for each classification of naturalness)* for the naturalness levels for each recreational setting using a series of forest stand visualizations.

Figure 124. Stand visualizations for each classification of naturalness



Administrative Setting Characteristics

The BLM provides a wide range of recreational opportunities for the public across western Oregon. These opportunities are supported by a network of recreational developments that include:

- campgrounds
- day-use areas
- trail systems
- backcountry byways
- environmental education areas
- recreation and public purpose leases to local governments

Included within these areas are numerous wildlife viewing areas, visitor centers, picnic areas, boat ramps, waysides, and other amenities.

See the tables at the end of *Chapter 2* for listings of all recreational developments by district.

Administrative setting characteristics include:

- management controls and constraints (e.g., legal access, regulatory signing, and law enforcement presence)
- motorized use restrictions (e.g. off-highway vehicle area designations)
- visitor services (e.g., interpretive exhibits, environmental education programs, and on-site personnel)

Timber management actions typically do not directly affect these administrative setting characteristics. However, certain aspects of these administrative setting characteristics are important to understanding the recreation program:

- Legal public access is necessary for visitors seeking to recreate on public lands.
- Recreation management areas set the stage for most aspects of the administrative setting.
- Off-highway vehicle area designations directly influence the distribution of visitor use.

Since a majority of BLM lands in western Oregon are intermingled with private lands, public access can vary greatly. Reciprocal right-of-way agreements, easements, and unsecured access rights across adjacent private lands all have a determining affect on public access, which, in turn, influence visitor use.

The BLM has assigned either a secured or an unsecured legal public access status to every distinct management unit of BLM land throughout western Oregon.

Secured legal public access includes public access rights that have been secured by the United States. Public access rights are generally included in the acquisition of exclusive

or access road easements where the United States has acquired control of the right-of-way. Physical access must be present and available via roads or trails.

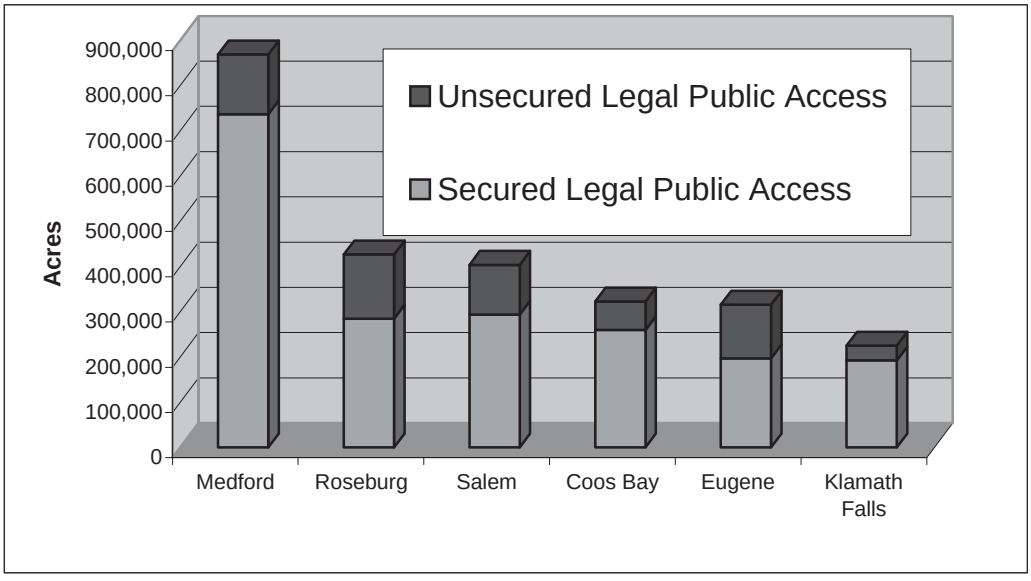
Unsecured legal public access includes public access rights that have not been secured by the United States. Administrative access may be legally and physically available to the BLM, although the right-of-way agreements or easements do not include legal access rights for the public.

There are 1.9 million acres (77%) of BLM lands that are legally accessible to the public and 600,000 acres (23%) that are legally inaccessible to the public. See *Table 122 (Legal public accessibility of BLM lands by district)* and *Figure 125 (Proportion of BLM lands by district with secured or unsecured legal public access)* for these results by district.

Table 122. Legal public accessibility of BLM lands by district

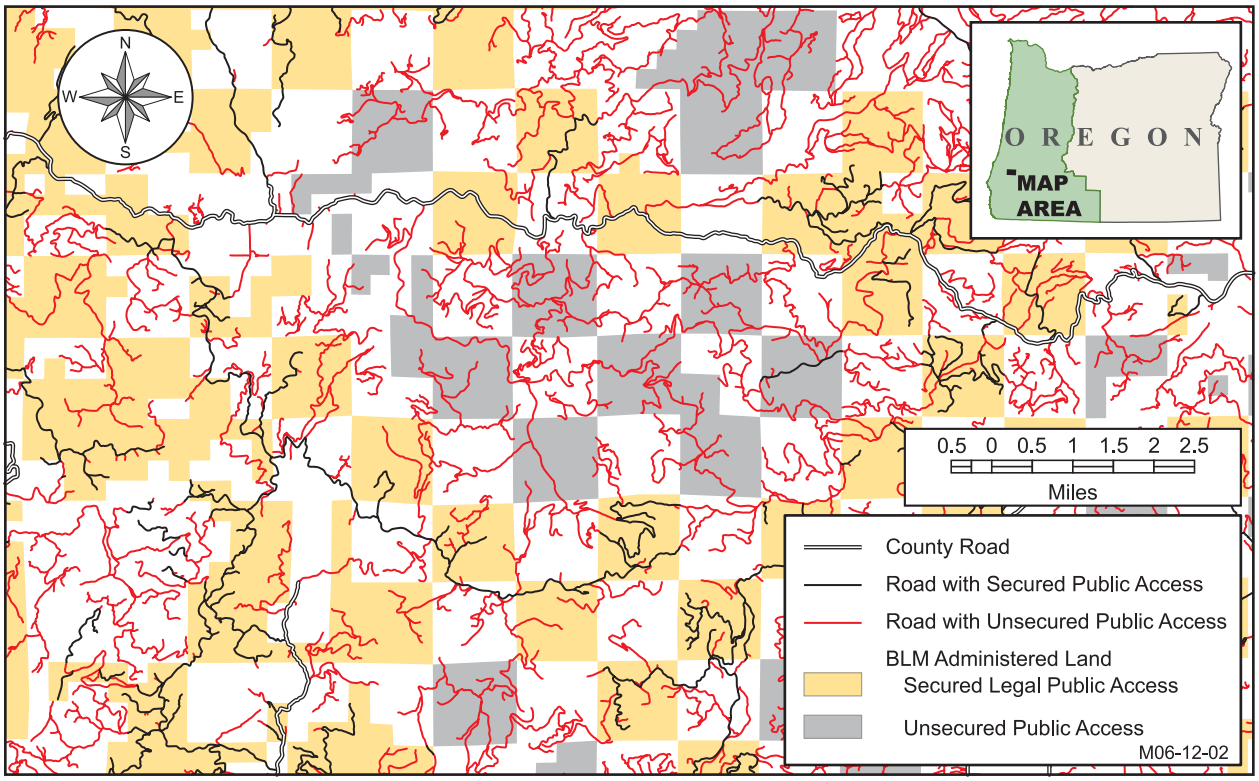
District	Secured Legal Public Access		Unsecured Legal Public Access	
	Acres	Percentage	Acres	Percentage
Salem	293,337	73%	109,887	27%
Eugene	196,740	62%	118,475	38%
Roseburg	284,484	67%	141,832	33%
Coos Bay	259,578	81%	62,647	29%
Medford	736,424	85%	131,804	15%
Klamath Falls Resource Area (Lakeview District)	192,190	85%	32,711	15%
Totals	**1,962,754**	**77%**	**597,356**	**23%**

Figure 125. Proportion of BLM lands by district with secured or unsecured legal public access



See *Figure 126 (Secured and unsecured legal public access to a portion of the BLM's land base in the Coos Bay District)* for an example of secured and unsecured legal public access to a portion of BLM lands in the Coos Bay District. A complete set of legal public accessibility maps are available to the public for review at the district offices.

Figure 126. Secured and unsecured legal public access to a portion of the BLM's land base in the Coos Bay District



All BLM lands are classified as either special or extensive recreation management areas:

- A special recreation management area is a unit of public land identified to provide specific recreational opportunities (i.e., activities, experiences, and benefits). The BLM manages 27 special recreation management areas in western Oregon that total 151,150 acres. See the tables at the end of *Chapter 2*.
- Extensive recreation management areas include all other BLM lands that are not classified as special recreation management areas. Recreation management is generally custodial in nature and used to address dispersed recreational demand. Management is designed to ensure visitor safety, limit resource impacts, and limit visitor conflicts. Extensive recreation management areas total 2.2 million acres across the planning area. See the tables at the end of *Chapter 2*.

All BLM lands are required to be designated as open, limited, or closed to motorized vehicles. Designations are based on the protection of natural and cultural resources, public safety, and limiting visitor conflicts.

- **Open areas.** Areas where off-highway vehicle use is unlimited since there are no issues regarding resources, visitor conflicts, or public safety to warrant limiting cross-country travel.
- **Limited areas.** Areas where off-highway vehicle use is restricted in order to meet recreational and resource management objectives. Restrictions may include:

the number or types of vehicles; the time or season of use; permitted or licensed use only; and limiting use to existing or designated roads and trails.

- **Closed areas.** Areas that are closed to all motorized vehicle use to protect resources, ensure visitor safety, or reduce visitor conflicts.

The BLM also establishes subarea designations for making distinctions within larger off-highway vehicle areas. An off-highway vehicle emphasis area is an example of a subarea designation where off-highway vehicle use is more concentrated and intensively managed. These areas do not allow or prevent off-highway vehicle use. That is only determined through the broader designations of open, limited, and closed. The BLM currently manages six off-highway vehicles emphasis areas within the planning area (totaling 58,000 acres).

The combination of these area and sub-area designations affects the administrative setting, which can in turn influence the level and distribution of recreational demand across the landscape. See the tables at the end of *Chapter 2* for the current off-highway vehicle area and emphasis area designations by district.

Social Setting Characteristics

Social setting characteristics include: visitor contacts (number of encounters with other visitors), the distribution of visitors (number of visitors per area), and evidence of visitors (signs of past visitor use). Evaluating the level and distribution of visitors across the range of physical settings aids in understanding how timber management affects recreation use.

Recreation on BLM lands occurs within the larger context of overall recreational demand in western Oregon. When comparing the BLM's most recent visitor use data (USDI, BLM 2006b) with the Oregon Parks and Recreation Department's most recent outdoor recreation survey data (OPRD 2003), an estimated 17% of the total recreational demand throughout the planning area occurs on BLM lands.

Recreational demand is measured in two ways: (1) the total number of visitors per year, and (2) the total number of participants by 13 primary recreation activity categories. Since one visitor can participate in more than one activity, the number of participants is typically higher than the number of actual visitors.

Overall recreational demand is increasing at a rate of 1.9% each year in western Oregon (OPRD 2003). If this rate remains constant over the next 10 years, total visitation on BLM lands within the planning area is expected to increase from 5.1 to 6.2 million visitors by the year 2016.

This rate of increase is not the same for all recreation activities, nor does the rate of change for individual activities proportionally affect overall changes in recreational demand. For example, nonmotorized boating is expected to increase 7% annually; however, this activity accounts for less than 1% of the total public use on western Oregon

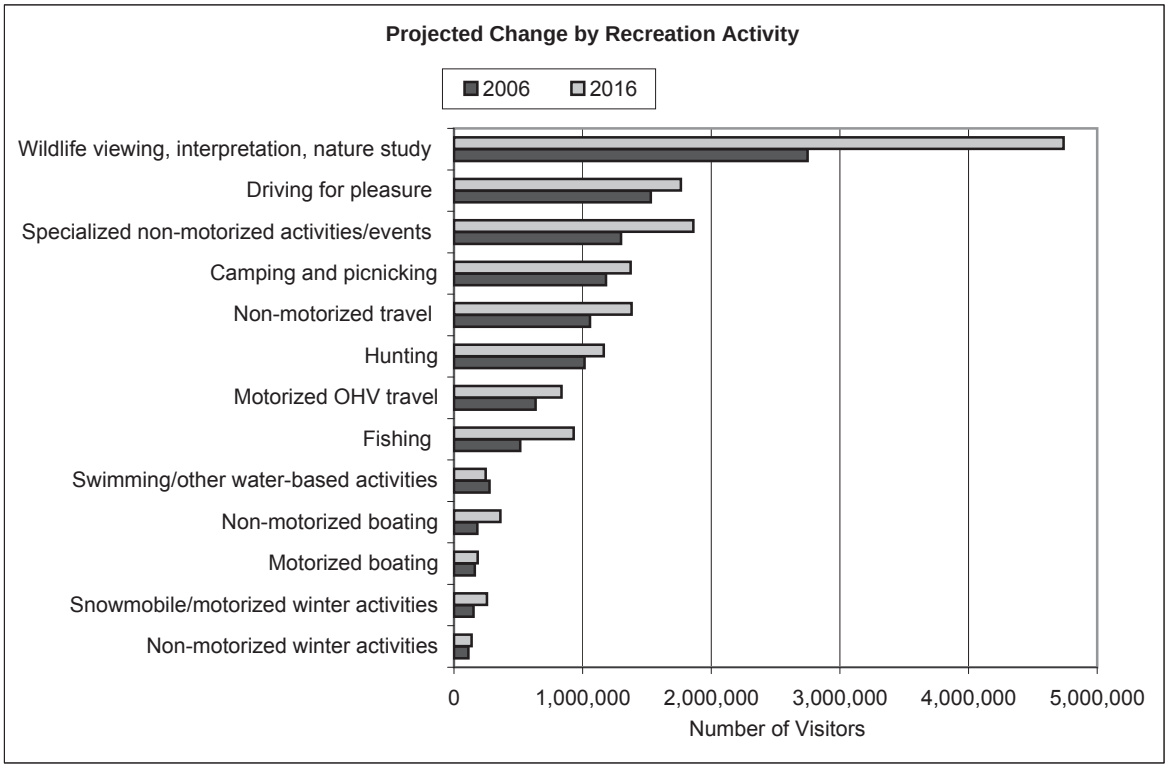
BLM lands. On the other hand, camping and picnicking is projected to increase at a rate of 1% each year, but it accounts for 9% of total visitation.

See *Table 123 (Current and projected levels of participation by recreation activity within the planning area from 2006 to 2016)* for the current level of participation for 13 primary recreation activities on western Oregon BLM lands, the annual rate of change for each activity (based on statewide trends), and their projected levels by the year 2016. See *Figure 127 (Current and projected levels of participation by recreation activity within the planning area from 2006 to 2016)* for an illustration of these trends by activity.

Table 123. Current and projected levels of participation by recreation activity within the planning area from 2006 to 2016

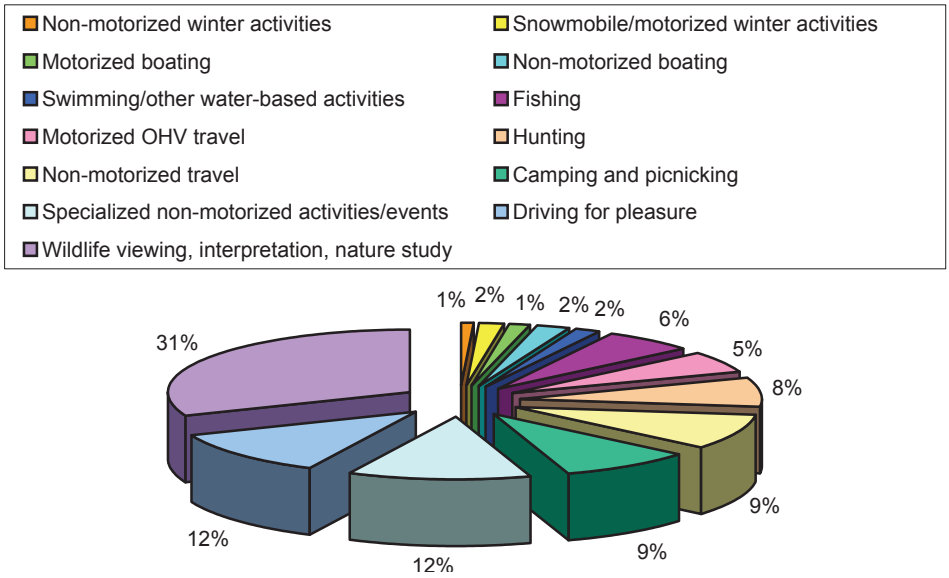
Recreation Activity	Current Level (2006)	Annual Rate of Change	Projected Level (2016)
Nonmotorized winter activities	112,153	1.6%	136,827
Snowmobile and other motorized winter activities	151,061	5.0%	255,897
Motorized boating	161,763	1.0%	183,439
Nonmotorized boating	181,822	7.0%	360,917
Swimming and other water-based activities	277,203	-0.8%	246,156
Motorized off-highway vehicle travel	634,823	2.3%	835,427
Fishing	514,091	5.8%	930,505
Hunting (big game, upland game, and migratory game birds)	1,014,102	1.1%	1,163,175
Nonmotorized travel (hiking, biking, and horseback riding)	1,057,134	2.2%	1,380,617
Camping and picnicking	1,181,868	1.2%	1,373,331
Specialized nonmotorized activities and events	1,297,771	3.1%	1,861,004
Driving for pleasure (along designated BLM roadways)	1,530,294	1.1%	1,764,429
Wildlife viewing, interpretation, and nature study	2,748,317	5.2%	4,738,099

Figure 127. Current and projected levels of participation by recreation activity within the planning area from 2006 to 2016



See *Figure 128 (Proportion of projected recreational demand by activity in the year 2016)*. The proportions are based on the current levels and annual rates of change for each activity.

Figure 128. Proportion of projected recreational demand by activity in the year 2016



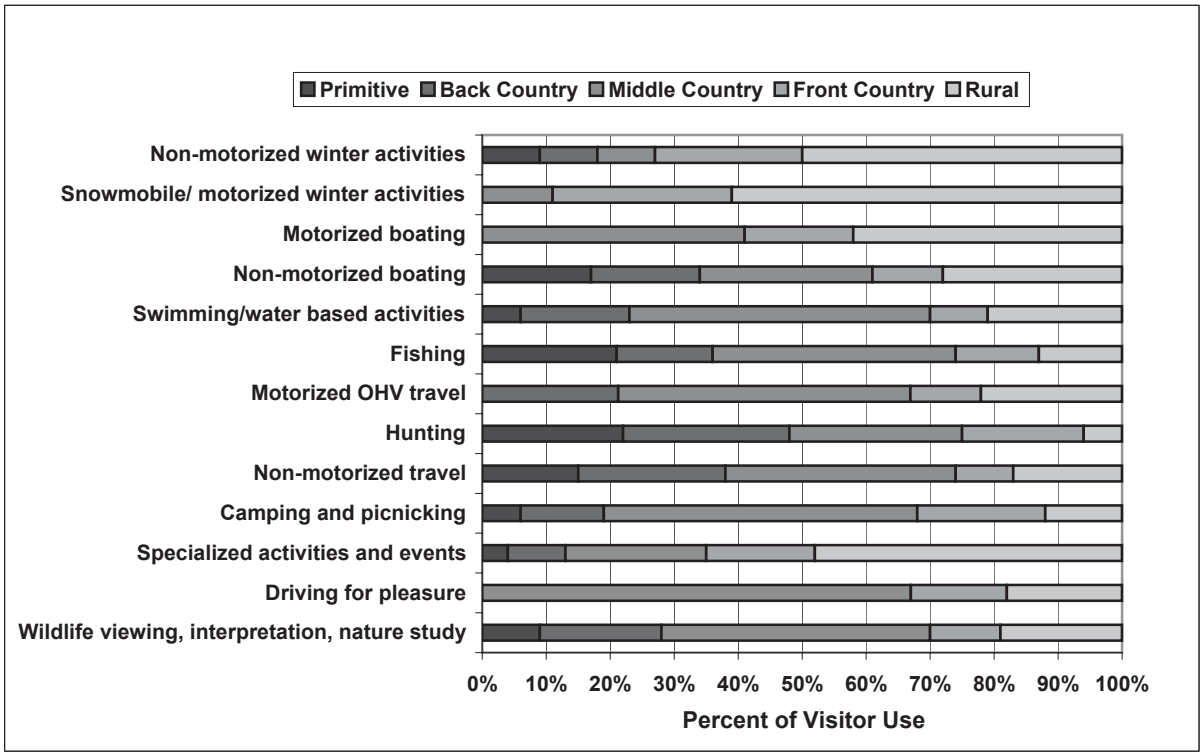
The setting preferences of visitors are used to determine the distribution of recreational demand, which has been adapted from statewide survey data collected for Oregon's Statewide Comprehensive Outdoor Recreation Plan (OPRD 2003)[14]. It is assumed that the distribution of recreational demand on BLM lands within the planning area would mimic these statewide results. See *Table 124 (Distribution of recreational demand by setting for each recreation activity)* and *Figure 129 (Distribution of recreational demand by setting for each recreation activity)* for the distribution of recreational demand by setting for each recreation activity.

Table 124. Distribution of recreational demand by setting for each recreation activity

Recreational Demand	Distribution of Recreational Demand by Setting (% of visitor use)					
	Primitive	Back-country	Middle Country	Front Country	Rural	Totals by Demand
Wildlife viewing, interpretation, and nature study	9	19	42	11	19	**100**
Driving for pleasure	0	0	67	15	18	**100**
Specialized activities and events	4	9	22	17	48	**100**
Camping and picnicking	6	13	49	20	12	**100**
Nonmotorized travel	15	23	36	9	17	**100**
Hunting	22	26	27	19	6	**100**
Motorized off-highway vehicle travel	0	27	42	10	21	**100**
Fishing	21	15	38	13	13	**100**
Swimming and other water-based activities	6	17	47	9	21	**100**
Nonmotorized boating	17	17	27	11	28	**100**
Motorized boating	0	0	41	17	42	**100**
Snowmobile and other motorized winter activities	0	0	11	28	61	**100**
Nonmotorized winter activities	9	9	9	23	50	**100**

[14] In some cases, visitor preferences may be constrained by the administrative setting. For example, off-highway vehicle riders may prefer the primitive setting. These areas, however, are restricted to nonmotorized activities (e.g., wilderness areas). These management constraints were taken into account when developing *Table 124* to avoid such conflicts with BLM policy.

Figure 129. Distribution of recreational demand by setting for each recreation activity



Wilderness Characteristics

Key Points
There are 26,123 acres of BLM-administered lands in western Oregon that have been found to contain wilderness characteristics.

The BLM's authority to conduct wilderness reviews, including the establishment of new wilderness study areas, expired on October 21, 1993 pursuant to Section 603 of the Federal Land Policy and Management Act. However, the BLM has retained the authority under Section 201 of the Federal Land Policy and Management Act to inventory wilderness characteristics and to consider such information during land use planning.

Managing for wilderness characteristics may include protecting certain lands of sufficient size in their natural condition and providing opportunities for solitude or recreation that is primitive and unconfined.

To be of sufficient size, an area must be without roads and at least 5,000 acres. An exception may be made to this acreage requirement when a smaller area is considered large enough to provide for the preservation and use in an unimpaired condition because of its topography, vegetative screening, or other similar features. Another exception is when a BLM area with less than 5,000 acres adjoins an administrative boundary of the United States Forest Service and the combined acreage of the two roadless areas is a minimum 5,000 acres.

During the scoping for the western Oregon resource management plan revisions, 146 public wilderness proposals were received. Thirteen of these areas are located off BLM lands or outside of the western Oregon planning area. Those 13 proposals were not included in the evaluation process. The remaining 133 public wilderness proposals were evaluated to determine if they contain wilderness characteristics. Of these, nine areas were found to contain wilderness characteristics. The remaining 124 areas do not contain wilderness characteristics and, therefore, were not analyzed further.

Six of the nine areas with wilderness characteristics are smaller than 5,000 acres but meet the sufficient size criteria because they are contiguous with United States Forest Service roadless areas. Only the portions of these proposed areas that occur on BLM lands were evaluated and considered during this land use planning process.

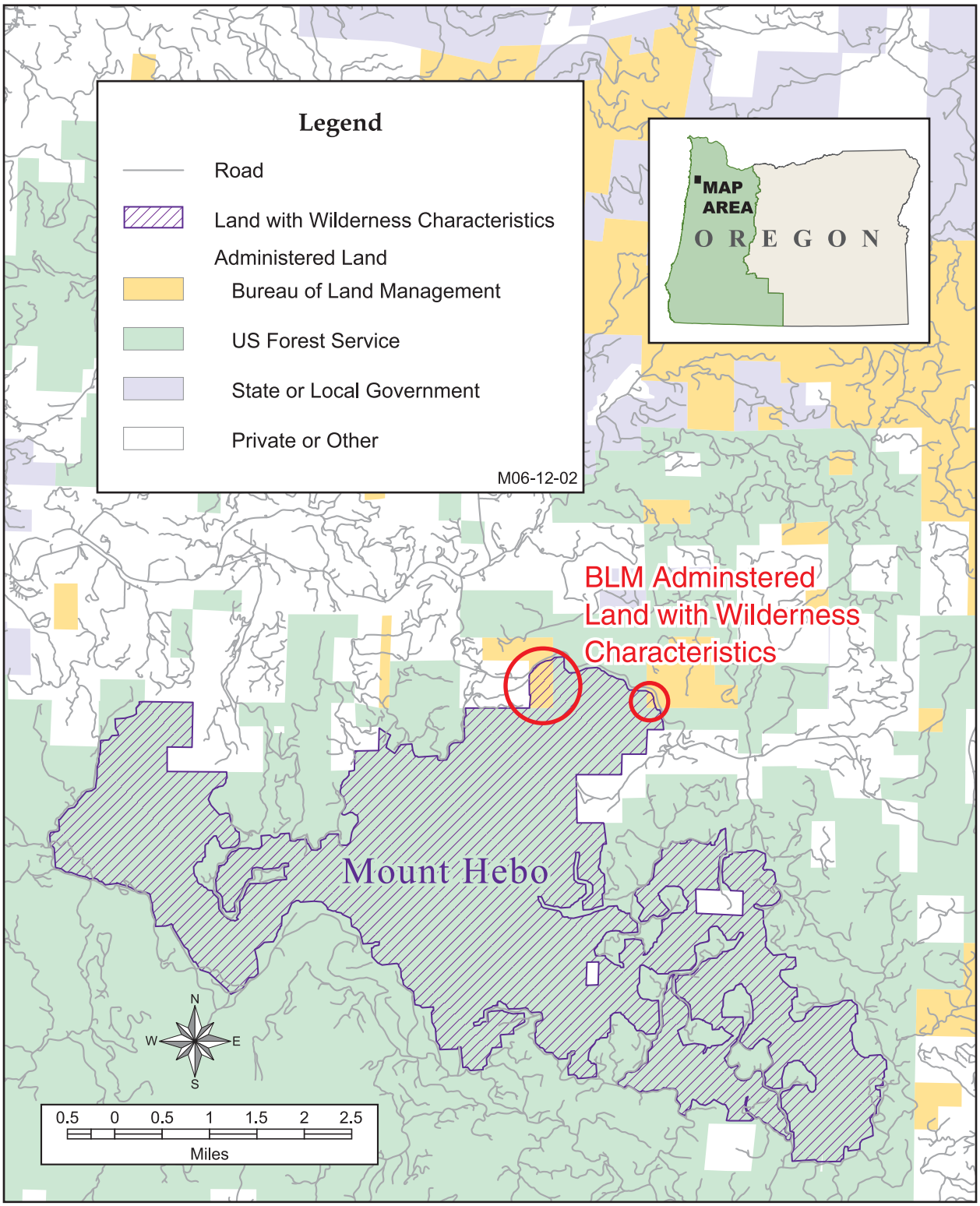
None of the proposed areas that are located on BLM lands are currently designated as wilderness areas or wilderness study areas. See *Table 125 (Lands with wilderness characteristics)* for the proposed areas that were found to contain wilderness characteristics. Refer to *Table22 (Lands with wilderness characteristics maintained under special management)* in *Chapter 2* for those areas that would receive special management. See *Appendix K. Wilderness Characteristics* for the evaluation process used to identify lands with wilderness characteristics.

Table 125. Lands with wilderness characteristics

BLM Lands	Total (acres)	Identified Wilderness Characteristics		
		Naturalness	Outstanding Opportunities for Solitude	Outstanding Opportunities for Primitive, Unconfined Recreation
Salem District				
Bull of the Woods/Opal Creek Additions	3,203	X	X	X
South Fork Clackamas River	919	X	X	
Salmon Huckleberry Additions	637	X	X	X
Mount Hebo	81	X	X	X
Eugene District				
No lands were identified with wilderness characteristics				
Roseburg District				
Williams Creek	116	X	X	
Coos Bay District				
Wasson Creek	3,408	X	X	X
Medford District				
Berry Creek	6,433	X	X	X
Wellington Mountain	5,659	X		X
Whiskey Creek	5,667	X	X	X
Klamath Falls Resource Area				
No lands were identified with wilderness characteristics				
Total	**26,123**			

Figure 130 (Mt. Hebo wilderness characteristics) shows an example of a small unit of BLM land with wilderness characteristics abutting a USFS roadless area.

Figure 130. Mt. Hebo wilderness characteristics



Visual Resources

Key Points
Visual resource inventory classes provide a mechanism to assess the visual impacts of management actions.

Visual resource management is a system for minimizing the visual impacts of surface-disturbing activities and for maintaining scenic values. The BLM's visual resource management system consists of two distinct components:

- visual resource inventory classes (one set of classes—Class I through Class IV)
- visual resource management classes (another set of classes—Class I through Class IV)

Visual resource inventory classes portray the relative quality of visual resources. Inventory classes do not establish management direction and are not used as a basis for constraining or limiting surface-disturbing activities, except for the Class I visual resource inventory class. There are four inventory classes that are assigned to BLM lands through the inventory process:

- **Visual resource inventory Class I.** This class is assigned to areas where a management decision has been made to preserve a natural landscape. This includes areas such as wilderness areas, wilderness study areas, wild and scenic rivers classified as wild, and other congressionally and administratively designated areas.
- **Visual resource inventory Class II, Class III, and Class IV.** These classes are assigned to areas based on a combination of scenic qualities, sensitivity levels, and distance zones.

  Class II visual resource inventory areas have a higher visual resource quality than do Class IV visual resource inventory areas.

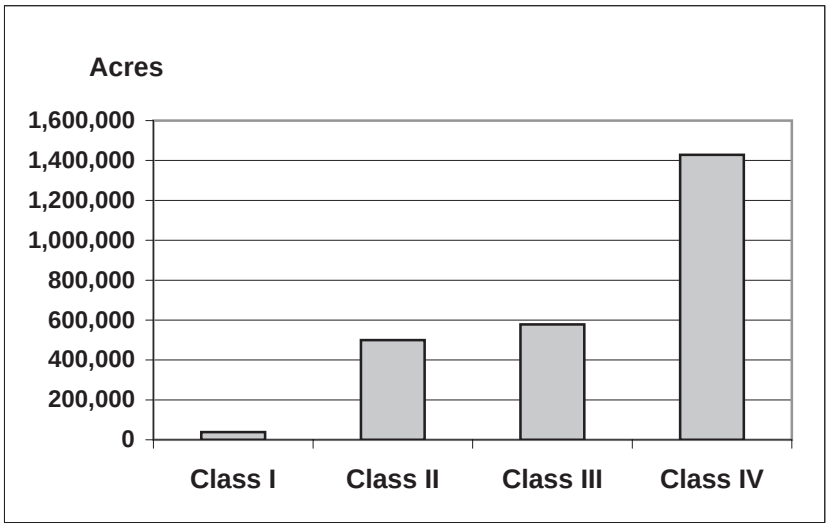
Visual resource management classes are designated through a resource management plan. These class designations can vary from the inventory class designations, except for the Class I visual resource management class. Refer to *Chapter 2* for a description of the management objectives and the allocation of visual resource management classes.

See *Table 126 (Acres of each visual resource inventory class by district)* and *Figure 131 (Acres by visual resource inventory class within the planning area)*.

Table 126. Acres of each visual resource inventory class by district

BLM District	Visual Resource Inventory Classes (acres)			
	Class I	Class II	Class III	Class IV
Salem	19,593	56,996	56,612	253,869
Eugene	1,187	4,739	34,606	272,836
Roseburg	0	92,354	23,582	307,895
Coos Bay	592	13,455	61,974	245,108
Medford	57,093	266,248	317,049	223,447
Klamath Falls Resource Area (Lakeview District)	340	42,824	79,578	100,876
Totals	**78,805**	**476,616**	**573,401**	**1,404,031**

Figure 131. Acres by visual resource inventory class within the planning area



National Landscape Conservation System

Key Points
The BLM manages a variety of National Landscape Conservation System designations within the planning area.

The National Landscape Conservation System, established in June 2000, is designed to conserve, protect, and restore nationally significant landscapes that have outstanding cultural, ecological, and scientific values. The establishment of the system does not create new legal protections. It does, however, provide the administrative structure, staff, and budget that allows the BLM to better manage these areas.

All National Landscape Conservation System designated lands are withdrawn from timber harvesting with the exception of designated, suitable, and eligible wild and scenic rivers that are classified as scenic or recreational. These two classifications allow for limited timber harvesting in a manner that does not impair their free-flowing character, classification, or identified outstandingly remarkable values. Because of this variation in management, only wild and scenic rivers are described in detail below. All National Landscape Conservation System designated lands are summarized in *Table 127 (National Landscape Conservation System designated lands by district)*.

Table 127. National Landscape Conservation System designated lands by district

Designation Type	Name	BLM District	Acres
National monument	Cascade-Siskiyou	Medford	53,000
Wilderness areas	Table Rock	Salem	5,700
	Wild Rogue	Medford	8,700
National scenic trail	Pacific Crest	Medford	488
		Klamath Falls	12
Wilderness study areas	Soda Mountain	Medford	6,107
	Brewer Spruce	Medford	1,705
	Little Sink	Salem	80
	Cherry Creek	Coos Bay	570
	Mountain Lakes	Klamath Falls	340
Outstanding natural area	Yaquina Head	Salem	100
Other congressional designations	Mount Hood Corridor	Salem	4,700
	Bull Run Watershed Management Unit	Salem	660
Wild and scenic rivers	See *Table 128* below	All districts	109,533
		Total	**191,695**

Notes:
- Acreages for the Pacific Crest National Scenic Trail are based on a 100-foot wide corridor with one linear trail mile being equal to 12 acres.
- Acreage for the wild and scenic rivers is based on a half-mile wide corridor with one linear river mile being equal to 320 acres.

Most rivers are added to the National Wild and Scenic Rivers System through federal legislation after a study of the river's eligibility and suitability for designation. The result of the study process is a decision on whether to recommend the designation of a river to Congress (USDA, USDI 1999). There are a number of river segments that are at various stages of this process because of the high concentration of free-flowing rivers within the planning area and the in-depth nature of the study process.

Of the 122 designated, suitable, and eligible wild and scenic river segments:

- 12 are designated;
- 9 are suitable for recommendation to congress; and
- 101 are eligible but have not yet been studied for suitability.

The BLM must provide permanent protection of designated wild and scenic rivers. Interim protection is required for eligible and suitable river segments, until either:

1. An eligible river segment has been determined to be unsuitable for inclusion as a wild and scenic river after completing a suitability study.

2. A determination is made by Congress to include or remove a suitable river segment from the National Wild and Scenic River System.

All designated, suitable, and eligible wild and scenic river segments must be classified as wild, scenic, or recreational. These classifications are defined as follows.

- **Wild river segments.** River segments that are free of impoundments and generally inaccessible, except by trail. Their watersheds or shorelines are essentially primitive and their waters unpolluted. These represent vestiges of primitive America. No timber harvesting is allowed.

- **Scenic river segments.** River segments that are free of impoundments, their shorelines or watersheds are largely primitive and undeveloped, but their shorelines are accessible in places by roads. Limited timber harvesting is allowed.

- **Recreational river segments.** River segments that are readily accessible by road or railroad, they may have some development along their shorelines, and they may have undergone some impoundment or diversion in the past. Limited timber harvesting is allowed.

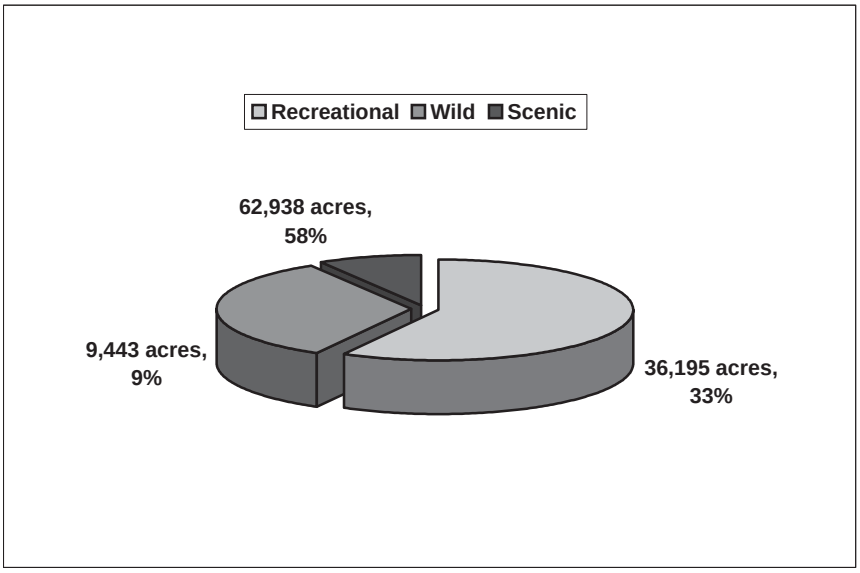
In addition to meeting one of the above criteria, all designated, suitable, and eligible rivers must possess one or more outstandingly remarkable value. These include: scenic, recreational, geological, fish, wildlife, historic, prehistoric, or other similar values.

See *Table 128 (Wild and scenic rivers by district)* for a summary of the wild and scenic river segments that occur on BLM lands within the planning area. See *Figure 132 (Wild and scenic rivers by classification)* for a summary of these river segments by classification. Individual wild and scenic river segments are listed by district in the tables at the end of *Chapter 2*.

Table 128. Wild and scenic rivers by district

Wild and Scenic River Classification	Status	District	Number of River Segments	Acres	Limited Timber Harvesting Allowed
Wild	Designated	Salem	1	142	No
		Medford	1	6,602	
	Suitable	Medford	4	5,083	
	Eligible	Medford	30	24,368	
Scenic	Designated	Salem	3	1,398	Yes
		Klamath Falls	1	2,780	
	Eligible	Salem	3	1,401	
		Medford	2	3,864	
Recreational	Designated	Medford	1	4,911	
		Roseburg	1	2,142	
		Salem	4	2,505	
	Suitable	Salem	2	6,004	
		Eugene	3	6,691	
	Eligible	Salem	25	8,560	
		Coos Bay	4	1,958	
		Eugene	6	2,512	
		Roseburg	3	4,338	
		Medford	28	24,274	
		Total	**122**	**109,533**	

Figure 132. Wild and scenic rivers by classification



Soils

Key Points
Soils perform many functions in the environment that are important for plant growth, water quality, and human benefit. Natural events and management actions can change the capacity of a soil to perform these functions.

Physical, chemical, and biological properties determine soil compactibility, erosiveness, and productivity. For example, shallow soils tend to hold less moisture and nutrients and are more susceptible to loss of soil productivity than deeper soils. Some soils are more or less susceptible to landslides and debris flows depending on geology and slope.

Precipitation falls on the soil surface and is either:

- taken up by plants after being infiltrated and stored in the soil, or
- moves across or through the soil into streams and lakes.

The condition of the soil surface determines how this occurs. The potential for plant growth depends on the ability of the soil to accept, hold, and release nutrients and moisture. Soil provides the environment for root growth and development. Soil serves as the habitat for microorganisms that control processes related to plant nutrition, nutrient cycling, and the biological control of pests. The condition of the subsoil (soil below the surface) determines the effectiveness of these functions (Larson et al. 1996).

Natural events or management actions can change soil properties. Wildfire can reduce the organic matter found in soil and landslides can cause erosion. Timber harvesting, site preparation, road construction, prescribed burns and fuels reduction, off-highway vehicle use, mining, and livestock grazing cause soil compaction or displacement, surface erosion, and mass wasting processes. They also alter nutrient status, soil biology, and long-term soil productivity.

Compaction

Soil compaction is the packing together of soil particles by physical pressure or vibration at the soil surface that results in an increase in soil density and a decrease in pore space. When pore space is decreased to a point where water, air, and plant roots have restricted movement, it increases surface runoff and reduces plant growth. All soils are susceptible to compaction and displacement "regardless of soil type, machine type [ground skidding machinery will cause soil compaction], soil moisture, or other soil characteristics" (Skaugset 1997). In addition, "research and monitoring confirmed that despite their unique design and use, highly mechanized systems (e.g., harvesters and forwarders) for logging younger and smaller timber have the potential to produce significant soil compaction" (Adams 2005).

Soil displacement is a process where the soil surface is moved some distance by mechanical means or the hoof action of livestock. If nutrients, water, and soil organisms are removed from the site, rooting depth is reduced to the point plant growth is decreased. This process usually occurs concurrently with soil compaction.

Compaction and displacement from past timber harvesting activities remain. The extent of these conditions across the planning area is not known.

Soil compaction is also caused by road construction. The road surface must be compacted to hold the weight of rolling vehicular traffic. This results in soil that is unavailable for tree growth. Some literature suggests, however, that the growth of roadside trees may benefit from the increased light, moisture, and reduced competition (Miller et al. 1989). It is not known if increased growth makes up for the loss of trees on the running surface of a road. There are approximately 78,300 acres of roads that are administered by the BLM within the planning area, which represents about 3% of BLM land.

Erosion

Erosion is the detachment and movement of soil particles by water, wind, ice, or gravity. All soils are susceptible to erosion. The soils within the planning area are subject to two types of erosion:

- surface erosion
- mass soil movement from debris flows or avalanches, slumps, and earth flows

Surface erosion is rare on BLM lands within the planning area since undisturbed forest soils have a cover of vegetation, duff, and litter, which limits the overland flow of water and the subsequent erosion. Surface erosion can occur on compacted sites (e.g., roads).

Mass soil movement is common on BLM lands in western Oregon. Slope failures are consistent with the soils, geologic material, and topography in western Oregon (Burroughs et al. 1976). Fast moving debris flows develop in shallow, coarse textured soils on steep slopes (greater than 65 %) in V-shaped drainages (usually in bedded sedimentary rock). Slumps and earth flows occur in deep, saturated soils that are high in silt or clay on gentle to moderate slopes. Soils derived from volcanic and deeply weathered sedimentary materials are subject to this mass movement process.

Both wildfires and prescribed burns cause soil heating. Wildfire is a natural process that occurs with varying frequency, intensity, and severity. Prescribed burns are used as a tool for preparing sites for planting after timber harvests, for changing vegetative species, and for fuels reduction. When soil heating occurs to the point where there is a breakdown in soil structure, soil functions are impaired. Such impairments can include a reduction or loss of organic matter and microbial species, water repellency, and surface runoff.

Productivity

Soil productivity is the ability of a soil to produce vegetation. Vegetative growth requires adequate air, water, and nutrients. The physical (texture and structure), chemical (organic matter decomposition and nutrient release), and biological (nutrient cycling and nitrogen fixation) properties of soil supply air, water, and nutrients for plant growth. When any of these properties are altered such that vegetative growth is reduced, soil function is impaired. These soil properties are influenced by soil compaction and displacement, erosion, and fire.

Soil productivity can be altered through such management actions as the harvesting of timber or the addition of fertilizer. Nitrogen is the main growth-limiting nutrient within the planning area and all districts have applied nitrogen fertilizer in the past, except for some Coast Range areas with soils that are not nitrogen limited.

Organic matter decomposition and the subsequent nutrient release is a major factor of long-term soil productivity. The small components of trees (needles, leaves, and twigs) contain the highest concentrations of nitrogen and yet are the easiest material to remove from a site through displacement, erosion, or fire.

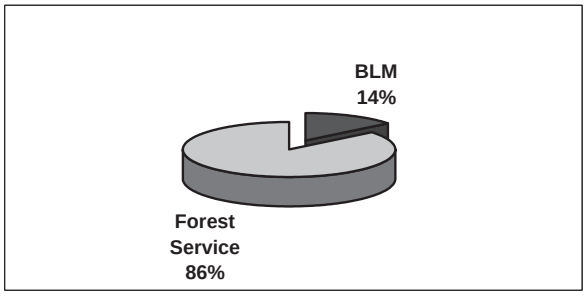
Grazing

Key Points

- The availability of forage and water is generally adequate for livestock.
- The number of vacant allotments and leases within the planning area has increased since 1996 by over 300%.
- The condition within individual allotments is variable based on historic grazing levels, past management actions, and current grazing management.

The Medford and Coos Bay districts and the Klamath Falls Field Office administer livestock grazing on 560,000 acres, which represents 22% of the planning area. See *Map 7 (Lands available for livestock grazing)* in *Chapter 2*. This level of grazing represents 14% of the total federal grazing acres that occur on lands that are covered by the Northwest Forest Plan. See *Figure 133 (Percentage of grazing on BLM and Forest Service lands within the planning area).*

Figure 133. Percentage of grazing on BLM and Forest Service lands within the planning area



The existing grazing leases and permits authorize a total of 26,840 active animal unit months during the grazing season. See *Table 129 (Livestock grazing authorizations by district)*.

Table 129. Livestock grazing authorizations by district

Authorization Type	Coos Bay District	Medford District	Klamath Falls Resource Area (Lakeview District)	Total
Allotments	0	95	96	191
Leases	4	0	0	4
Public land acres	16	352,312	207,682	560,010
Active animal unit months	23	13,416	13,401	26,840
Permittees or lessees	3	59	92	154

The level of livestock grazing on Forest Service and BLM lands that are covered by the Northwest Forest Plan has decreased between the early 1990s and the early 2000s (Charnley 2006). The reasons for the decline include:

- Requirements of the Northwest Forest Plan
- Periods of drought
- Requirements of the Endangered Species Act
- Socioeconomic factors causing the viability of grazing operations to decline
- Difficulty of managing livestock across the checkerboard pattern of intermingled private and federal lands

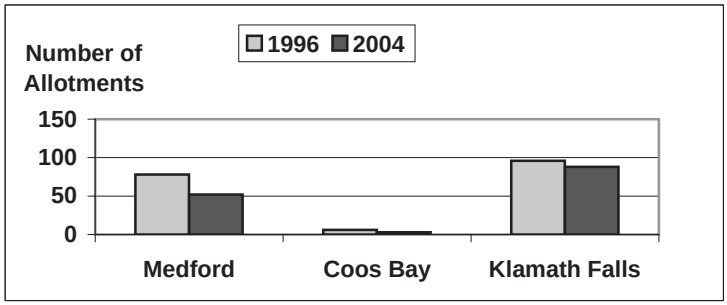
The level, duration, and timing of livestock grazing use within the planning area has been leased or permitted at or below the levels of the current resource management plans. The number of vacant allotments and leases within the planning area has increased from 17 in 1996 (all in the Medford District) to 53 in 2004 (43 in the Medford District, 2 in the Coos Bay District, and 8 in the Klamath Falls Resource Area of the Lakeview District). See *Figure 134 (Change in the number of active allotments between 1996 and 2004)*. Some allotments have been vacant since the 1970s. The reasons for the increase of vacant allotments include:

Vacant allotment

A vacant allotment is an allotment that does not currently have an active permit or lease.

- relinquishment by operators
- cancellation due to nonuse or noncompliance
- lack of interest
- intermingled private land making it difficult to graze within an allotment
- lack of fencing to control livestock on public land

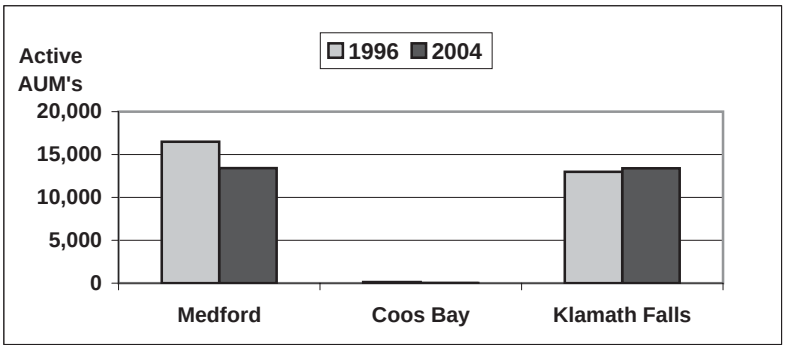
Figure 134. Change in the number of active allotments between 1996 and 2004



The overall number of active animal unit months decreased within the planning area. See *Figure 135 (Change in active animal unit months between 1996 and 2004)*. The increase in the total active animal unit months for the Klamath Falls Field Office between 1996 and 2004 is a result of a combination of factors, including:

- Land sales, acquisitions, and exchanges
- Changes based on rangeland health assessments and rangeland survey results
- Adjustments to correct past allocation errors
- New information

Figure 135. Change in active animal unit months (AUMs) between 1996 and 2004



The condition within individual allotments is variable based on historic grazing levels, past management actions, and current grazing management.

- In the Coos Bay District, the vegetation on BLM land within the four grazing leases is characterized by a mix of native grass species, noxious weeds, and nonnative pasture vegetation with the nonnative pasture species being the dominant vegetation.
- In the Medford District, the vegetation within grazing allotments is characterized by a mix of grassland, chaparral, and mixed conifers and hardwoods.
- In the Klamath Falls Resource Area of the Lakeview District, the eastern portion of the resource area is characterized by nonforested uplands, which are comprised of sagebrush and juniper communities. The western portion of the resource area is characterized by mixed conifers and hardwoods.

Current grazing regulations direct the BLM to manage livestock grazing in accordance with the *Standards for Rangeland Health and Guidelines for Livestock Grazing Management for Public Lands Administered by the bureau of Land Management in the States of Oregon and Washington*. The standards are the basis for assessing and monitoring rangeland conditions and trends. If livestock is a significant causal factor in the failure to meet a standard, management will be implemented to ensure that progress is being made toward the attainment of the standard. A total of 101 allotments, which is 52% of the number of allotments and leases and 53% of the total number of public land acres within the planning area, have been assessed. Livestock was identified as a significant causal factor in the failure to meet one or more of the standards on all or portions of seven allotments. See *Table 130 (Rangeland health standards assessment results)*.

Table 130. Rangeland health standards assessment results

Rangeland Standards Category	Coos Bay District		Medford District		Klamath Falls Resource Area (Lakeview District)		Totals	
	Allot-ments	Acres	Allot-ments	Acres	Allot-ments	Acres	Allot-ments	Acres
Meeting or Making Significant Progress Toward Meeting All Standards	4	16	23	20,280	44	105,548	71	125,844
Not Meeting or Making Significant Progress but Appropriate Action Has Been Taken to Ensure Significant Progress (Livestock is a factor)	0	0	0	0	7	36,369	7	36,369
Not Meeting or Making Significant Progress Toward Meeting Standards Due to Causes Other Than Livestock Grazing	0	0	17	99,667	6	34,697	23	134,364
Total Assessed	**4**	**16**	**40**	**119,947**	**57**	**176,614**	**101**	**296,577**
Total Not Assessed	**0**	**0**	**55**	**232,365**	**39**	**31,068**	**94**	**263,433**
Totals per District	**4**	**16**	**95**	**352,312**	**96**	**207,682**	**195**	**560,010**

Note: The category of *Rangelands Not Meeting All Standards or Making Significant Progress Toward Meeting the Standard-No Appropriate Action has been Taken to ensure Significant Progress Toward Meeting the Standard (Livestock is a Significant Factor)* is not included in the above table as the numbers would all be zero.

Range improvements have been developed when needed to achieve the standards for rangeland health for Oregon and Washington, resource management plan objectives, or other allotment specific objectives. See *Table 131 (Range Improvements constructed or maintained from 1996 through 2006)*. Range improvements have been constructed to:

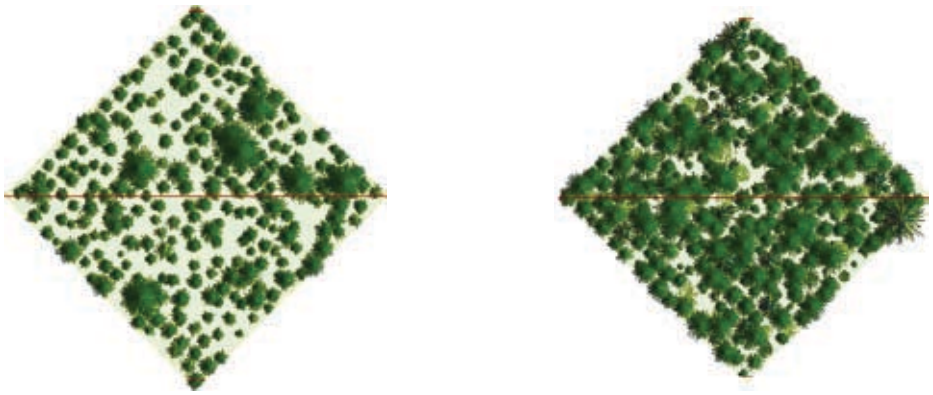
- improve the distribution of livestock;
- provide livestock with forage;
- provide for restoration;
- protect sensitive areas;
- improve wildlife habitat; and
- facilitate intensive management of livestock through the implementation of grazing systems.

Table 131. Range Improvements constructed or maintained from 1996 through 2006

Type of Project	Coos Bay District		Medford District		Klamath Falls Resource Area (Lakeview District)		Totals	
	Units	Miles	Units	Miles	Units	Miles	Units	Miles
Livestock Fences Constructed	0	0	18	5	11	19	29	24
Livestock Fences Maintained	0	0	123	64	21	38	144	102
Reservoirs Constructed or Springs Developed	0	---	6	---	3	---	9	---

As overstory canopy cover decreases, understory forage production increases (USDA, Soils Conservation Service 1971; Young et al. 1967). Production of forage within regeneration harvest units is greater than within thinned stands because the understory vegetation does not have to compete with the overstory for limited resources. Over time, forage production would decline as juvenile trees continue to grow and begin to outcompete forage for the limited resources. The understory production is also influenced by successional stage and forest type (Walburger et al. 2005). The amount of forage production would be higher within a stand establishment forest than within a young, mature and structurally complex forest. See *Figure 136 (Forage production within a stand establishment forest versus a young forest)*.

Figure 136. Forage production within a stand establishment forest versus a young forest



Stand Establishment Forest Young Forest

Off-highway vehicle use affects livestock grazing through the disturbance or harassment of livestock by the type of vehicles and access that permittees and lessees use to manage livestock or to conduct range improvement maintenance.

- Areas designated as open to off-highway vehicle use provide more opportunities for the disturbance or harassment of livestock than areas designated as limited.
- Areas designated as open to off-highway vehicle use do not limit the type of vehicle and availability of access that operators can use to move livestock or conduct range improvement maintenance.

Fuels treatments affect livestock grazing by temporarily changing the use of foraging areas and changing forage production. Adjustments to foraging areas would be needed if soil and vegetation are no longer capable of supporting livestock following fuels treatments. Forage production would decline following fuels treatments but would increase over time as vegetation recovered.

Wild Horses

Key Points
The wild horses within the Pokegama Herd Management Area have an appropriate management level of 30 to 50 head.

The Pokegama Herd Management Area is the only herd management area within the planning area. It encompasses a total of 80,885 acres in Oregon and California and includes private, state, and federal lands. The planning area contains 84% of the herd management area, which is 67,869 acres. See *Map 12 (Location of Pokegama Herd Management Area)* in *Chapter 2* and *Figure 137 (Wild horses in the Pokegama Herd Management Area)*.

Figure 137. Wild horses in the Pokegama Herd Management Area

Approximately 23% of the herd management area that lies within the planning area is located on BLM land while the remainder is located on private land. The wild horse herd is estimated to spend approximately 80 to 90% of its time on private land. The herd management area that is on BLM land is administered by the Klamath Falls Field Office. The private landowners have generally allowed the presence of wild horses on their lands—providing that the horses are within the established appropriate management level and do not range outside of the herd management area.

The appropriate management level for the Pokegama Herd Management Area is 30 to 50 head. The appropriate management level has been maintained through two captures that were completed in 1996 and 2000. Since the designation of the herd management area in 1971, the wild horse population has ranged from 25 in 1972 to 55 in 2000. The current estimate of the herd size is 30 to 35 animals; however, actual horse numbers are difficult to determine in a forested landscape.

The average growth rate for the Pokegama herd is 4 to 5%, which is below the average rate of 20% for other wild horse herds. The lower growth rate for the Pokegama herd may be related to a higher ratio of male to female horses (Gottlieb 1993). The lower growth rate may also be related to young horses being killed by mountain lions during the winter or being illegally removed (USDI, BLM 2002). The overall condition of the herd is excellent (USDI, BLM 1996c, 2002).

Due to the high percentage of private lands (77%) within the herd management area and the use the herd makes of those lands, 150 animal unit months of forage are allocated to the herd on BLM lands. That figure is based on the proportion of BLM-administered lands in the herd management area.

The Oregon portion of the herd management area lies within the boundaries of two grazing allotments. There is abundant forage and available water within the two allotments that comprise the herd management area, even though the distribution of the wild horses is not uniform. The Pokegama herd prefers (94%) meadows, open areas, and the tree cover on the edge of meadows (Gottlieb 1993). During the spring and summer the horses are seen in the northern and central portions of the herd management area. Due to the typically high winter snow accumulations present on the northern and central portions of the herd management area, the horses concentrate in the southern portion of the area from December through March.

The majority (95%) of the Californian portion of the herd management area (13,016 acres) is located on private and state land, while only 5% is located on BLM land. The Pokegama herd can usually be found on the Californian portion of the herd management area during the winter and early spring, although they can be found there at any time of the year.

The diet of the Pokegama herd is predominantly grasses and grass-like species. The primary water sources for the Pokegama herd include creeks, springs, and reservoirs. The BLM and private land owners have constructed several exclosures to protect riparian areas from wild horse use. The majority (70 to 80%) of developed water sources (springs and reservoirs) for the Pokegama herd are located on private land (Lindsey 2006).

Off-highway vehicle use affects wild horses through disturbance or harassment. Areas designated as open to off-highway vehicle use would provide more opportunities for the disturbance or harassment of the wild horse herd than areas designated as limited.

Fuels treatments affect wild horses by temporarily changing the use of traditional watering or foraging areas and changing forage production. Adjustments to traditional watering or foraging areas would be needed if soil and vegetation are no longer capable of supporting wild horses following fuels treatments. Forage production would decline following fuels treatments but would increase over time as vegetation recovered.

As overstory canopy cover decreases understory forage production increases (USDA, Soils Conservation Service 1971; Young et al. 1967). The production of forage within regeneration harvest units is greater than within thinned stands because the understory vegetation does not have to compete with the overstory for limited resources. Over time, forage production would decline as juvenile trees continue to grow and would begin to outcompete forage for the limited resources. The understory production is also influenced by successional stage and forest type (Walburger et al. 2005). The amount of forage production would be higher within a stand establishment forest than within a young, mature, or structurally complex forest. See *Figure 136 (Forage production within a stand establishment forest versus a young forest)* in the *Grazing* section of this chapter.

Areas of Critical Environmental Concern and Research Natural Areas

Key Points
• Relevant and important resource values are being protected and maintained on BLM-administered lands through the special management attention that is prescribed within 132 designated and potential areas of critical environmental concern on 85,548 acres. • There is a high level of diversity in both the values protected within the areas of critical environmental concern across the planning area and the number and types of values contained within any one area of critical environmental concern.

Areas of critical environmental concern were defined in the Federal Land Policy and Management Act as areas within the public lands where special management attention is required to protect or to prevent irreparable damage to:

- important historic, cultural, or scenic values;
- fish and wildlife resources;
- other natural processes or systems; or
- life and safety from natural hazards.

Special management attention is developed to expressly protect relevant and important values. The management measures used for special management attention would not be necessary if the relevant and important features were not present, and would not be prescribed in the absence of the designation.

Some special management attention is designed to change the relevant and important value on a trend towards the desired condition. Other special management attention is designed to protect the relevant and important values from management actions or other human activities, such as timber harvesting or recreation activities, by prohibiting those activities or by modifying the methods that would be used.

In order to be considered for designation as an area of critical environmental concern, an area must meet relevance and importance criteria and require special management attention. An area meets the relevance criterion if it contains one or more of the following:

- an important historic, cultural, or scenic value;
- a fish and wildlife resource;
- a natural process or system; or
- a natural hazard.

The value, resource, process or system, or hazard described above must have substantial significance in order to satisfy the importance criteria. This generally means that the value, resource, process or system, or hazard is characterized by one or more of the following:

- it has more than locally significant qualities that give it special worth, consequence, meaning, distinctiveness, or cause for concern, especially compared to any similar resource;

- it has qualities or circumstances that make it fragile, sensitive, rare, irreplaceable, exemplary, unique, endangered, threatened, or vulnerable to adverse change;
- it has been recognized as warranting protection in order to satisfy national priority concerns or to carry out the mandates of the Federal Land Management and Practices Act;
- it has qualities that warrant highlighting in order to satisfy public or management concerns about safety or public welfare; or
- it poses a significant threat to human life or safety, or to property.

Research natural areas are designated as a type of area of critical environmental concern. These areas are established and maintained for the primary purpose of research and education because the land has one or more of the following characteristics:

- a typical representation of a common plant or animal association;
- an unusual plant or animal association;
- a threatened or endangered plant or animal species;
- a typical representation of common geologic, soil, or water feature; or
- an outstanding or unusual geologic, soil, or water feature.

The research natural area network is designed to play a role as a control group or reference site to allow the BLM to determine if changes that are due to climate change, invasive organisms, or disturbance processes are occurring in the forests that are being managed for sustained yield to the same degree as in the research natural areas.

Outstanding natural areas are dually designated as an area of critical environmental concern. These areas are designated to protect the unique scenic, scientific, educational, and recreational values of certain areas within the public lands.

Within the planning area, there are:

- 94 designated areas of critical environmental concern;
- 5 potential areas of critical environmental concern that have been under interim management;
- 34 designated areas of critical environmental concern that are also research natural areas; and
- 7 designated areas of critical environmental concern that are also outstanding natural areas.

There are 85,548 acres within the designated and potential areas of critical environmental concern. The potential areas of critical environmental concern are under interim management. (The potential areas of critical environmental concern were nominated during the previous resource management plan process and are referred to in this analysis as “old” potential areas of critical environmental concern.) See *Table 132 (Designated and old potential areas of critical environmental concern by district).*

Table 132. Designated and old potential areas of critical environmental concern by district

Areas of Critical Environmental Concern (ACECs)	Salem	Eugene	Roseburg	Coos Bay	Medford	Klamath Falls	Totals
Designated ACECs	26	14	10	11	28	5	94
Potential ACECs (under interim mgmt)	0	3	0	0	0	2	5
Research natural areas	8	5	7	1	12	1	34
Outstanding natural areas	5	1	0	0	1	0	7
Total ACEC acres per district	20,029	12,915	12,165	10,211	17,692	12,536	85,548
Total BLM acres per district	403,000	315,100	426,300	322,700	865,800	224,900	2,557,800
% ACEC acres of BLM acres	5.0%	4.1%	2.9%	3.2%	2.0%	5.6%	3.3%

Note: The research natural areas and outstanding natural areas are dually designated as areas of critical environmental concern, and their numbers are already counted within the designated and potential numbers.

Each district received new nominations for areas of critical environmental concern for the revisions of the western Oregon resource management plans. Thirty-three areas were found to meet the relevance and importance criteria and were recommended for further analysis in the plan revisions as new potential areas of critical environmental concern. While these areas are not currently designated as areas of critical environmental concern, their relevant and important values receive interim management upon nomination and are discussed here. None of these areas were nominated as research natural areas or outstanding natural areas. There are 20,608 acres within these 33 new potential areas of critical environmental concern. See *Table 133 (New potential areas of critical environmental concern by district)*.

Table 133. New potential areas of critical environmental concern by district

Areas of Critical Environmental Concern (ACECs)	Salem	Eugene	Roseburg	Coos Bay	Medford	Klamath Falls	Totals
New potential ACECs	10	5	3	6	7	2	**33**
Total ACEC acres per district	5,508	2,040	202	4,053	8,620	185	20,608
Total BLM acres per district	403,000	315,100	426,300	322,700	865,800	224,900	2,557,800
% ACEC acres of BLM acres	1.4%	0.6%	0.05%	1.3%	1.0%	0.08%	0.8%

Relevant and important values are usually described in four categories. See *Table 134 (Value categories for designated and old potential areas of critical environment concern by district*) and *Table 135 (Value categories for new potential areas of critical environmental concern by district)*.

- Historic, cultural, or scenic values include, but are not limited to, rare or sensitive archeological resources and religious or cultural resources that are important to Native Americans.
- Fish and wildlife resources include, but are not limited to, habitat that is needed for endangered, sensitive, or threatened species, or habitat that is essential for maintaining species diversity.

- Natural processes or systems include, but are not limited to, endangered, sensitive, or threatened plant species; rare, endemic, or relic plants or plant communities that are terrestrial, aquatic, or riparian; or rare geological features.
- Natural hazards include, but are not limited to, areas of avalanche, dangerous flooding, landslides, unstable soils, seismic activity, or dangerous cliffs. A hazard caused by human action may be considered a natural hazard if it is determined through the resource management planning process that it has become part of a natural process.

Table 134. Value categories for designated and old potential areas of critical environment concern by district

Value Category	Salem	Eugene	Roseburg	Coos Bay	Medford	Klamath Falls	Totals
Historic, cultural, and scenic	8	4	2	5	8	5	**32**
Fish and wildlife	17	12	3	5	8	5	**50**
Natural process or system	26	15	9	11	27	7	**95**
Natural hazard	2	0	0	0	0	0	**2**

Table 135. Value categories for new potential areas of critical environmental concern by district

Value Category	Salem	Eugene	Roseburg	Coos Bay	Medford	Klamath Falls	Totals
Historic, cultural, and scenic	0	0	0	1	1	1	**3**
Fish and wildlife	1	3	0	2	3	1	**10**
Natural process or system	9	4	3	5	7	2	**30**
Natural hazard	1	0	0	0	0	0	**1**

While it is only necessary for an area to meet the relevance and importance criteria for one value to qualify as an area of critical environmental concern, many areas within the planning area meet these criteria for several values. However, the number of values that meet the relevance and importance criteria can vary widely across the planning area, as can the combination of values that meet these criteria within an area of critical environmental concern. For example, area of critical environmental concern values range from a single special status plant species (Kincaid's lupine) in the Stouts Creek Potential Area of Critical Environmental Concern in Roseburg, to a combination of unique geologic features, vernal pools, special status plants (natural processes and systems), listed fairy shrimp (fish and wildlife), developed interpretive educational area, scenic and cultural values at the Table Rocks Area of Critical Environmental Concern/Outstanding Natural Area in Medford.

Cultural Resources

Key Points
Cultural and paleontological sites are not evenly distributed across the districts but the location of sites is predictable.

Cultural and paleontological resources are nonrenewable and typically consist of physical remains. Some traditional use sites and some historic sites may only be identified through written historic records or oral traditional sources and may not have physical remains. Collectively, these resources can be called heritage resources. See *Table 136 (Heritage resources by district)*.

Table 136. Heritage resources by district

Heritage Resources	BLM Districts					
	Salem	Eugene	Roseburg	Coos Bay	Medford	Klamath Falls
Archaeological sites[a]	58	89	223	47	357	924
Historic sites[b]	142	7	23	45	711	217
National Register of Historic Places (eligible)	7	2	45	5	130	0[c]
National Register of Historic Places (listed)	4	0	2	1	26	0[c]
% of district inventoried	25	4	15	10	7	50
Paleontological sites	6	0	18	19	2	Isolated

Notes:
[a]Sites that contain either or both prehistoric and historic surface and subsurface deposits.
[b]Sites with historic structural remains.
[c]No formal determinations have been conducted.

Cultural resource locations are identified as:

- sites (the locations of a significant event, a prehistoric or historic occupation or activity, or a building or structure); or
- isolated finds (the locations with fewer than 10 artifacts).

Cultural sites may be prehistoric, historic, or both. Sites may be entirely buried, may consist of above-ground or built features only (particularly historic sites), may include archeological remains, or may consist of features that are not native or natural to the specific environment. Nonnative features may be evidenced by domestic fruit trees and a clearing, which may be the only remaining evidence of a homestead site.

Types of Cultural Resource Sites

The types of cultural resource sites include lithic scatters and other prehistoric sites, historic sites, paleontological sites, and traditional use sites.

- Lithic scatters account for at least 80% of the prehistoric sites within the planning area. Lithic scatters are sites that consist primarily of flakes and chipped stone tools.
- Other categories of prehistoric sites recorded within the planning area include rock shelters, middens, middens with structural features, rock art, rock features, lithic quarries, house pits, and peeled trees. Human burial sites may occur in districts either as individual sites or as features within larger sites (e.g., middens and housepit villages). Stacked rock hunting blinds and rock ring villages are contained in the Klamath Falls Resource Area of the Lakeview District. Stacked rock cairns in the Klamath Falls Resource Area are often associated with Native American vision quests.
- Historic sites within the planning area are predominantly associated with the following activities:
  - homesteading, ranching, and settlement
  - logging
  - fire suppression
  - mining
  - subsistence living
  - government management of the land
- Paleontological sites consist of the physical remains of past animal or plant life in the form of fossils. Paleontological sites are uncommon within the planning area. The known sites have fossil remains of invertebrate marine and plant species. No known sites have vertebrate fossil remains.
- Traditional use sites play a current role in a living community's historically rooted beliefs, customs, and practices. Traditional use sites within the planning area may include areas where traditional resources (food resources, basket making resources, and other traditional material sites) are collected and spiritual or sacred sites are located. Two of the federally recognized Indian tribes within the planning area (the Confederated Tribes of Warm Springs and the Klamath Indian Tribe) have off-reservation treaty rights. The Klamath Indian Tribe's rights, however, apply to their former reservation boundaries, which are not within the planning area. Members of the Confederated Tribes of Warm Springs do exercise their off-reservation rights within the planning area (west of the Cascade crest into the Portland basin and extending south into the northeast reaches of the Eugene District). Trust responsibility directly applies to proposed agency actions that could pose an effect on tribal lands and resources (e.g., water quality, air quality, or fire control).

Prehistoric Sites

Overall site density is difficult to ascertain on BLM-administered lands in western Oregon due to the checkerboard pattern of land ownership, which has prevented extensive cultural resource surveys from being conducted over large contiguous areas within any single terrain type. Ascertainment of site density is further handicapped by heavy groundcover in the forested environment. However, it is possible to make some broad generalizations regarding prehistoric site density based on BLM inventory acreages and site documentation from the past 30 years.

Northern and Coastal Areas (Salem, Eugene, and Coos Bay Districts)

The majority of prehistoric archaeological sites on the west slopes of the Cascade Range are situated in predictable locations. Sites are typically situated:

- along the crests of major ridge systems (often within saddles);
- on river and stream terraces and on upland slump benches and meadows;
- on the lower reaches of east, south, and west aspect slopes within the 400 to 500 foot upslopes of larger secondary streams; and
- where quarry sites occur on slopes.

Ridgeline sites are the most scattered as their locations are strongly associated with saddles, which are limited in number and distribution. Not all ridgeline saddles contain archaeological sites. Sites within this location category have a site density of 1 or 2 sites per linear mile of ridgeline.

Valley margin sites have much higher densities with as many as 14 sites recorded within a single 500 acre tract for an average density of approximately 1 site per 37 acres. However, site distribution in this setting is often much more concentrated with as many as six distinct artifact clusters being located within a 40 acre tract.

The BLM lands in the Salem and Eugene districts, with some notable exceptions, are absent from the valley floors of all, but the most minor, streams.

There are only 12 recorded prehistoric archaeological sites located on BLM land in the Coast Range. The lack of prehistoric archaeological sites is verified by the results of numerous preproject cultural resource surveys. The few known sites do not provide enough information to identify topographic settings that have a high probability for site occurrence.

The scarcity of known prehistoric sites on BLM land in the Coast Range is in part due to the history of BLM land tenure in the Coast Range. Most of the land administered by the BLM is revested O&C parcels and in the Coast Range those parcels have steep midslopes that largely preclude habitation.

Southern Area (Roseburg and Medford Districts)

In the Siskiyou Mountains, known prehistoric sites are located in the vicinity of permanent springs and along river and stream terraces. The underlying serpentine bedrock includes pockets of high-quality rock that were used prehistorically for tool production. As least one excavated site on BLM land is located on a small midslope terrace with access to raw tool-making materials. Other prehistoric sites on BLM land are found along ridgetops. The availability of water was a greater factor in choosing site locations for prehistoric habitation in the southern areas of Oregon than in either the Coast Range or the Western Cascades, particularly during the fall acorn harvest.

Known prehistoric site density appears higher in this region than in the Coast Range, although the scattered nature of BLM parcels and of the surveyed areas limits meaningful quantitative measurement.

Slope is a prominent factor in the location of prehistoric sites in the Medford District. Slopes that are greater than 35% are associated with a lower incidence of prehistoric site occurrence. Other factors include the proximity to water and the presence of culturally important geologic resources (e.g., tool stone).

The Roseburg District manages a larger number of acres that are located on river and stream terraces than either of the Salem or Eugene districts.

The BLM manages scattered parcels within the Oregon coastal shelf, which is the area between the Pacific Ocean and the foothills of the Coast Range and the Siskiyou Mountains. This north/south corridor has seen the development of substantial historic settlement and infrastructure and this development has adversely affected the preservation of prehistoric cultural resources (mostly shell middens).

Klamath Falls Area (Klamath Falls Resource Area of the Lakeview District)

Prehistoric cultural resource occurrence reflects a mix of two physiographic provinces—the Basin and Range and the High Cascades. Sites tend to be near water sources that are within areas affording unobstructed views of prominent landscape features (e.g., Mt. Shasta, Mt. McLoughlin, Yainax Butte, and Bryant Mountain), along ridgelines, and adjacent to rock outcrops.

The Klamath River Canyon contains some of the oldest and most significant prehistoric sites known in this area. Many of these sites are located on private property (PacifiCorp), although nearly 30 sites are known to exist on BLM land.

The Gerber Block (located in the eastern portion of the Klamath Falls Resource Area of the Lakeview District) contains the vast majority of known archaeological sites in the resource area. Both the Klamath Indians and Modoc Indians were known to use this area for hunting and gathering. Numerous village sites, lithic and ground stone artifact scatters, hunting blinds, and vision quest sites have been documented in this area.

Historic Sites

The location and density of cultural sites varies greatly within the planning area. Historic site distribution differs from that of prehistoric sites. The majority of historic sites consist of the remains of features that were constructed as temporary or permanent residences or as transportation facilities for the purposes of:

- homesteading;
- obtaining timber, minerals, and other commodity resources;
- protecting against fires; or
- managing government resources.

Sites related to homesteading, settlement, logging, and transportation are found generally in the Cascade Range, Coast Range, and Siskiyou Mountains.

Historic sites occur in a variety of locations, such as:

- alongside drainages,
- along ridgelines and on peaks,
- in and around meadows and wetlands, and
- along stream terraces.

Slope is not a reliable predictor for historic site occurrence, particularly those associated with logging or mining. The presence of geologic resources (e.g., a precious metal), however, is a reliable predictor for mining sites.

Few historic structures from the time of the first settlement activities (the mid nineteenth through the early twentieth centuries) can still be found standing.

Historic sites representing early settlement activities appear to be more frequent in the Cascade Range and the Siskiyou Mountains than in the Coast Range for several reasons.

- The Willamette Valley was the destination of Oregon's earliest settlers and was always the most densely populated area in the state relative to other regions.
- The early settlement of agriculturally productive land in the Willamette Valley resulted in later-arriving settlers seeking homesteads.
- The economic boom and bust cycles in the Willamette Valley led to short-term homesteading or subsistence living attempts in the Willamette uplands, which have left some cultural remains visible today.
- Farming and ranching activities in the Siskiyou Mountains were more easily undertaken in that area's open environment.
- Dryer weather in the southern portions of the state preserved structures better.
- Remaining sites are more visible in the Cascade Range and in the Siskiyou Mountains than in the Coast Range due to the open vegetation in those areas.

Paleontological Sites

While rare within the planning area, paleontological resources have been found in the sedimentary rock that exists on all of the districts, except the Eugene District.

Traditional Use Sites

The identification of traditional use sites cannot be effectively accomplished without the help of recognized tribal governments and other traditional groups who currently use the sites for traditional practices. Once identified, cultural sites are evaluated and managed according to two different sets of criteria:

- **Eligibility criteria of the National Register of Historic Places.** Eligibility for listing on the National Register of Historic Places is assessed using criteria that addresses site integrity and considers factors that include uniqueness, research potential in the study of history or prehistory, and association with important events or persons that have made contributions to the broad patterns of history. The first element addressed in the National Register of Historic Places significance criteria is site integrity.
- **Criteria of the management use categories of the BLM** (BLM Manual Section 8110.42). Six BLM management use categories (scientific use, conservation for future use, traditional use, public use, experimental use, and discharged from management) are employed to provide for site protection and use standards. Although some scientific and experimental uses result in the physical alteration of resources, in general, use does not imply consumptive use. Managed use of cultural resources can be fully compatible with long-term preservation, and also provide the means by which preservation is achieved.

The Confederated Tribes of Warm Springs have reserved treaty rights within the planning area. Other recognized tribes also have traditional areas and resources of concern within the planning area. A list of tribes with interests within the planning area is included in *Appendix N. Cultural Resources*. The importance of identified traditional use sites and resources are determined in consultation with federally recognized tribal governments.

Adverse impacts to heritage values occur when sites are disturbed and site material contexts become mixed or churned, materials are damaged, and site integrity is disrupted or destroyed. Change to site setting can also be an adverse impact.

Threats to site integrity can be natural- or human-caused, inadvertent or intentional, or direct or indirect. Natural causes include erosion, weathering, gradual deterioration and decay, flooding, and wildfire. Human activities that result in ground or vegetation disturbance, and that can directly or indirectly affect heritage resource values, include timber harvest, reforestation, road building and decommissioning, burning and fire line construction, recreation development and use, livestock grazing, special forest product collection, and mineral extraction. Heritage resource values are also adversely impacted by such intentional disturbances as theft and vandalism.

Traditional use sites can be impacted by visual and audible intrusions, loss of access, alteration of setting, and loss of or reduction in the quantity or quality of the material (resource) needed for traditional practices.

Lands, Realty, Access, and Transportation

Lands and Realty

Land use plans use land tenure zones to identify lands that are available for retention, proposed disposal, or acquisition. The factors considered in evaluating opportunities for the disposal or acquisition of lands can be found in *Appendix O. Lands, Realty, Access, and Transportation*.

The three land tenure zones identify lands as follows.

- Zone 1 is the retention and acquisition zone.
- Zone 2 is the exchange and consolidation zone.
- Zone 3 is the disposal zone.

For the acreage of the zones for the six districts within the planning area, see *Table 137 (Acres of land tenure zones by district)*.

Table 137. Acres of land tenure zones by district

BLM District	Zone 1	Zone 2	Zone 3	Total BLM Acres per District
Salem	160,200	233,300	9,500	**403,000**
Eugene	80,900	234,200	100	**315,200**
Roseburg	35,900	377,000	13,400	**426,300**
Coos Bay	4,600	317,000	1,000	**322,600**
Medford	292,100	566,500	7,200	**865,800**
Klamath Falls Resource Area (Lakeview District)	212,100	8,200	3,800	**224,100**
Total acres per zone	**785,800**	**1,736,200**	**3,500**	**2,557,000**

There has been limited activity in the acquisition of lands by purchase under Zone 1. One active acquisition project is ongoing—the Sandy River/Oregon National Historical Trail project that is located in the Salem District.

The majority of the BLM's land within the planning area is identified as Zone 2 (suitable for exchange). Land changes, as a method of adjusting land tenure, have had limited use in the support of resource management programs. Land exchanges have become extremely controversial and difficult to complete. Most land exchanges and transfer activities within the planning area were directed by federal legislation rather than by a discretionary agency action.

There are 35,000 acres of BLM land within the planning area that are designated as Zone 3 (suitable for sale). There have been 2,186 acres sold to date—sold primarily to resolve unintentional occupancy trespass cases. Lands identified for sale are not sold if project-level reviews show conflicts with the land tenure adjustment criteria. Specific parcels of Zone 3 lands are shown in *Appendix O. Lands*.

Section 3 of the Oregon Public Lands Transfer and Protection Act (Public Law 105-321), which is dated October 23, 1998, established a "no net loss" requirement for lands that are administered by the BLM in western Oregon. The act requires that, when selling, purchasing, or exchanging land, the BLM may not:

- Reduce the total acres of the Oregon and California Railroad Grant (O&C) lands or the Coos Bay Wagon Road (CBWR) lands.
- Reduce the number of acres of O&C, CBWR, and public domain lands that are available for timber harvesting below what existed on the date of enactment.

The act requires the BLM to ensure a no net loss of acres on a 10-year basis. To date, the BLM in western Oregon shows a surplus of 50 acres of O&C land and a deficit of 63 acres of harvestable timberland. There has been a general decline in the use of land sales or land exchanges in western Oregon as methods of adjusting land tenure since the enactment of this law.

Withdrawals generally segregate land from operations under the nondiscretionary general land laws, mining laws, and sometimes the mineral leasing laws, but do not always affect BLM surface management. Classifications generally segregate the lands from all forms of appropriation under the public land laws, including the mining laws, but not the mineral leasing laws. The existing withdrawals and classifications within the planning area are shown in *Appendix O. Lands*.

There are 86 communication sites located on BLM land within the planning area. Several sites have multiple authorized users or uses, including two-way, microwave, and low power relay. These uses are generally compatible on the same site. Mass media users with associated high power transmissions are generally not compatible with existing low power uses on these developed sites. Existing communication site information is shown in *Appendix O. Lands*.

Access

BLM land is generally available for needed right-of-ways where consistent with local comprehensive plans, Oregon statewide planning goals and rules, and the exclusion and avoidance of areas identified in resource management plans. Numerous types of right-of-ways have been authorized by the BLM, including:

- state highways
- county roads
- private access roads

- trails
- power transmission lines
- electric distribution and service lines
- telephone and cable television lines
- railroads
- water pipelines and reservoirs
- canals
- federal highway material sites
- communication sites
- oil and gas pipelines
- bicycle paths

The checkerboard land ownership pattern of the O&C lands generates most of the need to cross public lands in order to provide access and utilities to intermingled private lands. New right-of-way proposals across public lands are likely to continue in the future. The location and nature of such proposals is generally not known until an application is received by the BLM.

Major existing right-of-way corridors within the planning area are shown in *Map 9 (Utility corridors)* in *Chapter 2*. Existing facilities located within right-of-way corridors include Bonneville Power Administration and private electric transmission lines, pipelines, fiber-optic lines, and transportation infrastructure.

A programmatic environmental impact statement to designate corridors for oil, gas, and hydrogen pipelines, and electricity transmission and distribution facilities on federal lands in 11 western states is currently underway by the Department of Energy. After the environmental impact statement is completed (December 2007), the BLM will amend relevant land use plans, as necessary, to implement any new corridor designations. The project currently includes the Salem, Eugene, Roseburg, Medford, and Lakeview districts.

The proposed Jordan Cove Energy Liquid Natural Gas Terminal and Pacific Connector Gas Pipeline project would include an approximately 223-mile-long, 36-inch-diameter natural gas pipeline extending from a new terminal in Coos Bay southeastward across Coos, Douglas, Jackson, and Klamath counties in Oregon to an interconnection with an existing pipeline near Malin, Oregon. The proposed route extends across 40 miles of BLM land in the Roseburg, Coos Bay, Medford, and Lakeview districts. The Federal Energy Regulatory Commission will prepare an environmental impact statement to address the environmental consequences of the project. The final environmental impact statement is scheduled to be finished by December 2007.

The majority of right-of-ways granted over BLM land in western Oregon are for logging roads. In most cases, other right-of-ways (for such uses as domestic or irrigation water lines, or utility lines for servicing residences) are authorized within or adjacent to existing road clearing limits. In addition, there are numerous temporary use permits in effect that authorize other activities on public lands, including:

- apiary (beehive) sites;
- agricultural cultivation of small areas;
- residential encroachments or other structures pending their removal or long-term authorization;
- national guard or military reserve training; and
- other miscellaneous short-term activities.

Leases are issued for land uses involving substantial construction, development, or land improvement. No new permits or leases (under any authority) are allowed for landfills and other waste disposal facilities.

The BLM land within the planning area is predominantly intermingled in a checkerboard pattern with private land. Intermingled nonfederal lands are owned primarily by private timber companies and are managed for commercial timber production. Most of the legal access to the federal and nonfederal timberlands is provided through long-term or perpetual reciprocal right-of-way agreements between the United States and the private timberland owners. It is estimated that 80% of the public lands within the planning area are available for road construction and use under reciprocal right-of-way agreements. Reciprocal right-of-way agreements provide the United States and the private landowner with the right to use and construct logging roads on each other's property for forest management and timber removal.

Transportation

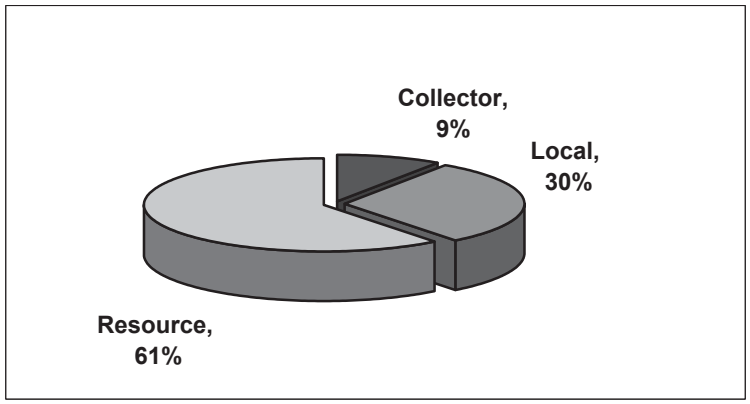
The BLM controls approximately 14,000 miles of road within the planning area. Approximately 13,000 miles (about 93%) of BLM roads have some form of surfacing (bituminous, aggregate, or pit run). The primary purpose for development and use of the BLM road system is the transportation of timber. The majority of the BLM road system is authorized for use by intermingled private timberland owners through reciprocal right-of way agreements and used for transportation of timber harvested from their lands.

Although most BLM roads are not public roads, the BLM road system serves as a means for the public to access public lands for recreational activities where public access rights have been obtained or to provide ingress and egress to residences. The roads of the BLM road system are described by the following functional classifications. For a quantitative comparison of the road types, see *Figure 138 (Distribution of functional classifications for BLM roads)*.

- **Collector roads.** Those roads that normally provide access to large blocks of public land and connect to state and county road systems.
- **Local roads.** Those roads that primarily provide access to lands that are adjacent to the collector network and serve travel over relatively short distances.
- **Resource roads.** Those roads that are primarily spur roads and provide access for only one or two types of resource management and carry very low traffic volumes.

Road construction standards and maintenance intensity are generally highest on collector roads and lowest on resource roads.

Figure 138. Distribution of functional classifications for BLM roads



Transportation management includes the development of a transportation management plan, road density reduction, and maintenance of the road system to meet the needs of resource programs. A transportation management plan for western Oregon was developed in 1996 (with a subsequent revision in 2002). The BLM has decommissioned approximately 590 miles of road. An additional 1,360 miles of BLM roads are identified for potential road closure. The BLM's contractual obligations in reciprocal right-of-way agreements preclude a substantial reduction in road mileage within fifth-field watersheds.

Maintenance of the BLM road system within the planning area follows the guidance in the western Oregon transportation management plan of 2002. Each district develops an annual maintenance operating plan that contains a list of roads scheduled to be maintained in the current year. Approximately 25% of the BLM road system (3,800 miles) is scheduled to be maintained in any given year. See *Figure 139 (Miles of road maintenance)*. Road maintenance activities include:

- roadside brush removal
- road surface grading and replacement
- pavement maintenance and replacement
- ditch cleaning
- culvert cleaning and replacement
- slough and slide removal

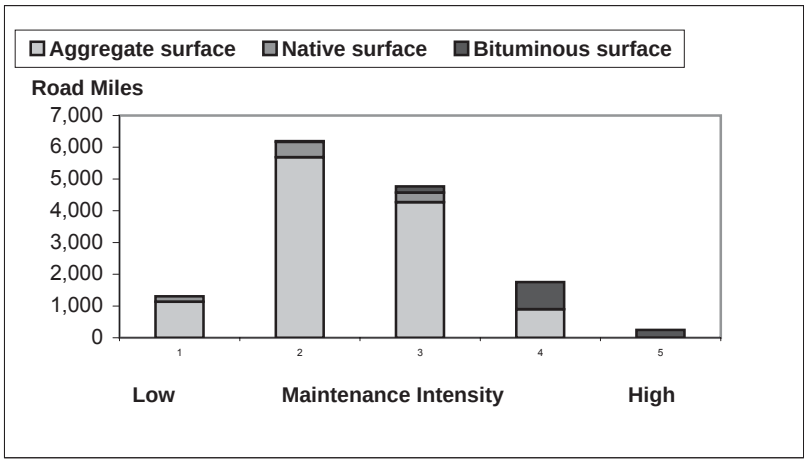
Drainage facilities currently under assessment include:

- 350 bridges
- 500 major culverts (greater than 80 inches in diameter)
- 40,000 minor culverts

Maintenance levels (for the intensity of maintenance) are assigned to BLM roads using a progressive five-level system (levels 1 through 5). Higher maintenance intensity (level 4 or 5) is typically assigned to bituminous surface collector roads. Native surface local

roads receive at least level 1 or 2 maintenance to ensure resource protection. Roads at levels 3 to 5 are maintained on a scheduled basis and may receive more extensive maintenance during periods of short-term increased use for timber hauling.

Figure 139. Miles of road maintenance



The following tables display the current inventory of transportation development on and to BLM land within the planning area.

Table 138. Road functional classifications by BLM district within the planning area

Land Control Category	Functional Classifications of Roads (miles)					
	Arterial	Collector	Local	Resource	Unknown	Road Totals
Salem District						
BLM Controlled	0	219	847	1,434	27	2,527
BLM Land, No Control	15	17	75	67	199	373
Salem Totals	**15**	**236**	**922**	**1,501**	**226**	**2,900**
Eugene District						
BLM Controlled	0	138	1,553	350	4	2,045
BLM Land, No Control	34	20	145	45	41	285
Eugene Totals	**34**	**158**	**1,698**	**395**	**45**	**2,330**
Roseburg District						
BLM Controlled	0	372	775	1,637	47	2,831
BLM Land, No Control	15	12	109	191	45	372
Roseburg Totals	**15**	**384**	**884**	**1,828**	**92**	**3,203**
Coos Bay District						
BLM Controlled	0	227	408	1,257	3	1,895
BLM Land, No Control	17	27	59	109	162	374
Coos Bay Totals	17	254	467	1,366	165	2,269
Medford District						
BLM Controlled	0	390	1,091	3,128	102	4,711
BLM Land, No Control	32	36	72	106	443	689
Medford Totals	**32**	**426**	**1,163**	**3,234**	**545**	**5,400**
Klamath Falls Resource Area (Lakeview District)						
BLM Controlled	2	87	133	143	0	365
BLM Land, No Control	3	8	150	1	188	350
KFalls RA Totals	**5**	**95**	**283**	**144**	**188**	**715**
Totals (All)	**118**	**1,553**	**5,417**	**8,468**	**1,261**	**16,817**

Table 139. Road standards by BLM district within the planning area

Land Control Category	Width of Roads (miles)				
	Double-Lane	Multiple-Lane	Single-Lane	Unknown	Road Totals
Salem District					
BLM Controlled	23	0	2,407	97	2,527
BLM Land, No Control	16	0	136	221	373
Salem Totals	**39**	**0**	**2,543**	**318**	**2,900**
Eugene District					
BLM Controlled	18	0	1,945	82	2,045
BLM Land, No Control	21	0	214	50	285
Eugene Totals	**39**	**0**	**2,159**	**132**	**2,330**
Roseburg District					
BLM Controlled	31	0	2,746	54	2,831
BLM Land, No Control	20	1	300	51	372
Roseburg Totals	**51**	**1**	**3,046**	**105**	**3,203**
Coos Bay District					
BLM Controlled	60	0	1,792	43	1,895
BLM Land, No Control	5	17	182	170	374
Coos Bay Totals	**65**	**17**	**1,974**	**213**	**2,269**
Medford District					
BLM Controlled	25	0	4,557	129	4,711
BLM Land, No Control	47	2	192	448	689
Medford Totals	**72**	**2**	**4,749**	**577**	**5,400**
Klamath Falls Resource Area (Lakeview District)					
BLM Controlled	8	0	312	45	365
BLM Land, No Control	2	0	26	322	350
KFalls RA Totals	**10**	**0**	**338**	**367**	**715**
Total (All)	**276**	**20**	**14,809**	**1,712**	**16,817**

Table 140. Road surface type by BLM district

Land Control Category	Surface Type of Roads (miles)			
	Aggregate	Bituminous	Natural or Unknown	Road Totals
Salem District				
BLM Controlled	2,145	139	243	2,527
BLM Land, No Control	134	25	214	373
Salem Totals	**2,279**	**164**	**457**	**2,900**
Eugene District				
BLM Controlled	1,494	224	327	2,045
BLM Land, No Control	174	25	86	285
Eugene Totals	**1,668**	**249**	**413**	**2,330**
Roseburg District				
BLM Controlled	2,057	176	598	2,831
BLM Land, No Control	183	8	181	372
Roseburg Totals	**2,240**	**184**	**779**	**3,203**
Coos Bay District				
BLM Controlled	1,139	414	342	1,895
BLM Land, No Control	111	10	253	374
Coos Bay Totals	**1,250**	**424**	**595**	**2,269**
Medford District				
BLM Controlled	3,005	300	1,406	4,711
BLM Land, No Control	97	39	553	689
Medford Totals	**3,102**	**339**	**1,959**	**5,400**
Klamath Falls Resource Area (Lakeview District)				
BLM Controlled	150	34	181	365
BLM Land, No Control	13	3	334	350
KFalls RA Totals	**163**	**37**	**515**	**715**
Totals (All)	**10,702**	**1,397**	**4,718**	**16,817**

Energy and Minerals

Key Points

- Most of the lands within the planning area are open to the exploration and development energy and mineral.
- The coal-bearing sandstones and siltstones of the Coos Bay Basin contain methane gas at a rate that compares very favorably to existing natural gas from coal operations elsewhere in the United States and Canada.
- Coastal and ridge line areas within the planning unit are rated as having outstanding potential for wind-driven power generation.
- Approximately 3 to 5% of all mineral materials that are produced in Oregon come from public lands. Within the planning area, there are about 250 sites that each produce between 1,000 and 25,000 tons per year.

Physiographic and Geologic Terrains

The planning area is divided into several physiographic provinces (the Coast Range, the Willamette Valley, the Western Cascades, the Eastern Cascades, and Klamath). The unique geologic origin and morphology of each province controls their potential for mineral occurrence.

The heavily vegetated, elongated Coast Range province consists of a long, narrow belt of moderately high mountains and coastal headlands that extend southward from the Columbia River to the Middle Fork of the Coquille River and westward from the continental shelf inland to the western edge of the Willamette Valley. The area of the Coast Range province is approximately 200 miles long by 30 to 60 miles wide. The shoreline depositional basins of this province (including the southwest coastal coal beds) hold the potential for the accumulation of natural gas.

The Willamette Valley province extends southward for 130 miles from the Columbia River to Cottage Grove and comprises a 30 to 40 mile wide low land catch basin between the Coast Range and the Western Cascade. The valley dips gently from about 400 feet in elevation at its southern end to near sea level at Portland. The material deposited by floods consists mainly of gravels to fine sediments and is separated at intervals by low hills.

The planning area contains lands that have a moderate to high potential for both hydrothermal metallic deposits and geothermal energy.

The Coast Mountains and the Willamette Valley terminate to the south against the 12,000 square miles of the Klamath. It is a province of deep, narrow valleys and peaks, bounded to the west by a narrow coastal plain with steep headlands and the Cascades Mountains to the east. Intrusions within the Klamath Mountains have created a high potential for the accumulation of hydrothermal metallic deposits and secondary enrichment zones.

The Basin and Range is a province of narrow, north and south trending fault-block mountains and alternating broad basins bordering the Cascade Mountains to the west and the High Lava Plains of central Oregon to the north. The Basin and Range may have some potential for natural gas while its volcanic past has created a high potential for geothermal resources.

Regulation and Availability of Mineral and Energy Resources

In Oregon, the BLM administers the mineral estate on nearly 40 million acres of BLM, U.S. Forest Service, and other federal and Indian lands. Approximately 2,557,700 acres are within the planning unit. An additional 68,600 acres of federal subsurface mineral estate exists beneath private surface. Known and inferred information indicates that about half of this area has a low potential for mineralization of interest with 40% at a moderate potential and 5% with a higher likelihood. Aside from the restrictions that are imposed by law, regulation, or executive/secretarial order, over 90% of the BLM-administered public lands, including O&C lands, are currently available for mineral and energy exploration and development (subject to the tenets of the individual resource management plans of the districts).

Mineral and energy resources on federal lands are managed under the authorities enacted by Congress in the following laws:

- Mining Law of 1872 (e.g., metallic and gem stones)
- Mineral Leasing Act of 1920 (e.g., energy and industrial chemicals)
- Mineral Materials Sales Act of 1947 (e.g., common variety construction materials)
- Mining and Materials policy Act of 1970
- Federal land Policy and Management Act of 1976
- National Materials and Minerals Policy, Research and Development Act of 1980

The cornerstone of BLM minerals management policy is the understanding that public lands will remain open for exploration and development, unless it is clearly in the national interest to withdraw them in whole or in part from mineral entry. Furthermore, the BLM encourages environmentally sound practices for mineral exploration and development on the open public lands by individuals and industry in a manner that satisfies both National and local needs.

Known and Inferred Mineral Occurrence Potential

Summarized below is the approximate aerial extent of the BLM-administered mineral estate, current acreage open or closed to mineral entry, and the likely potential for the occurrence of economic mineralization (consistent with the existing resource management plans) for each district within the planning area.

Salem District

Table 141. Known and inferred mineral occurrence potential for the Salem District

Category	Acres	Remarks
Federal Surface and Mineral Estate	398,100	
Federal Minerals and Private Surface	27,800	
Locatable		(e.g., metallics and gemstones)
Closed	5,900	Nondiscretionary
Closed	16,200	Discretionary
Open	49,200	Standard restrictions/stipulations
Open	326,800	Additional restrictions
Unknown or Low	321,900	Mineral occurrence potential
Moderate	18,000	Mineral occurrence potential
High	58,200	Mineral occurrence potential
Salable		(e.g., sand, gravel, stone, clays, pumice)
Closed	5,900	Nondiscretionary
Closed	220,400	Discretionary
Open	49,200	Standard restrictions/stipulations
Open	122,600	Additional restrictions
Unknown or Low	387,600	Mineral occurrence potential
Moderate	5,000	Mineral occurrence potential
High	1,000	Mineral occurrence potential
Leasable		(e.g., oil, gas, geothermal, coal, chemical minerals)
Closed	5,900	Nondiscretionary
Open	49,200	Standard restrictions/stipulations
Open	122,000	Additional restrictions
Open	221,000	No surface occupancy
Unknown or Low	389,100	Mineral occurrence potential
Moderate	219,500	Mineral occurrence potential
High	25,400	Mineral occurrence potential

Provinces and mineral potentials within the Salem District:

- Geologic terrains (west to east):
  - Coast Range
  - Willamette Valley
  - Cascade Mountains
- Minerals:
  - ferruginous bauxite throughout Willamette Valley
  - porphyritic copper and gold in headwater area of Santiam River
  - good potential for lode metallics near St. Helens
  - scattered low to moderate potential for beach placers
- Mineral materials:

  Aggregate and basalt rock abundant throughout district
- Energy:
  - high potential for gas near Mist with moderate potential throughout Coast Range and Willamette Valley
  - scattered low grade coal deposits east of Salem and Newport
- Known production:
  - natural gas (Mist field)
  - coal (Columbia Co.)
  - clays (Portland area)

Eugene District

Table 142. Known and inferred mineral occurrence potential for the Eugene District

Category	Acres	Remarks
Federal Surface and Mineral Estate	318,000	
Federal Minerals and Private Surface	1,300	
Locatable		(e.g., metallics and gemstones)
Closed	400	Nondiscretionary
Closed	15,300	Discretionary
Open	290,600	Standard restrictions/stipulations
Open	10,000	Additional restrictions
Unknown or Low	299,900	Mineral occurrence potential
Moderate	13,500	Mineral occurrence potential
High	2,900	Mineral occurrence potential
Salable		(e.g., sand, gravel, stone, clays, pumice)
Closed	100	Nondiscretionary
Closed	9,100	Discretionary
Open	200	Standard restrictions/stipulations

Category	Acres	Remarks
Open	307,000	Additional restrictions
Unknown or Low	300,100	Mineral occurrence potential
Moderate	12,500	Mineral occurrence potential
High	3,800	Mineral occurrence potential
Leasable		(e.g., oil, gas, geothermal, coal, chemical minerals)
Closed	100,000	Nondiscretionary
Open	--	Standard restrictions/stipulations
Open	138,000	Additional restrictions
Open	177,000	No surface occupancy
Unknown or Low	99,000	Mineral occurrence potential
Moderate	316,000	Mineral occurrence potential
High	--	Mineral occurrence potential

Provinces and mineral potentials within the Salem District:

- Geologic terrains (west to east):
  - Coast Range
  - Willamette Valley
  - Cascade Mountains
- Minerals:
  - gold placers in the headwaters of the McKenzie and Middle Fork of the Willamette Rivers, and the Dorena Lake area
  - metallic placer potential around Eugene
- Mineral materials:
  - aggregate and basalt rock abundant throughout district
  - clays at Hobart Butte
- Energy:

  speculative to moderate potential for gas in the Willamette Valley and coastal areas

Roseburg District

Table 143. Known and inferred mineral occurrence potential for the Roseburg District

Category	Acres	Remarks
Federal Surface and Mineral Estate	425,600	
Federal Minerals and Private Surface	1,700	
Locatable		(e.g., metallics and gemstones)
Closed	300	Nondiscretionary
Closed	4,800	Discretionary
Open	366,200	Standard restrictions/stipulations
Open	20,800	Additional restrictions
Unknown or Low	307,600	Mineral occurrence potential
Moderate	88,000	Mineral occurrence potential
High	24,400	Mineral occurrence potential
Salable		(e.g., sand, gravel, stone, clays, pumice)
Closed	30	Nondiscretionary
Closed	8,400	Discretionary
Open	381,700	Standard restrictions/stipulations
Open	29,200	Additional restrictions
Unknown or Low	--	Mineral occurrence potential
Moderate	418,700	Mineral occurrence potential
High	1,900	Mineral occurrence potential
Leasable		(e.g., oil, gas, geothermal, coal, chemical minerals)
Closed	30	Nondiscretionary
Open	356,300	Standard restrictions/stipulations
Open	53,300	Additional restrictions
Open	9,700	No surface occupancy
Unknown or Low	420,600	Mineral occurrence potential
Moderate	78,100	Mineral occurrence potential
High	155,800	Mineral occurrence potential

Provinces and mineral potentials within the Roseburg District:

- Geologic terrains:
  - Coast Range
  - Klamath
- Minerals:
  - nickel laterites east of Riddle; mercury in the headwaters of the Calapeoya and North Umpqua
  - disseminated copper and gold throughout the pre-late Jurassic rocks along the Umpqua River and its tributaries
  - placer metallics east of Drain and Sutherline

- Mineral materials:

  aggregate and basalt rock abundant throughout district

- Energy:

  scatter low grade coal deposits near Glide, Melrose, and Carson Valley

- Known production:

  nickel (Riddle)

Coos Bay District

Table 144. Known and inferred mineral occurrence potential for the Coos Bay District

Category	Acres	Remarks
Federal Surface and Mineral Estate	329,600	
Federal Minerals and Private Surface	12,200	
Locatable		(e.g., metallics and gemstones)
Closed	1,000	Nondiscretionary
Closed	11,500	Discretionary
Open	99,500	Standard restrictions/stipulations
Open	217,600	Additional restrictions
Unknown or Low	--	Mineral occurrence potential
Moderate	--	Mineral occurrence potential
High	--	Mineral occurrence potential
Salable		(e.g., sand, gravel, stone, clays, pumice)
Closed	600	Nondiscretionary
Closed	14,700	Discretionary
Open	84,600	Standard restrictions/stipulations
Open	229,700	Additional restrictions
Unknown or Low	303,900	Mineral occurrence potential
Moderate	4,600	Mineral occurrence potential
High	900	Mineral occurrence potential
Leasable		(e.g., oil, gas, geothermal, coal, chemical minerals)
Closed	1,600	Nondiscretionary
Open	101,400	Standard restrictions/stipulations
Open	56,300	Additional restrictions
Open	170,300	No surface occupancy
Unknown or Low		Mineral occurrence potential
Moderate		Mineral occurrence potential
High		Mineral occurrence potential

Provinces and mineral potentials within the Coos Bay District:

- Geologic terrains:
  - Coast Range
  - Klamath
- Minerals:
  - gold, platinum, and chromite in coastal black beach sands
  - disseminated lode and placer copper, chromite, and gold with scattered nickel laterite deposits throughout prelate Jurassic rocks along the Rogue River, its tributaries, and in the Kalmiopsis Wilderness
  - silica beach sands at the mouth of the Umpqua River
- Mineral materials:

  aggregate and basalt rock abundant throughout district
- Energy:

  moderate to high potential for coal in early Tertiary basins surrounding Coos Bay with associated coal bed methane
- Known production:
  - subbituminous coal (Coos Co.)
  - silica sands

Medford District

Table 145. Known and inferred mineral occurrence potential for the Medford District

Category	Acres	Remarks
Federal Surface and Mineral Estate	866,300	
Federal Minerals and Private Surface	4,700	
Locatable		(e.g., metallics and gemstones)
Closed	16,800	Nondiscretionary
Closed	20,800	Discretionary
Open	536,500	Standard restrictions/stipulations
Open	293,400	Additional restrictions
Unknown or Low	473,100	Mineral occurrence potential
Moderate	388,700	Mineral occurrence potential
High	10,100	Mineral occurrence potential
Salable		(e.g., sand, gravel, stone, clays, pumice)
Closed	--	Nondiscretionary
Closed	--	Discretionary
Open	864,800	Standard restrictions/stipulations
Open	--	Additional restrictions
Unknown or Low	--	Mineral occurrence potential

Category	Acres	Remarks
Moderate	864,800	Mineral occurrence potential
High	--	Mineral occurrence potential
Leasable		(e.g., oil, gas, geothermal, coal, chemical minerals)
Closed	22,000	Nondiscretionary
Open	232,500	Standard restrictions/stipulations
Open	539,700	Additional restrictions
Open	73,300	No surface occupancy
Unknown or Low	789,500	Mineral occurrence potential
Moderate	202,700	Mineral occurrence potential
High	52,600	Mineral occurrence potential

Provinces and mineral potentials within the Medford District:

- Geologic terrains:
  - Klamath
  - Cascade Mountains
- Minerals:

  disseminated lode and placer copper, chromite, and gold with scattered nickel laterite deposits throughout prelate Jurassic rocks throughout the area of the middle Rogue River and tributaries with major mining regions and pocket deposits along contacts of fine grained slate, argillite and carbonaceous rock
- Mineral materials:

  aggregate and basalt rock abundant throughout district
- Energy:

  scattered low grade coal deposits near Medford and Ashland
- Known production:
  - gold and precious metals (along Galice, Josephine, Sucker, Althouse Creeks and the Illinois River)
  - talc
  - subbituminous coal (Jackson Co.)

Klamath Falls Resource Area (Lakeview District)

Table 146. Known and inferred mineral occurrence potential for the Klamath Falls Resource Area of the Lakeview District

Category	Acres	Remarks
Federal Surface and Mineral Estate	212,000	
Federal Minerals and Private Surface	21,000	
Locatable		(e.g., metallics and gemstones)
Closed	4,700	Nondiscretionary
Closed	700	Discretionary
Open	191,600	Standard restrictions/stipulations
Open	37,900	Additional restrictions
Unknown or Low	99,000	Mineral occurrence potential
Moderate	128,000	Mineral occurrence potential
High	900	Mineral occurrence potential
Salable		(e.g., sand, gravel, stone, clays, pumice)
Closed	300	Nondiscretionary
Closed	14,500	Discretionary
Open	--	Standard restrictions/stipulations
Open	222,500	Additional restrictions
Unknown or Low	--	Mineral occurrence potential
Moderate	200,000	Mineral occurrence potential
High	1,300	Mineral occurrence potential
Leasable		(e.g., oil, gas, geothermal, coal, chemical minerals)
Closed	300	Nondiscretionary
Open	--	Standard restrictions/stipulations
Open	197,600	Additional restrictions
Open	40,800	No surface occupancy
Unknown or Low	--	Mineral occurrence potential
Moderate	200,000	Mineral occurrence potential
High	1,500	Mineral occurrence potential

Provinces and mineral potentials within the Klamath Falls Resource Area of the Lakeview District:

- Geologic terrains:
  - Cascade Mountains
  - western Basin and Range
- Minerals:

  diatomite along Sprague River

- Mineral materials:
  aggregate, basalt rock, and pumice are abundant throughout district
- Energy:
  - moderately favorable potential for geothermal from Klamath Falls and southward
  - speculative gas
- Known production:
  diatomite

Energy Resources

Currently, exploration or development of inground energy resources within the planning area are focused on the hydrocarbon potential (i.e., coal and natural gas) that are generally associated with Cenozoic marine sediments. Small quantities of low-grade coal have been mined in both the Salem and Coos Bay districts. There is a potential for occurrence elsewhere in the Coast Range and Willamette Valley provinces. The potential for renewable wind energy has yet to be tapped but is generally rated at good to better over most of the planning area.

Natural Gas

Conventional natural gas has been produced since the 1970s near the community of Mist in west-central Columbia County. The Mist Gas Field produced over 65 billion cubic feet of gas since its discovery in 1979 with a value of about $125 million. Modern seismic technology is being used to guide the discovery of new pools at the field. The Mist Gas Field now includes two commercial underground natural gas storage projects. The potential existence of gas deposits in many coastal and Coast Range areas of western Oregon resulted in the leasing of nearly 6 million acres from federal, state, and local agencies and the permitting of over 500 wells in the 1980s.

In western Oregon, there are up to 100,000 prospective onshore acres for natural gas production. These are enhanced by excellent year-round access via logging and fire control roads and the availability of already constructed timber recovery staging areas for drilling sites. Currently, there are no conventional that are producing gas wells on federal leases.

To date, the state of Oregon's Department of Geology and Mineral Industries has created only one gas field designation for the area encompassing the Mist Gas Field. Another gas field designation, however, is expected soon for the Coos Basin. The designation is required to accomplish state requirements for well spacing designations, mineral rights, and the control of drainage. It also increases interest and competition among development companies.

In the state of Oregon, nonfederal leasing and applications for permits to drill for production are currently focused in the Mist Gas Field, which has 16 current production wells and eight applications recently submitted for production permits (Houston, 2007), and focused in the Coos Basin (115,000 acres leased for three single-pad multiwell production systems).

Coal Bed Methane

Coal bed methane was recently proved up along the southwest coast with the strong likelihood of commercial development in the Coos Bay District. Foreseeable development of coal bed methane plays could potentially result in an additional 25,000 acres of BLM-managed lease offerings. To develop this resource, the industry estimates a near-term build-out of between 300 and 719 wells (Halferty 2007) with approximately 37 wells and 77 wells on BLM lands.

The coal-bearing sandstones and siltstones of the Coos Bay Basin are estimated to form a section approximately 6,600 feet thick with multiple seams containing approximately 780 billion cubic feet of methane gas (approximately 10 billion cubic feet per section) with a producible rate that compares favorably to existing natural gas from coal operations elsewhere in the United States and Canada. A commercial drilling program is underway near the Coos County natural gas line and within a few miles of unleased federal coal. The Coos Bay District is beginning an environmental assessment process to develop special lease stipulations for about 10,000 acres that appear to be of interest to industry for coal bed natural gas. The environmental assessment should be completed in time to allow leasing to begin in September 2007.

Geothermal

Oregon has the distinction of being a state where geothermal resources are available in many areas. These resources are suitable for many different types of uses including the current dominant production for direct heat applications.

Although Oregon does not generate commercial electricity from geothermal energy, the potential is there. A U.S. Interior Department report identifies seven sites as among the 35 highest potential geothermal regions in the country. These sites include the Newberry Crater (near Bend), a location of past geothermal exploration, and the Klamath Falls, Lakeview, Crump Lake, Summer Lake, Malheur River, and Vale areas of southern and eastern Oregon.

Wind

Nationally, about 20% of installed wind energy capacity is on federal lands. Coastal areas and ridge lines within the planning unit are rated as having a good to excellent potential for wind-driven power generation—the better portion of the 7,991 megawatts for all of Oregon. Oregon currently has some 435 megawatts

of installed wind power generating capacity with another 140 megawatts proposed (American Wind Energy Association 2007). Notable areas with a good to excellent potential include the Columbia River corridor and the Oregon coast. The Columbia River corridor is generally an area of high wind resource; however, the complex terrain causes considerable local variability. The annual average wind resource at exposed areas ranges from Class 3 to Class 6. Spring and summer are the seasons of maximum wind power, except for the extreme west where the maximum resource is in winter. The power potential of western Oregon is classified at 4. Winter is the season of maximum power potential at sites well exposed to the prevailing south and southeasterly winds. During the summer, wind power is high along the central and southern Oregon coast at sites well-exposed to northerly winds and is associated with the strong surface pressure gradients created by the cold water and relatively warm interior (Wind Energy Resource Atlas of the United States 2007).

Energy Transmission

The proposed 1 billion cubic feet per day 223-mile Pacific Connector Gas Pipeline (Pacific Connector) is being jointly developed by Williams' Northwest Pipeline (Williams' Northwest), Pacific Gas and Electric Company (PG&E), and Fort Chicago Energy Partners L.P. (Fort Chicago). It will join the proposed Jordan Cove liquefied natural gas terminal being developed by Fort Chicago near Coos Bay, Oregon, to the Williams' Northwest pipeline system near Myrtle Creek, Oregon, and then to Pacific Gas and Electric Company's backbone gas transmission system near Malin, Oregon. About 56 miles of the proposed route cross federal land that is managed by the BLM and the Forest Service, and will require a federal right-of-way. Environmental reviews and public participation are underway as part of the Federal Energy Regulatory Commission prefiling process.

National Energy Policy

Within the planning area, implementation of the National Energy Policy is a priority for modernizing the energy infrastructure, increasing supplies of renewable and nonrenewable energy, and accelerating conservation, protection, and improvement of the environment.

Oregon's contribution to this effort is focused on:

- Acting in a timely manner to requests for right-of-ways and easements for energy exploration and development (e.g., geophysical surveys and infrastructure to develop and transport renewable and nonrenewable energy, and emphasizing parallel use of existing right-of-ways wherever possible).
- Being receptive to alternative energy proposals and the completion of an environmental impact statement relating to the authorization of wind energy projects (Nevada, Idaho, Oregon, Arizona, and Utah are principal areas identified for development).

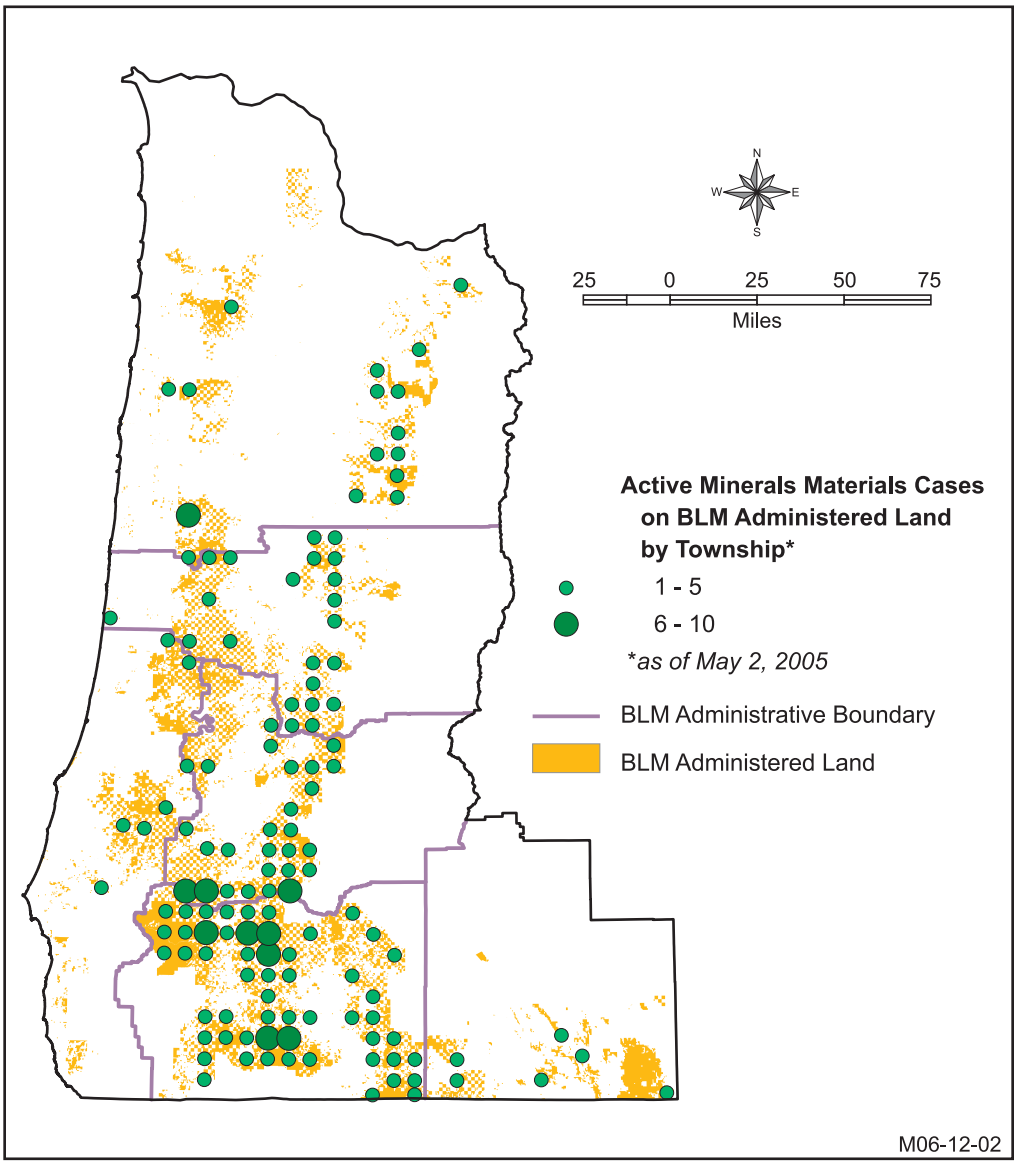
- Being prepared for increased interest in oil and gas drilling in the southwest Oregon coastal area based on promising exploration taking place on private lands.
- Emphasizing adjudication of lands nominated for oil, gas, and geothermal leasing; timely processing of drilling permits; development of wind and geothermal resources; hydropower relicensing; monitoring to ensure environmentally sound practices; and integrating study findings of the Energy Policy Act into BLM land use plans.
- Facilitating National Energy Policy goals for modernizing energy infrastructure, increasing energy supplies, and accelerating the protection and improvement of the environment.
- Providing opportunities for environmentally sound commercial development.
- Supporting land use plan decisions for renewable and nonrenewable energy exploration, development, and transportation of energy sources.
- Reducing impediments that are limiting access across public lands.
- Issuing right-of-way authorizations for necessary infrastructure to develop and transport renewable and nonrenewable energy (e.g., oil or gas from producing areas or electricity generated from a variety of sources, such as hydropower, coal or gas-fired generators, and geothermal).

Summary of Mineral Occurrence Potential

Salable Mineral Materials

Within the planning area, the functions of the BLM's principle mineral material program (common sand, gravel, rock, volcanic cinders, and clay) are related to designation of sites (community pits and common use areas), disposals (issuing sale contract and free use permits), and compliance inspections. Mineral materials are the most commonly mined commodities in Oregon. See *Figure 140 (Active mineral materials cases on BLM-administered lands by township).*

Figure 140. Active mineral materials cases on BLM-administered lands by township



Although production from BLM pits has declined since the 1980s due to the decrease in logging road construction, approximately 3 to 5% of all mineral materials produced in Oregon come from public lands, including from some 250 sites within the planning area that can yield between 1,000 and 25,000 tons per year. This trend is expected to continue with an average annual growth rate of approximately 1% requiring significant quantities of crushed stone, sand, and gravel to come from resources yet to be delineated. Despite its low unit value, the aggregate and crushed stone industry is a major contributor to the regional economics (U.S. Geological Survey 2007).

Currently, activity is limited primarily to small sales and the use of larger volumes by other federal, state, and local agencies. In many portions of the planning area, rock sources are becoming scarce or are encumbered by restrictions, which limit the availability of rip-rap, large bounders and surfacing material required for restoration projects or timber harvesting activities. In the rapidly developing urban areas, expensive materials are being purchased from private sources and transported to BLM projects, at times passing potential BLM-administered sources.

Locatable Minerals

Locatable minerals include metallic minerals (i.e., gold, silver, lead, and zinc) and some nonmetallic minerals (e.g., fluorspar, asbestos, mica, gemstones, and uncommon varieties of sand, gravel, and stone). Large areas of southwestern Oregon are within mining districts. Most claim sites within the planning area are situated in the Klamath Mountains and the Western Cascades.

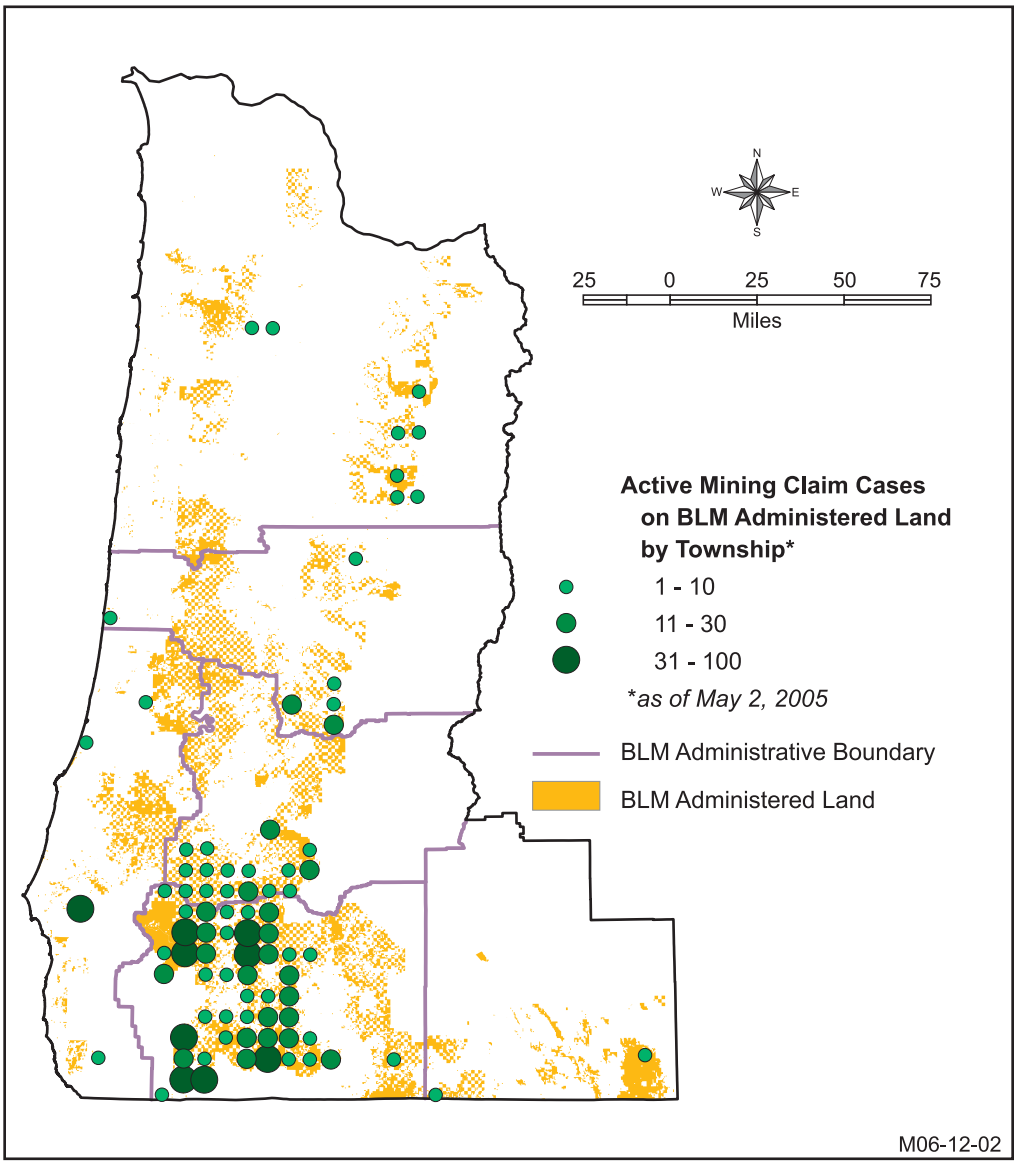
Mining district

A mining district is a section of country that is usually designated by name and described or understood as being confined within certain natural boundaries in which gold, silver, or other minerals may be found in paying quantities.

All BLM districts within the planning area carryout actions that are related to the administration of some 2,500 claims of active record. See *Figure 141 (Active mining claim cases on BLM-administered lands by township)* for the spatial distribution of claim sites to the nearest township. Related actions include:

- the processing of mining notices and plans of operations,
- the inspection of mining claims and mill sites for surface management compliance,
- the determination of mining claim validity,
- the processing of patents that are not otherwise precluded by moratorium, and
- the mitigation of trespass and unauthorized occupancy cases.

Figure 141. Active mining claim cases on BLM-administered lands by township



Sporadic small-scale placer gold mining is the main type of locatable production occurring on BLM lands within the planning area, particularly in the southern districts. The number of active mining claims in western Oregon has generally declined due to changes in federal regulations that have resulted in increased fees for recording claims and maintenance.

Summary of Potential

Currently, none of the types of mineral entry (i.e., locatable, salable, or leasable) contribute significantly to the economic base of the communities within the planning area.

For western Oregon, the mineral occurrence potential can generally be described as follows:

- **Natural gas.** Submarginal to moderately favorable for natural gas from Coos County northward to the Columbia River with areas of high potential surrounding Coos Bay and in the vicinity of Mist in Columbia County. Conventional oil and gas potential exist as identified speculative petroleum systems (Ryu et al. 1990). Part of a structural sedimentary basin system that extends on and offshore from the Klamath Terrains boundary (Middle Fork of the Coquille River) north to the Columbia River (extending into Washington) and from the continental shelf east to the Willamette Valley.
- **Coal bed natural gas (methane).** Focused mainly on the Coaledo Formations of the onshore portion of the Coos Basin (an area of approximately 250 square mile located on the western edge of the Coos Bay District). Federally managed mineral rights are approximately 12.3% of the basin while the BLM-administered mineral right is approximately 7.6%.
- **Coal.** Highly favorable in the Coos Bay Field and Eden Ridge Field in southern Coos County, although of generally poor quality with interstratified carbonaceous shale.
- **Locatable metallic deposits.** Moderate to highly favorable throughout southwestern Oregon and in the vicinity of St. Helens in Columbia County. Reported production of gold and nickel in Douglas and Josephine counties.
- **Saleable.** Moderate to high potential across the planning area.

See *Table 147 (Summary of the mineral occurrence potential within the planning area by resource type)*.

Table 147. Summary of the mineral occurrence potential within the planning area by resource type

Resource Type	Unknown or Low Potential[a]	Moderate Potential[b]	High Potential[c]
Locatable (acres)	1,180,000	636,000	97,000
Salable (acres)	1,534,000	1,000,000	9,000
Leasable (acres)	2,016,000	1,265,000	235,000
Wind[d] (% of planning area)	20% is Class 1 and 2	75% is Class 4	5% is Class 5 and 6

Note: All values rounded to the nearest 1,000.

[a]**Unknown or low potential:** References and district documents indicate geologic formations and processes are not favorable for the accumulation of mineral resources or there is insufficient information to make a determination of the mineral potential.

[b]**Medium potential:** References and district documents indicate geological formation and processes are favorable for the accumulation of mineral resources. For example, there may be additional mineral resources in old mines, or prospects or new resources in areas with a high lever of mining notice filing.

[c]**High potential:** References and district documents indicate geological formation and processes are favorable for the accumulation of mineral resources. These are areas of known active mines or active exploration and development activities, which indicate a high potential for the accumulation of mineral resources.

[d]**Wind class:** According to the Wind Energy Resource Atlas of the United States, wind classes are as follows: Class 1 (< 200 W/m^2), Class 2 (200 to 300 W/m^2), Class 3 (300 to 400 W/m^2), Class 4 (400 to 500 W/m^2), Class 5 (500 to 600 W/m^2), and Class 6 (600 to 800 W/m^2).

Restrictions that could affect the exploration and development of energy and mineral resources can be divided into five categories:

- nondiscretionary closures
- discretionary closures
- no surface occupancy stipulations
- standard stipulations
- additional restrictions

See *Table 148 (Acres of the restrictions that could affect the exploration and development of energy and mineral resources)* for the acres of the existing restrictions.

Table 148. Acres of the restrictions that could affect the exploration and development of energy and mineral resources

Restrictions	Unknown or Low Potential	Moderate Potential	High Potential
Nondiscretionary closures	389,000	128,000	59,000
Discretionary closures	25,000	8,000	1,000
No surface occupancy stipulations	56,000	121,000	0
Standard stipulations	2,618,000	2,251,000	275,000
Additional restrictions	354,000	286,000	5,000

Note: The sum of acres for each resource type (locatable, saleable, and leasable), which include overlap, are rounded to nearest 1,000.

United States Department of the Interior
Bureau of Land Management
Oregon State Office
333 S.W. 1st Avenue
Portland, Oregon 97204

OFFICIAL BUSINESS
PENALTY FOR PRIVATE USE, $300

PRIORITY MAIL
POSTAGE AND FEES PAID
Bureau of Land Management
Permit No. G-76

BLM/OR/WA/PL-07/046+1792

Draft Environmental Impact Statement

for the Revision of the Resource Management Plans of the Western Oregon Bureau of Land Management Districts

of Salem, Eugene, Roseburg, Coos Bay, and Medford Districts, and the Klamath Falls Resource Area of the Lakeview District

Volume II

BLM

Salem, Eugene, Roseburg, Coos Bay, Medford, and Klamath Falls Offices

August 2007

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interest of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

Chapter 4 – Environmental Consequences

Chapter 4 of this draft environmental impact statement analyzes the environmental consequences of the alternatives for the six resource management plans of the planning area that are being revised.

In this chapter:

Introduction **475**

Ecology **494**

Socioeconomics **534**

Environmental Justice **554**

Timber **557**

Special Forest Products **590**

Botany **593**

Invasive Plants **611**

Wildlife **633**

Fish **723**

Water **745**
Fire and Fuels **765**
Air **773**
Recreation **775**
Wilderness Characteristics **784**
Visual Resources **789**
National Landscape Conservation System **793**
Soils **794**
Grazing **798**
Wild Horses **804**
Areas of Critical Environmental Concern **807**
Cultural Resources **811**
Energy and Minerals **816**

Introduction

Chapter 4 describes the environmental consequences of the alternatives on the affected environment (described in *Chapter 3*) within the planning area (defined in *Chapter 2*). The various resources and programs would be affected to various degrees by each of the four alternatives (the No Action Alternative and the three action alternatives). Also described in this chapter are the analytical assumptions, the key assumptions, the analytical methodology and modeling, and the data that were used in the analyses of this draft environmental impact statement. Finally, this chapter suggests mitigation measures that may be needed for some resources or programs to reduce impacts.

Keep in mind that this draft environmental impact statement describes the generalized management-level actions and not the site-specific implementation-level actions.

Analytical Assumptions

The analytical assumptions that were used in the analysis of the alternatives are based on the science of and the relationships within the natural systems that exist within the planning area. The specific assumptions that were used in this draft environmental impact statement for the analysis of each resource or program are contained within the 2006 *Proposed Planning Criteria and State Director Guidance* document and its subsequent updates (incorporated by reference). In addition, the details about the methodology, including assumptions, that was used to model vegetation, water, large wood source areas, timber valuation, and socioeconomics are included as appendices.

Following are the key assumptions that are common to all four alternatives. The assumptions that are specific to a resource or program are contained within the individual sections of *Chapter 4* for those resources or programs.

Key Assumptions and Information Common to All Four Alternatives

Terminology

The following terms are used in this draft environmental impact statement.

- **Commercial forest lands.** Those lands that are capable of producing 20 cubic feet per year of wood of commercial species. These lands are identified in the timber productivity capability classification (see *Appendix Q – Vegetation Modeling*). These lands are biologically capable of producing a sustained yield of timber.
- **Forested lands**. Those lands that are capable of 10% tree stocking. This excludes roads and such nonforest areas as water, meadows, and rock outcrops, which are identified in the GIS data.

- **Long term.** For the management direction of these resource management plan revisions, long term is considered to be 100 years.
- **Short term.** For the management direction of these resource management plan revisions, short term is considered to be 10 years.

Projection of Forest Conditions

For all four alternatives, the lands that would be available for harvesting in support of the allowable sale quantity and sustained yield management (harvest land base) were mapped. Other lands (nonharvest land base) were also mapped and segregated into those lands where active management could occur and those lands where timber harvesting is prohibited. This mapping allowed the spatial application of the analytical assumptions of the alternatives, including timber harvesting, to model forest conditions over time. These modeled projections of forest conditions were expressed as classifications of habitat for the northern spotted owl, and as structural stages of forests, which were used by the interdisciplinary team in their analyses. See *Appendix B – Ecology* and *Appendix Q – Vegetation Modeling*.

As part of this revision effort, the BLM has modeled timber harvesting and the development of wildlife habitat on BLM-administered lands. See *Appendix Q – Vegetation Modeling*. This modeling allowed projections to be made of the changes to the vegetation over time in the harvest land base. See the *Ecology* section of this chapter.

Information from the Northwest Forest's Plan 10-Year Monitoring Report

Information from the Northwest Forest Plan's 10-year monitoring report was considered in the analyses in this draft environmental impact statement. Some of the general key findings in this monitoring report were that:

- watershed conditions improved,
- late-successional and old-growth forest increased more than was anticipated, and
- less timber harvesting occurred on federal lands than was anticipated.

Specific information used from the report is referenced in the individual sections found in Chapters 3 and 4.

Existing Federal and State Agency Plans

For purposes of analysis, it is assumed that other federal and state agencies would continue the implementation of their current plans as written.

- The U.S. Forest Service would continue to implement their current land and resource management plans, which incorporate the standards and guidelines of the Northwest Forest Plan. The late-successional and riparian reserves would continue to grow into late-successional forest over time. The matrix lands would continue to provide the same overall amount and spatial pattern of vegetation over time.
- State lands and other federal lands would continue to provide the same overall amount and spatial pattern of vegetation over time.

Although changes do occur on particular parcels of land, it is not feasible to project specific changes to millions of acres of land over time. Such a projection would be extremely complex and cost prohibitive to make. In the case of U.S. Forest Service's matrix lands, the assumption that matrix lands would not appreciably change is conservative for species analysis, since forested stands in the matrix would continue to grow until harvested, and in some cases would develop into late-successional habitat.

Private Lands

It is assumed that private lands, including both industrial forest lands and non-industrial lands would continue to provide the same overall amount and spatial pattern of vegetation over time as presently exists.

Industrial forest lands are generally harvested on a short rotation basis, which is approximately every 40 years within the planning area. This means that these lands rotate through vegetative conditions in a regulated fashion from 0 to 40 years. At the landscape level, it is therefore expected that current vegetation patterns would remain approximately the same.

Private, non-industrial lands are owned by a variety of individuals and entities (including private homeowners, local governments, and corporations). It would be cost and time prohibitive to predict the countless scenarios that could occur on these lands. In addition, these lands are less connected to the BLM's management than the intermingled industrial forest lands, state lands, and other federal lands.

Past Effects

As the Council on Environmental Quality in guidance issued on June 24, 2005, points out, the "environmental analysis required under NEPA is forward-looking," and review of past actions is required only "to the extent that this review informs agency decisionmaking regarding the proposed action." Use of information on the effects on past action may be useful in two ways according to the CEQ guidance. One is for

consideration of the proposed action's cumulative effects, and secondly as a basis for identifying the proposed action's direct and indirect effects.

The CEQ stated in this guidance that "[g]enerally, agencies can conduct an adequate cumulative effects analysis by focusing on the current aggregate effects of past actions without delving into the historical details of individual past actions." This is because a description of the current state of the environment inherently includes the effects of past actions. The CEQ guidance specifies that the "CEQ regulations do not require the consideration of the individual effects of all past actions to determine the present effects of past actions." Our information on the current environmental condition is more comprehensive and more accurate for establishing a useful starting point for a cumulative effects analysis, than attempting to establish such a starting point by adding up the described effects of individual past actions to some environmental baseline condition in the past that, unlike current conditions, can no longer be verified by direct examination.

The second area in which the CEQ guidance states that information on past actions may be useful is in "illuminating or predicting the direct and indirect effects of a proposed action." Extrapolation of data from largely anecdotal information of past actions is not generally accepted as a reliable predictor of effects. The basis for predicting the direct and indirect effects of this proposed action and its alternatives is published empirical research, the general accumulated experience of the resource professionals in the agency with similar actions, and models that apply current scientific knowledge regarding relationships of our proposed management actions and effects that are generally accepted by the scientific community in the various specialized fields.

Scoping for this project did not identify any need to exhaustively list individual past actions or analyze, compare, or describe the environmental effects of individual past actions in order to complete an analysis which would be useful for illuminating or predicting the effects of the proposed action.

For purposes of analysis, projects designed under the current RMPs proposed prior to October 1, 2005, are assumed completed as proposed. For example, the habitat on acreage included in a timber sale project proposed prior to that date would be displayed and analyzed as harvested, whether or not that harvest has yet been completed in fact.

BLM Budget

It is assumed that all four alternatives would be adequately funded to implement the alternatives as designed..

Administrative Actions

It is assumed that these types of routine transactions and activities (see *Chapter 2* for details) would occur under all four alternatives at approximately the same level as during the past 10 years. The effects of these actions have been generally incorporated into the analysis for each resource or program.

Reasonably Foreseeable Mineral Development

Minerals that can be reasonably foreseeable for development include:

- fluid minerals (from natural gas wells, oil wells, geothermal wells and plants, and coal bed natural gas wells);
- salable minerals (from rock quarries and decorative stone collection); and
- locatable minerals (from dredging and mines).

With the exception of coal bed natural gas, it is assumed that these types of activities would occur at a rate consistent with the past 10 years and would not vary by alternative. Exploration and development of coal bed natural gas is occurring on private lands in the Coos Bay District and exploration on BLM-administered lands is expected to increase in the next 10 years. Development scenarios would not vary by alternative. A detailed description of the reasonably foreseeable development scenario can be found in *Appendix P – Energy and Minerals.* The effects of these actions have been generally incorporated into the analysis for each resource or program. Site-specific analysis would occur during project implementation.

Threatened and Endangered Species

It is assumed that the current listing status for species under the Endangered Species Act would remain in effect.

Several recovery planning efforts and redesignations of critical habitat are currently underway. Information from these efforts was used in formulating the alternatives, management objectives and actions, and effects analyses to the extent practical. As these efforts are updated or completed, they would be considered between the draft and final environmental impact statements. The alternative that is subsequently adopted and implemented will be consistent with the recovery plan and management requirements for redesignated critical habitat.

Analytical Methodologies and Models

The analytical methodologies that were used in assessing the effects of the alternatives are described in detail in the 2006 *Proposed Planning Criteria and State Director Guidance* document. The public was requested to provide comments on the methodologies. Those comments were used to refine the methodologies used in the analysis. The analyses are both qualitative and quantitative in nature. The methodologies consist of procedures or models from experimental forests, scientific papers, previous environmental impact statements, and procedures developed by the BLM's specialists.

Analytical models have been used to assess and compare some of the environmental consequences of the alternatives. These models simplify the complexity of biological, physical, or economic systems. Even though they are limited by current knowledge, they represent a synthesis of the knowledge of BLM staff and other scientists who are familiar with the subjects of concern.

Forest Vegetation and Habitat Modeling

The alternatives outline a range of approaches for managing the BLM forest lands by varying the size and placement of land use allocations and varying the intensity with which the BLM forests are managed. These different management approaches would result in a range of outcomes—forest characteristics, habitat types, and sustainable harvest levels. A model was used to simulate the development of the forest over time under each alternative. The model simulated the application of management practices and forest development assumptions to characterize what the forests would be like in 10, 20, 50, and 100 years into the future. The outputs from this modeling form a quantitative basis for the analysis in this draft environmental impact statement that compares the alternatives.

The OPTIONS model by D.R. Systems was used to model forest vegetation conditions, to model endangered species habitat, and to determine a sustainable harvest level. It is a scenario-based model and not an optimization model. A scenario-based model simulates the intensity of management and the analytical assumptions of the alternatives that produce a solution that satisfies both the objectives of the alternative and a sustainable harvest level. An optimization model seeks to find combinations of the types, timing, and intensity of harvests that increase the value of a forest in terms of its economic value from timber harvesting, as well as its ecological and social value from its composition.

The OPTIONS model is also a spatially explicit model. This allowed for the development of map-based scenarios for the estimation of the environmental consequences of the alternatives within the short term (10 years) and long term (100 years).

The OPTIONS model was applied to the approximately 2.5 million acres of BLM-administered lands within the planning area. The surrounding private, state, and other federal lands comprise approximately 22 million acres. Modeling the

non-BLM lands to the same level of detail as the BLM-administered lands was not practical. Context vegetation modeling for the non-BLM lands was done by applying assumptions regarding the future management of non-BLM lands to the Interagency Vegetation Mapping Project satellite image vegetation classification.

The OPTIONS model came with no data and was used only as a modeling tool. The BLM was responsible for the data, assumptions, and rules that were used in formulating the model for analyzing the alternatives. A complete description of the OPTIONS modeling effort can be found in *Appendix Q – Vegetation Modeling*.

The Organon growth and yield model was used to determine the volume outputs for the silviculture regimes of each alternative and was a key input into the OPTIONS model. A complete description of the growth and yield modeling effort can be found in *Appendix Q – Vegetation Modeling*.

The OPTIONS model provided an assessment of the changes to the structural stages of forests and the changes to the habitat of the northern spotted owl over time for each alternative. A detailed description of these vegetation classes may be found in *Appendix B – Ecology*. The OPTIONS model also provided changes to key baseline vegetation conditions and northern spotted owl habitats. These outputs were used by resource specialists to estimate the environmental consequences of the alternatives. Outputs were also used as data inputs for other models (such as the modeling of hydrology and fire).

The harvest treatments that were simulated in the model for the first 10 years were used to develop a first decadal scenario. This first decadal scenario was used for the purpose of estimating short-term change to the forests and the display of the types of treatments that would be applied. It also served as a basis to estimate road construction and harvesting methods. In addition, the first decadal scenario served as a quality control check of the sampled harvest units that were identified by the model. These harvest units were examined for the practicality of implementation. The first decadal scenario was not intended to be a plan for subsequent implementation on the ground. The environmental consequences from subsequent implementation of forest treatments through actual projects will be analyzed and disclosed in project-level environmental analysis. Project-level analysis will examine project level impacts and determine if they are within those already anticipated and described in this Environmental Impact Statement. Additional information about the first decadal scenario can be found in *Appendix D – Timber*.

Geographic Information System Data

To support the western Oregon resource management planning effort in the mid 1980s, the BLM created an automated geospatial database, which is a geographic information system (GIS) database. Ongoing collaborative efforts in data collection, data standards, and data acquisition have resulted in a significant increase in the amount and accuracy of the geospatial data that is available for land use planning.

The quality, quantity, and management of the data that is contained within the GIS database have provided managers and resource professionals with the ability to analyze complex land management issues and scenarios. The western Oregon component of the GIS database includes forest vegetation, management units, roads, hydrology, elevation, ownership, and a wide range of wildlife habitat information (including the location of threatened and endangered species on BLM-administered lands).

Existing data was evaluated for accuracy, reliability, and limitations. Missing, incomplete, or outdated information was identified and updated when practical. Of particular note is an update to the estimated amount of BLM lands that are contained in the riparian reserve land use allocation under the No Action Alternative. Over the past 10 years, the extent of the hydrology network has been more fully mapped and the information regarding the presence of fish has increased. This improved GIS data about hydrology and the presence of fish on BLM lands within the planning area made it possible to model the extent of the riparian reserves to a precision that was not feasible 10 years ago. For the 1995 resource management plans, it was estimated that 22% (522,000 acres) of the western Oregon BLM lands within the planning area were contained in the riparian reserve land use allocation (the portion covering the matrix and adaptive management areas after all other allocations are deducted). This number has been adjusted downward to 15% (364,000 acres) for the No Action Alternative.

Other corrections that resulted from the improved accuracy of the GIS information included a mapping correction. A mapping error during the previous Medford District resource management plan revision resulted in the inaccurate reporting of the district's acres that were open to off-highway vehicle use. The resource management plan showed 391,400 acres were open to off-highway vehicle use when, in fact, only 139,878 acres were open to off-highway vehicle use.

Besides the improved GIS data, another important source of data that was used in the analysis of the alternatives included the recently completed decadal assessment of the Northwest Forest Plan. This decadal assessment generated data that described the condition of the environment across the area of the Northwest Forest Plan.

In general, data that was used in the analysis of the alternatives was summarized at various scales, including the planning area, physiographic provinces, the BLM districts, and fifth-field watersheds. There are 260 fifth-field watersheds, which average 87,000 acres in size, that are located all or partially within the planning area.

Reference Analysis

In addition to analyzing subalternatives, which are variations of an alternative that add, remove, or modify certain management actions, several reference analyses are also analyzed in this draft environmental impact statement. Reference analyses provide additional information that is useful to more fully understand the effects of one or more of the alternatives.

Like the subalternatives, the analysis of the reference analyses is focused and limited to specific analytical questions. Unlike the subalternatives, however, the reference analyses are not selectable during decision making because they do not meet all of the qualifications for being a subalternative.

The two reference analyses for this draft environmental impact statement include:

1 ***Allow no harvesting.*** This reference analysis will provide information about the vegetation condition that would occur naturally without management and the capacity of the BLM-administered lands to provide wildlife habitat.

2. ***Manage most commercial forest lands for timber production.*** This reference analysis will provide information about the vegetation condition and timber production levels that would occur if most of the BLM-administered lands (except the National Landscape Conservation System lands, the administratively withdrawn lands, and lands within 25 ft. of streams) were managed for timber harvesting.

Scope of the Analysis

The Council on Environmental Quality's regulations for implementing the National Environmental Policy Act (NEPA) direct that "NEPA documents must concentrate on the issues that are truly significant to the action in question, rather than amassing needless detail" (40 CFR 1500.1(b)). Issues are "truly significant to the action in question" if they are necessary to make a reasoned choice between alternatives (i.e., the issue relates to how the alternatives respond to the purpose and need). Issues are also "truly significant to the action in question" if they relate to significant direct, indirect, or cumulative impacts resulting from the alternatives. This analysis addresses the environmental consequences that are associated with the issues that are related to the purpose and need (see *Chapter 1*). For example, the analysis of fisheries focuses on the effects on listed fish species to address the issue of "How should the BLM manage federal lands in a manner that is consistent with the Endangered Species Act in order to contribute to the conservation of species." Other fish species occur within the planning area, and some have different habitat requirements and life histories than the listed fish species. However, this analysis does not attempt to analyze the effects of the alternatives on all fish species. Similarly, the analysis of plants and wildlife focus on the effects on species listed under the Endangered Species Act, and analyze effects on special status species to the extent necessary to evaluate changes in populations or habitat that would contribute to a need

to list the species under the Endangered Species Act. These sections do not attempt to analyze the effects of the alternatives on all plant and animal species.

Direct and Indirect Effects

The Council on Environmental Quality's regulations for implementing the National Environmental Policy Act requires that both the direct and indirect effects on the quality of the human environment of a proposed action or alternative be disclosed.

- **Direct effects.** Those effects "which are caused by the action and occur at the same time and place."
- **Indirect effects.** Those effects "which are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable."

There is no requirement for discussing direct and indirect effects be discussed individually. Also, it can be difficult to distinguish between the two, particularly at the scale of the planning area. Therefore, the terms direct and indirect are not differentiated in the analysis of the effects in this draft environmental impact statement. Effects caused by the actions are identified without attempting to categorize them as direct or indirect.

Cumulative Effects

Cumulative effects result from the incremental impact of an action when added to other past, present, and reasonably foreseeable future actions (40 CFR 1508.7). Due to the nature of the analysis in this large scale and long-term resource management plan environmental impact statement, all environmental effects described in this environmental impact statement have incremental impacts that result in cumulative effects. Therefore, there is not a discreet and separate section labeled as cumulative effects. The discussion of effects on each resource incorporates the context of incremental effects thus revealing the cumulative effects of the action.

The cumulative effects in this draft environmental impact statement consider past and reasonably foreseeable future actions. The existing baseline information is a result of the aggregation of all past actions; therefore, it is not necessary to analyze past actions individually. For BLM-administered lands, reasonably foreseeable future actions are those actions that would occur as described under the various alternatives. For U.S Forest Service and state of Oregon lands, reasonably foreseeable future actions are those that would occur under their current land use plans. For private lands, reasonably foreseeable actions are those actions that would occur with the continuation of present management.

There are other broad-scale analyses that are currently underway that are relevant to the analyses of these environmental consequences. They include:

- ***Final Supplement to the 2004 Final Supplemental Environmental Impact Statement To Remove or Modify the Survey and Manage Mitigation Measure Standards and Guidelines.*** This supplement provides additional effects analyses in support of the 2004 record of decision to remove the survey and manage standards and guidelines. The U.S. Forest Service and the BLM have reinstated the survey and manage standards and guidelines until this supplement and the subsequent decision have been completed. The SEIS was completed in June, 2007 and the Record of Decision is expected in July, 2007. However, before any decision to remove the Survey and Manage standards and guidelines can be implemented, approval of the U.S. District Court for the District of Western Washington must be obtained. Since it is not certain if that will occur before this revision of the current RMPs is completed, we are assuming for purposes of analysis of the No Action Alternative for this western Oregon Plan Revision that Survey and Manage standards and guidelines consistent with the 2001 SEIS Record of Decision, including changes through the Annual Species Reviews completed through 2003, remain in effect.
- **Westwide Energy Corridor Project.** This project has a programmatic environmental impact statement to designate corridors for oil, gas, and hydrogen pipelines, as well as electricity transmission and distribution facilities on federal lands in 11 western states that is currently underway. The draft programmatic environmental impact statement, which is being coordinated by the Department of Energy, is scheduled for release in the summer of 2007. After the environmental impact statement is completed, the BLM will amend the relevant land use plans, as necessary, to implement corridor designations on the lands it administers. See the *Maps* section at the end of *Chapter 2* for the projected location of the corridor within the planning area. This project was included as a reasonably foreseeable future action for purposes of analyzing cumulative effects.
- **Proposed Jordan Cove Energy (Liquid Natural Gas Terminal) Project and Proposed Pacific Connector Gas Pipeline Project.** These two projects would consist of an onshore liquid natural gas import and storage terminal, which would be located on the bay side of the North Spit of Coos Bay, Oregon, and an approximately 223-mile-long, 36-inch-diameter natural gas pipeline, which would extend from the terminal southeastward across Coos, Douglas, Jackson, and Klamath counties to an interconnection with an existing pipeline near Malin, Oregon.
- The Federal Energy Regulatory Commission will prepare an environmental impact statement to address the environmental consequences of the project. The current schedule calls for completion of the draft environmental impact statement by August 2007 and the final environmental impact statement by December 2007. See the *Maps* section at the end of *Chapter 2* for the projected location of the corridor within the planning area. This project was included as a reasonably foreseeable future action for purposes of analyzing cumulative effects.

Spatial and Temporal Scales of Analysis

Some resources are spread more broadly across the planning area than others. The analysis of the alternatives at multiple spatial scales is necessary to examine those resources for which their geographic area differs from the planning area. For example, the analysis of certain animals or birds may require the consideration of a geographic area that is broader than individual districts. In contrast, the geographic area appropriate for the analysis of a rare plant may be quite limited. Information presented at multiple spatial scales helps the BLM to understand issues, analyze cumulative impacts, and tailor decisions to specific needs and circumstances.

It is also necessary to consider various temporal scales. The Council on Environmental Quality's regulations require a consideration of the relationships between the short-term uses of the human environment and the maintenance and enhancement of long-term productivity. Some natural processes and the implementation of management actions may occur over a relatively short time, whereas other natural processes and implementation of management actions occur over longer periods of time. Therefore, vegetation changes were analyzed at 10, 20, 50, and 100 years. When possible, interim benchmarks and rates of progress or trends have been identified for those management objectives that may not be achieved for decades, a century, or longer.

In general, for these analyses, the short term is considered 10 years and the long term is considered 100 years. In the analysis of certain resources, the definition of short term and long term varies from this general definition. In those instances, the time period for short and long term is specified in the text.

Incomplete or Unavailable Information

As noted in the individual analyses in this environmental impact statement, there are certain relationships for some of the resources that are not fully understood. This is to be expected given the complexities and interrelationships inherent in natural resource management. When encountering a gap in information (incomplete or unavailable information), the Council on Environmental Quality's regulations pose the question as to whether the information is "essential to a reasoned choice among alternatives" (40 CFR 1502.22(a)). While additional information would often add precision, if the basic data and central relationships are sufficiently well-established that new information would not likely reverse or nullify the relationships, or be essential to a reasoned choice among the alternatives, then it is not necessary.

If information that is relevant to reasonably foreseeable significant adverse impacts or that is essential to a reasoned choice among alternatives is unavailable, or if the costs of obtaining the information are exorbitant, an environmental impact statement must include statements to let the public know this and its effect on the ability to predict impacts to a particular resource.

Natural disturbances, salvaging, global climate change, and sudden oak death are areas of incomplete information.

Natural Disturbance and Salvage

This analysis does not include estimates of future natural disturbances, such as wildfires, windstorms, disease, or insect infestations, or subsequent salvaging. These disturbances will occur in the future under all four alternatives; however, the location, timing, severity, and extent of such disturbances are speculative.

Wildfire is the most predictable of these natural disturbances, yet it is still not possible at the scale of the planning area to identify reasonably foreseeable effects related to wildfires, which would be highly dependent on the wildfire location, timing, severity, and extent. Wildfire location, timing, severity, and extent would all be highly dependent upon variables that cannot be reasonably foreseen, such as weather, ignition sources, fuel conditions in the fire location, and the effectiveness of control efforts. For example, the Late Successional/ Old Growth Monitoring Report found that there was high variation among the provinces in the loss of late-successional forest to wildfires in the past 10 years—more than three-quarters of the acres lost to wildfires were the result of a single fire (Moeur et al. 2005, 95). The FSEIS of the Northwest Forest Plan assumed that 2.5% of late-successional forests would be lost to wildfires each decade (NWFP FSEIS, 3&4:42). Most of the planning area had a lower rate of loss in the past decade, but the Klamath province had a much higher loss rate (9.5% for the decade) (Spies 2006, 84; Moeur et al. 2005). It is not possible to accurately predict the total acreage of wildfires at the scale of all federal forests in a province. To predict total acreage of wildfires for BLM-administered lands, which are highly dispersed among other ownerships, would be far more speculative. To attempt to predict wildfire acreage for BLM-administered lands at finer scales, or to predict wildfire severity, timing, or extent, would be so speculative as to be arbitrary.

The alternatives contain management actions related to salvaging of trees killed following disturbances and those management actions vary among the alternatives. Information on the effects of natural disturbances and salvaging (or the absence of salvaging) is incomplete or unavailable. The analysis of the effects of such disturbances prior to their occurrence, and the possible associated salvaging, would require making so many speculative assumptions regarding specific circumstances that the conclusions of the analysis could not be used to make reasonably informed decisions regarding management actions. Such analysis can be addressed at the time of proposed implementation when specific circumstances can be analyzed.

The following describes general information on the effects of natural disturbances and salvaging.

Natural Disturbances

Natural disturbances kill trees, which creates snags and logs. Some disturbances, like wildfires, consume some portion of the trees that are killed, but other disturbances leave the killed trees intact. Disturbances drive the development of forest structure, composition, and process (Franklin et al. 2002). Disturbances have strong controls on the pattern of the landscape, nutrient cycling, hydrology, and habitat (Hutto 2006; Lindenmayer and Noss 2006; Reeves et al. 2006; Beschta et al. 2004; Ice et al. 2004; Karr et al. 2004; Lindenmayer et al. 2004; Robichaud et al. 2000; Perry 1998; Forman 1995). For example:

- **Soil conditions and processes.** The environmental impact statement for the Timbered Rock Fire Salvage and Elk Creek Watershed Restoration Project concluded that these wildfires altered the conditions and processes of the soil, which increased soil erosion and the risk of landslides (Timbered Rock EIS, 3-9 – 3-21). The environmental impact statement for the Biscuit Fire Recovery Project also concluded that that wildfire altered the conditions and processes of the soil, but did not conclude that the wildfire had increased the risk of landslides (Biscuit Fire EIS, III-81 – III-85).
- **Stream flow, sedimentation, and water temperature.** The environmental impact statement for the Timbered Rock Fire Salvage and Elk Creek Watershed Restoration Project and the environmental impact statement for the Biscuit Fire Recovery Project concluded that the wildfires had increased stream flow, sedimentation, and water temperature (Timbered Rock EIS, 3-45 - 3-53; Biscuit Fire EIS, III-206 - III-211).
- **Insect infestations.** The environmental impact statement for the Timbered Rock Fire Salvage and Elk Creek Watershed Restoration Project concluded that that wildfire would lead to only limited and localized subsequent tree mortality from insect infestations (Timbered Rock EIS 3-105 - 3-106). The environmental impact statement for the Biscuit Fire Recovery Project concluded that the extensive insect infestations were possible but impossible to predict (Biscuit Fire EIS, III-143 – III-144).

The environmental impact statement for the Timbered Rock Fire Salvage and Elk Creek Watershed Restoration Project and the environmental impact statement for the Biscuit Fire Recovery Project concluded that the wildfires had removed late-successional forest habitats and created early-successional habitats (Timbered Rock EIS 3-175 – 3-180; Biscuit Fire EIS, III-153 – III-173).

The analyses in these two environmental impact statements are incorporated by reference.

Salvaging

Salvaging after natural disturbances provides opportunities for timber harvesting. Such harvesting, when it would occur in the late-successional management areas, is not included in computing the allowable sale quantity (see the *Timber* section of this chapter), because this harvesting would not be repeated over time. The economic return from harvesting in the late-successional management areas that would not otherwise occur in the absence of a natural disturbance cannot be analyzed because of the speculative nature of the timing and magnitude of the disturbance and the value of the timber that might be killed. When harvesting after natural disturbance occurs in the timber management area or general landscape area, the harvests would be included as part of the allowable sale quantity. Any variations in the allowable sale quantity that is offered for sale in a given year, because of salvaging after a natural disturbance, would be averaged over subsequent years according to the management actions in the alternatives. Because such harvesting in the timber management area and general landscape area would become part of the scheduled allowable sale quantity, there would be no economic benefit beyond that assumed from normal harvesting in these areas.

Salvaging after natural disturbances can potentially reduce the risk of a future high-severity fire by reducing the quantity of large fuels (Biscuit Fire EIS III-37 – III-38, III-58; Timbered Rock EIS, III-162 - III-168; McIver and Starr 2000). The large fuels in a fire release a large amount of energy over a sustained time period. This heat pulse contributes to long-term soil damage (Timbered Rock EIS, III-163 - III-164). All disturbances that kill trees increase the quantity of both fine and large fuels on the ground. Salvage logging reduces the quantity of large fuels, but can increase the quantity of fine fuels. In contrast, Donato et al. (2006) and Beschta et al. (2004) concluded that salvage logging increases fire risk by increasing surface fine fuels, and suggested that leaving snags standing could result in a lower fire hazard. While the potential for reducing future fire severity by reducing large fuels is consistent with existing research on fire effects (Brown et al. 2003), there is little research that directly evaluates the effectiveness of salvage logging in achieving this objective. As noted by Reeves et al. (2006):

> "reburn probability and reburn fire behavior are understood mostly in theory; there is little empirical evidence that would be useful for evaluating risks."

Salvaging after natural disturbances can potentially reduce insect and disease outbreaks (Ice et al. 2004; Sessions et al. 2004; McIver and Starr 2000). For example, windthrow can contribute to increases in Douglas fir bark beetle populations (Furniss and Carolin 1977). However, the effect of salvage logging on future insect and disease outbreaks, like the

effect on reburns, is understood mostly in theory and without empirical evidence (Biscuit Fire EIS, III-143 – III-144).

Ground disturbances that are caused by salvage logging can mechanically break up hydrophobic soils, which can result from high-severity fires (McIver and Starr 2000). However, some studies suggest that hydrophobic soils are temporary and would be naturally altered before salvage logging would typically occur, and that the disturbances necessary to break up hydrophobic soils would cause soil compaction and erosion (Reeves et al. 2006; Beschta et al. 2004). The environmental impact statement for the Timbered Rock Fire Salvage and Elk Creek Watershed Restoration Project summarized the research on hydrophobic soils and concluded that they are not considered a major hydrologic concern in the Pacific Northwest, except for granitic soils (BLM Timbered Rock EIS, 3-21).

Salvaging can reduce safety hazards. Natural disturbances create snags and logs that can pose safety hazards to people and infrastructure (roads, trails, and recreation facilities). Salvaging can also reduce safety hazards during wildfire suppression, because large fuels contribute to the difficulty of suppression operations, and snags and logs pose direct safety hazards to firefighters (Biscuit Fire EIS, III-38 - III-41, III-51 – III-53, III-55 – III-56).

Salvage logging can disrupt natural tree regeneration (Donato et al. 2006; McIver and Starr 2000), but can improve access to disturbed sites to allow replanting and future silvicultural treatments (Sessions et al. 2004). Several studies have asserted that salvage logging necessarily causes forest degradation as a result of soil compaction, erosion, sedimentation to streams, and the spread of invasive species (Lindenmayer and Noss 2006; Reeves et al. 2006; Beschta et al. 2004; Karr et al. 2004). These adverse effects are only potential results of salvage logging, not certain results. As with other timber harvesting, proper logging design and implementation can avoid adverse effects on soil and water (Ice et al. 2004; Sessions et al. 2004; Duncan 2002; McIver and Starr 2000)

Salvaging does not directly contribute to the ecological recovery of disturbed forests, and, in some respects, impairs or delays ecological recovery. Salvaging does reduce snag and coarse woody debris levels, which reduces ecological functions and alters future stand development (Lindenmayer and Noss 2006; Noss et al. 2006; Reeves et al. 2006; Franklin et al. 2002). Salvage logging does simplify and homogenize the postdisturbance early-successional forest, and several studies have asserted that structurally complex early-successional forests are becoming increasingly rare and are important sites for many biological and ecological processes (Hutto 2006; Lindemayer and Noss 2006; Spies 2006; Ohmann et al. 2005; Lindemayer et al. 2004; Franklin et al. 2002).

Climate Change

In the past decades, the regional climate has become warmer and wetter with reduced snowpack (Scientific Consensus Statement 2004). Current climate conditions have changed from the climate conditions when the current old-growth stands were developing (Franklin et al. 2006). It is unknown whether these changes in climate have altered fundamental processes about tree regeneration and stand development in a way that changes the likely development of currently young stands.

The analysis assumes no change in climate conditions, because the specific nature of regional climate change over the next decades remains speculative. Although an increase in average annual regional temperatures is likely, changes to the amount and timing of precipitation are too uncertain to predict (U.S. Global Change Research Program 2001; Climate Impacts Group 2004; Scientific Consensus Statement 2004). Changes in the impact analysis as a result of climate change would be highly sensitive to changes in the amount and timing of precipitation. Furthermore, it would be very difficult to apply the results of climate change models to a finer scale than the entire Pacific Northwest, which limits the ability to apply the results of climate change models to the analysis of specific management strategies or actions. This analytical assumption is generally consistent with the recent U.S. Forest Service science consistency review *Addressing Climate Change in Plan Revision* (U.S. Forest Service 2005).

Either higher than previous temperatures or higher than previous atmospheric carbon dioxide levels could increase tree growth rates. However, the overall effects on regional forest growth are uncertain (Smith 2004), especially because of the uncertainty of precipitation changes. Increased summer temperatures combined with reduced summer precipitation could result in reduced tree growth rates and increased losses due to wildfires.

Increased temperatures could also result in changes to hydrologic processes, including reduced snowpacks, earlier snowmelt, shifting of the rain-on-snow zones, higher spring streamflows, and lower summer streamflows. However, as with forest growth, the overall effects on hydrologic processes are uncertain because of the uncertainty of precipitation changes. Increased winter precipitation could mitigate or overwhelm the effects of increased temperatures on snowpack and the changes in the timing of streamflows.

Sudden Oak Death

Sudden oak death is a recently recognized disease that is killing tanoak, oaks, and other plant species in California. The disease is caused by the introduced pathogen known as *Phytophthora ramorum*. The disease causes trunk cankers, which often directly leads to the death or weakening of a tree to the point that fungi or insects kill it (Rizzo et al. 2002). Tree mortality rates vary widely,

even in susceptible species. A wide range of other species with visible branch cankers or foliar lesions is infected by the pathogen, but with uncertain effects on the plant. One of the most common oak species within the planning area, Oregon white oak (*Quercus garryana*), appears to be unaffected by the pathogen (Rizzo 2003). The long-term effect of sudden oak death on infected forest ecosystems is unknown.

The disease has been confirmed in one location in Curry County in southwestern Oregon (Kanaskie et al. 2006). Future spread of the disease into Oregon is uncertain. Models identify different levels of risk of sudden oak death spread across the planning area (Kelly et al. 2005). Widespread infections and mortality of tanoak and oak species could alter not only forest composition and structure, but also important forest processes, such as nutrient cycling and wildlife habitat. For example, tanoak and oaks are important in many southwestern Oregon stands in providing cover and food for a wide variety of wildlife species. Widespread infections could affect suitable northern spotted owl habitat in southwestern Oregon through the removal of sub-dominant canopy tree and shrub species; altering habitat structure and prey base numbers. However, because future spread of the disease and subsequent tree mortality in the planning area is speculative, there is no basis on which this analysis can assume future changes to forest composition, structure, and process as a result of Sudden Oak Death.

Irreversible or Irretrievable Commitment of Resources

The irreversible or irretrievable commitment of resources refers to those that cannot be reversed or that are lost for a long period of time. Examples include the extraction of minerals or the commitment of land to permanent roads. Specific irreversible or irretrievable commitments of resources are described in the environmental consequences for each resource.

Adverse Effects That Cannot be Avoided

Under the National Environmental Policy Act (NEPA), an agency does not have to avoid adverse effects. However, an agency must identify adverse effects and disclose them. An agency must also identify the means to mitigate those adverse effects that can be mitigated—not all adverse effects can be mitigated. Adverse effects that cannot be avoided are those that remain after mitigation measures have been applied.

Mitigation

The Council of Environmental Quality's regulations state that mitigation includes avoiding, minimizing, rectifying, reducing, eliminating, or compensating for adverse

environmental impacts. Most measures often used in mitigating effects from timber management are already included in the design of the alternatives, and therefore assessed as part of the effects of the alternatives. Those mitigation measures that are not included in the design of the alternatives are identified in the discussions of environmental consequences for individual resources or programs.

Estimated Timber Management Activity for the First 10 Years

See *Table 149 (Estimated annual first decade levels of timber management activity by alternative)* for the assumed levels of timber management activities that were used in the analysis of the environmental consequences.

Table 149. Estimated annual first decade levels of timber management activity by alternative

Timber Management Activity	Unit	Alternative			
		No Action	Alt. 1	Alt. 2	Alt. 3
Regeneration harvesting ASQ	acres	60,500	90,600	143,400	3,900
Partial harvesting ASQ	acres	0	0	0	124,600
Thinning ASQ	acres	36,800	45,400	43,300	160,300
Allowable sale quantity (ASQ)	mmbf	268	456	727	471
Nonharvest land base thinning	acres	63,200	68,000	33,400	0*
Nonharvest land base (NHLB) volume	mmbf	87	81	40	2
Total harvest volume	**mmbf**	**355**	**537**	**767**	**473**
Permanent road construction	miles	360	520	610	550
Temporary road construction	miles	460	310	400	510
Right-of-way area for permanent road construction	acres	1,800	2,800	3,300	3,200
Ground-based yarding	acres	31,100	38,700	36,500	58,500
Cable yarding	acres	100,400	139,100	157,000	187,900
Aerial yarding	acres	29,000	26,200	26,600	42,400
Site preparation:					
Prescribed burning	acres	48,200	71,700	109,300	60,800
Other	acres	14,900	28,500	46,200	20,400
Release/precommercial thinning	acres	54,600	54,600	54,600	54,600
stand conversion	acres	2,100	2,100	2,100	2,100
Planting/unimproved genetics	acres	18,600	29,300	38,600	20,300
Planting/improved genetics	acres	50,800	73,500	115,700	62,400
Fertilization	acres	104,700	129,700	127,200	204,400
stand maintenance/protection	acres	112,500	161,400	259,900	134,400
Pruning	acres	37,600	37,600	37,600	37,600

*Acres round to 0.

Ecology

This analysis describes the abundance and spatial patterns of the forest structural stages that would exist under the alternatives:

- for the BLM-administered lands within the entire planning area by land use allocation and by physiographic province, and
- across all ownerships for the entire planning area by physiographic province.

This analysis compares these abundances and spatial patterns to the average historic conditions.

Key Points

- The abundance of the forest structural stages across all ownerships:
  - would not return to their average historic conditions in 100 years, even if there were no timber harvesting on the BLM-administered lands, and
  - would only shift 1% in 100 years under all four alternatives.
- The abundance of the forest structural stages on the BLM-administered lands:
  - would be consistent with the average historic conditions only under the No Action Alternative, and
  - would decrease the abundance of the young forests and increase the abundance of the mature &structurally complex forests from the current condition under all four alternatives.
- The retention of structural legacies in regeneration harvests, which would occur under the No Action Alternative and Alternative 3, would result in structurally complex forests redeveloping almost twice as fast after harvesting as under Alternatives 1 and 2.
- The alternatives would vary widely in the amount of existing old forest that would be harvested in 100 years—from 14% under the No Action Alternative to 63% under Alternative 3.
- Across all ownerships, the patch size of mature and structurally complex forests would increase under all four alternatives. The No Action Alternative would result in the largest increase and Alternative 3 would result in the smallest increase in all provinces.
- On the BLM-administered lands, the size and connectivity of the patches of the mature&structurally complex forests:
  - would increase from the current condition in most provinces under the No Action Alternative,
  - would decrease in most provinces under Alternatives 1 and 2, and
  - would decrease in all provinces under Alternative 3.

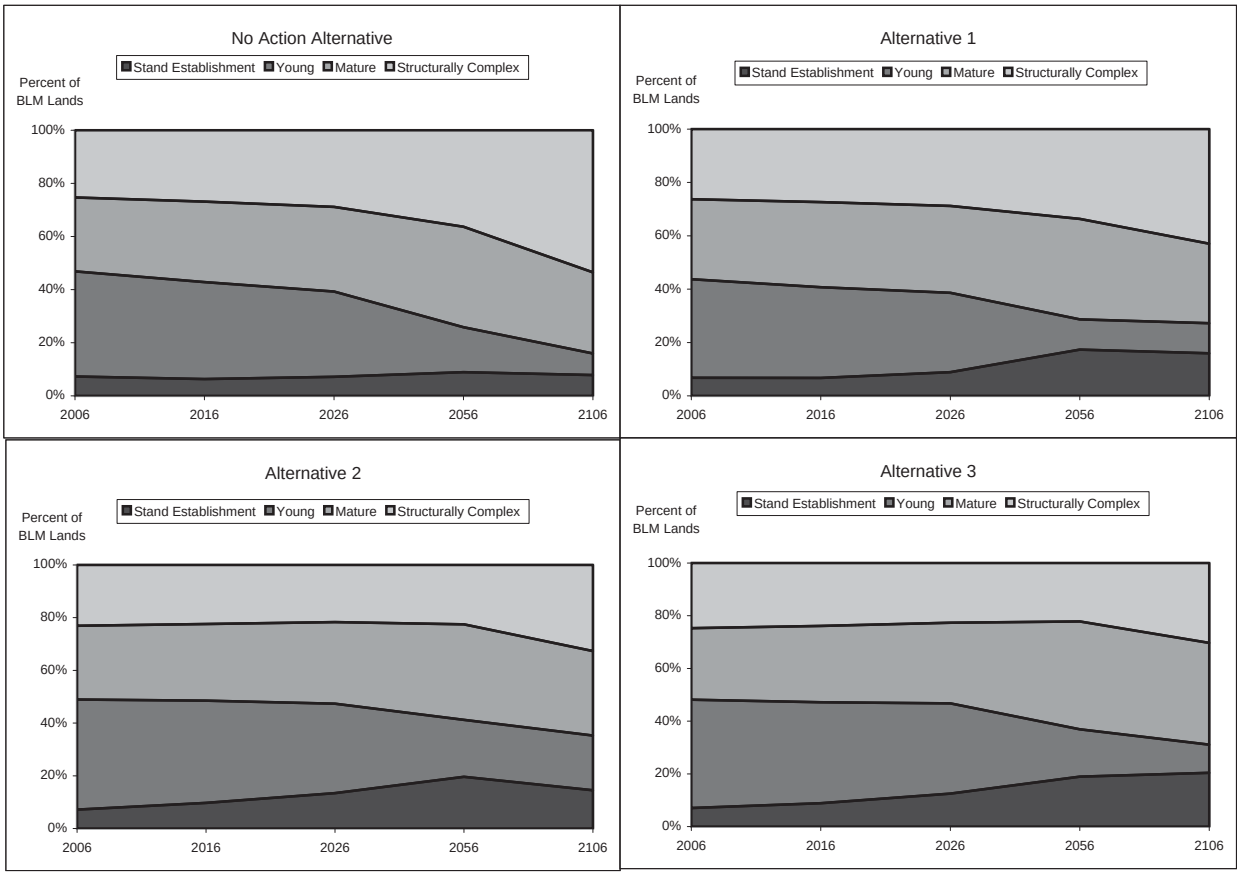
Ecological Conditions of the Conifer Forests on the BLM-Administered Lands across the Planning Area

On the BLM-administered lands in 100 years, the abundance of:

- the stand establishment forests would remain approximately constant under the No Action Alternative, and increase under the three action alternatives;
- the young forests would decrease under all four alternatives;
- the mature forests would increase under all four alternatives; and
- the structurally complex forests would increase under all four alternatives.

See *Figure 142 (Structural stage abundances on the BLM-administered lands by alternative).*

Figure 142. Structural stage abundances on the BLM-administered lands by alternative[1]



Under the No Action Alternative, the abundance of the forest structural stages on the BLM-administered lands would become roughly consistent with the estimates of the average historic conditions (Nonaka and Spies 2005) within 100 years. Under the three action alternatives, the abundance of the forest structural stages on the BLM-administered lands would move toward the average historic conditions, but would not reach the average historic conditions within 100 years. See *Figure 142*, *Figure 143 (Comparison of the BLM-administered forested lands by 2106 with the average historic conditions and current conditions by alternative)*, and *Table 150 (Structural stage abundances by percentage of the BLM-administered forested lands by alternative).*

[1] The 2006 forest structural stage abundances differ slightly among the alternatives because of the differences in how the inventory information is assembled for modeling under each alternative and the changes in the identification of nonforest. See the *Ecology* section in *Chapter 3* for the descriptions for Alternative 3 that used the 2006 data.

Figure 143. Comparison of the BLM-administered forested lands by 2106 with the average historic conditions and current conditions by alternative

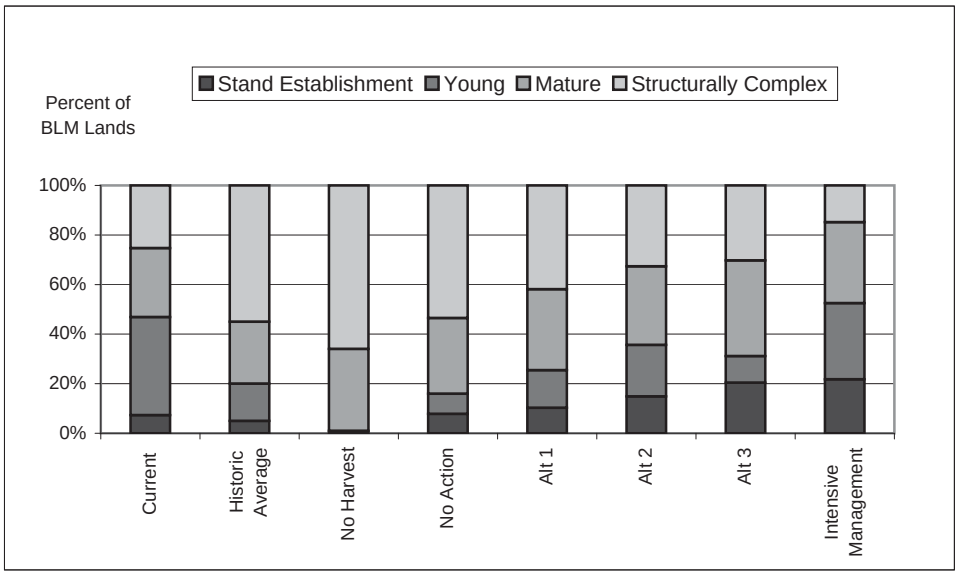


Table 150. Structural stage abundances by percentage of the BLM-administered forested lands by alternative

Year	Stand Establishment (%)	Young (%)	Mature (%)	Structurally Complex (%)
No Action Alternative				
2006	7	41	27	25
2016	6	36	30	27
2026	7	32	32	29
2056	9	17	38	36
2106	8	8	31	53
Historic Averages	5	15	25	55
Alternative 1				
2006	7	41	27	25
2016	7	39	29	25
2026	10	34	31	26
2056	14	19	37	30
2106	10	15	33	42
Historic Averages	5	15	25	55
Alternative 2				
2006	7	41	27	25
2016	10	39	29	22
2026	13	34	31	22
2056	20	22	36	23
2106	15	21	32	33
Historic Averages	5	15	25	55

Year	Stand Establishment (%)	Young (%)	Mature (%)	Structurally Complex (%)
Alternative 3				
2006	7	41	27	25
2016	9	38	29	24
2026	13	34	31	23
2056	19	18	41	22
2106	20	11	39	30
Historic Averages	5	15	25	55

The No Action Alternative would result in the BLM-administered lands being dominated by mature and structurally complex forests. The amount of the structurally complex forests would more than double in 100 years. The increase in structurally complex forests would be accompanied by a comparable decrease in the amount of young forests. The overall result of these changes would be to shift the BLM-administered lands from a condition in which the young forests are the most common to a condition in which the structurally complex forests are the most common. This shift would occur largely as a result of four factors:

- **The large acreage in the nonharvest land base would develop into mature and structurally complex forests.** The nonharvest land base would develop similarly under all four alternatives, but the nonharvest land base would be larger under the No Action Alternative than any other alternative (73% of the forested acres). See *Figure 148 (Structural stage abundances on the forested lands in the nonharvest land base by alternative)* later in this section.
- **The regeneration harvest rate would be too low to increase the amount of stand establishment forests, eventually resulting in a decrease in the young forests.** Regeneration harvesting in the harvest land base would create an average of 6,100 acres of stand establishment forest per year in the first decade, but 8,400 acres of stand establishment forest would develop into young forests across all allocations. Meanwhile, an average of 15,600 acres of young forest would develop into mature forest per year the first decade, which would result in a substantial decrease in the total abundance of young forest.
- **Green tree retention in regeneration harvests would speed the redevelopment of the structurally complex stands after harvesting.** The green tree retention requirements in the harvest land base would result in harvested stands developing into structurally complex forest almost twice as quickly as stands without structural legacies. Stand establishment forests with structural legacies, such as those produced under the No Action Alternative and Alternative 3, would develop into structurally complex forests in approximately 80 years for the most common stand conditions on productive sites. Stand establishment forests without structural legacies, such as those produced under Alternatives 1 and 2, would develop into structurally complex forests in approximately 150 years for common stand conditions on productive sites. See

Figure 144 (The influence of legacy retention on future stand development). This finding is consistent with other studies that concluded that green tree retention would speed the redevelopment of the structurally complex forests (Spies 2006, 94; Zenner 2005; Zenner 2000).

- **The standards and guidelines of the matrix land use allocation would constrain the harvesting of the structurally complex forests.** Several matrix standards and guidelines would contribute to the retention of the structurally complex forest within the harvest land base under the No Action Alternative:
  - the retention of late-successional forests in landscape areas where little late-successional forest persists (15% rule);
  - the maintenance of 25 to 30% of each connectivity/diversity block in late-successional forest;
  - the management of connectivity/diversity blocks on a 150-year area control rotation; and
  - a 120-year minimum regeneration harvest age in the Southern General Forest Management Area (Medford RMP, 72-74).

  The 120-year minimum regeneration harvest age in the Southern General Forest Management Area would contribute to the retention of the structurally complex forest because some forests (7,700 acres in 2006) in the Medford District were identified in the inventory as less than 120 years old, but were classified as structurally complex forest. The green tree retention requirements in regeneration harvesting in the Southern General Forest Management Area would result in harvested stands developing back into structurally complex forests in less than 120 years on some sites, which would result in the retention of the structurally complex forest.

More than any other alternative, the No Action Alternative would increase the size and connectivity of mature&structurally complex forest patches compared to the current condition, which would move the spatial patterns in the direction of historic conditions. See *Figure 151 (Change in the mean patch size from the current condition to 2106 by forest structural stage on the BLM-administered lands)* later in this section.
The No Action Alternative is the only alternative that would increase the size and connectivity of the mature&structurally complex forest patches in the Western Cascades and Klamath provinces. None of the alternatives would increase the size and connectivity of the mature&structurally complex forest patches in the Eastern Cascades province.

Figure 144. The influence of legacy retention on future stand development

No Action Alternative and Alternative 3
100-year old stand developed
with structural legacies
(structurally complex forest)

Alternatives 1 and 2
100-year old stand developed
without structural legacies
(mature with single canopy forest)

Under Alternative 1, the overall change in the abundance of the forest structural stages would be similar to the No Action Alternative, in part because the large acreage in the late-successional management areas would be coincident with the mapped late-successional reserves of the No Action Alternative. However, the shift in the forest structural stage abundances would not be as pronounced as under the No Action Alternative, because the total of the riparian management areas would be smaller than the riparian reserves of the No Action Alternative, the absence of green tree retention would slow the redevelopment of the structurally complex forests, and the regeneration harvest rate would be higher in the harvest land base.

Alternative 1 would increase the size and connectivity of the mature&structurally complex forest patches in the Coast Range province compared to the current condition, but less so than under the No Action Alternative. See *Figure 151 (Change in the mean patch size from the current condition by 2106 by forest structural stage on the BLM-administered lands)*. In all other provinces, Alternative 1 would decrease the size and connectivity of the mature&structurally complex forest patches compared to the current condition. Under Alternative 1, the BLM-administered lands would become strongly dichotomous, with the nonharvest land base being dominated by mature& and structurally complex forests and the harvest land base dominated by forests in the stand establishment without structural legacies and young without structural legacies forests. The edges between the harvest land base and nonharvest land base would be abrupt: the adjacent forests would contrast highly in their structure. Strongly dichotomous landscape patterns with abrupt edges would be inconsistent with modeled historic conditions for western Oregon (Nonaka and Spies 2005; Wimberly et al. 2000), and some research has suggested that such a dichotomous landscape would pose a risk to species and ecological processes (Spies 2006; Cissel et al. 1999; Forman 1995). However, little empirical research is available to evaluate the effects of a strongly dichotomous landscape pattern on most species and ecological processes.

In Alternative 2, the overall change in the abundance of the forest structural stages would also be similar to the No Action Alternative. However, the shift in structural stage abundances would be less pronounced than under Alternative 1, because the late-successional management areas and the riparian management area would be smaller than under Alternative 1. Similar to Alternative 1, the regeneration harvest rate under Alternative 2 would be higher in the harvest land base than under the No Action Alternative, and the absence of green tree retention would slow the redevelopment of the structurally complex forests under Alternative 2 compared to the No Action Alternative.

Alternative 2 would decrease the size of the mature&structurally complex forest patches compared to the current condition in all provinces, though less so than Alternative 3. See *Figure 151 (Change in the mean patch size from the current condition by 2106 by forest structural stage on the BLM-administered lands)*. Alternative 2 would decrease the connectivity of the mature&structurally complex forest patches in all provinces, except the Coast Range province where Alternative 2 would result in a smaller increase in connectivity than Alternative 1 or the No Action Alternative. Decreasing the size and connectivity would move the spatial pattern of the mature&structurally complex forests further away from the historic conditions. Alternative 2 would shift the spatial patterns and create a dichotomous landscape on the BLM-administered lands similar to Alternative 1.

Alternative 3 would result in the largest increase in the abundance of stand establishment forests and the smallest increase in the abundance of the structurally complex forest of all four alternatives. The development of the structural stages would be different under Alternative 3 from the other alternatives because of the relatively small acreage in the nonharvest land base. As a result, there would not be a large acreage predictably and inexorably developing into mature&structurally complex forests, as in the other alternatives. Nevertheless, Alternative 3 would have only slightly less mature&structurally complex forest by 2106 than would Alternative 1 and more than would Alternative 2. Alternative 3 would quickly redevelop mature&structurally complex forest after harvesting because of the use of partial harvesting and the retention requirements in both partial and regeneration harvesting.

Alternative 3 would decrease the size and connectivity of the mature&structurally complex forest patches in all provinces more than any other alternative, which would move the spatial pattern of the mature&structurally complex forest away from historic conditions. See *Figure 151 (Change in the mean patch size from the current condition by 2106 by forest structural stage on the BLM-administered lands)*.

The harvest intervals under Alternative 3 are designed to mimic the historic average fire return interval, which might suggest that Alternative 3 would be effective at restoring average historic conditions. However, the conclusion here that the application of the harvesting based on the average fire return interval would not restore average historic conditions in 100 years is consistent with other analyses (Nonaka and Spies 2005; Wallin et al. 1994). The current structural stage abundances and spatial patterns are the result of extensive forest management and human-caused fires in the twentieth century and is strongly inconsistent with the average historic conditions. The application of extensive

active forest management—even management mimicking natural disturbances—to the current condition would initially move forests away from the average historic conditions and likely take several centuries to return the BLM-administered lands to the average historic conditions.

The No Action Alternative and Alternative 3 would transform the stand establishment forests on the BLM-administered lands to a structural condition more like naturally-created early-successional forests than the current condition or Alternatives 1 or 2. See *Figure 145 (Stand establishment forests with and without structural legacies by alternative) and Figure 146 (Young forests with and without structural legacies by alternative)*. Under the No Action Alternative and Alternative 3, the stand establishment forests would quickly and completely shift to dominance by stand establishment with structural legacies. This shift would occur because the current stand establishment without structural legacy forests would develop into young forests, and would be replaced by new stand establishment with structural legacy forests because of the green tree retention when regeneration harvesting under the No Action Alternative and Alternative 3.

Alternatives 1 and 2 would create stand establishment forests that would lack the structural complexity of naturally-created early-successional forests. stand establishment with structural legacy forests would almost completely disappear because of the absence of green tree retention when regeneration harvesting. Alternative 2 would create a very small acreage of stand establishment with structural legacy when regeneration harvesting within riparian management areas along intermittent non-fish-bearing streams that are not prone to debris flows and in the management area adjacent to the Coquille Forest, where green tree retention is required.

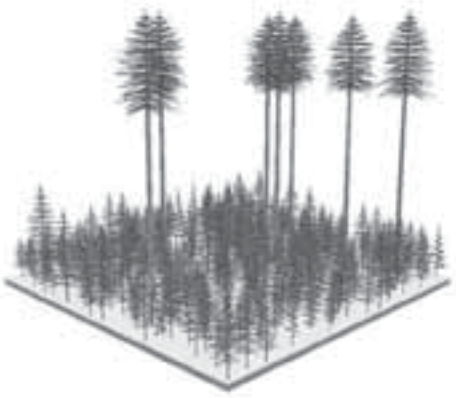
In 100 years, the abundance of stand establishment forest on the BLM-administered lands would be slightly above the average historic conditions under the No Action Alternative, and well above the average historic conditions under the three action alternatives.

The abundance of young forests would drastically decline under all four alternatives. The No Action Alternative and Alternative 3 would slowly shift the remaining young forests to an eventual dominance by young with structural legacy forests. This shift would occur because young forests without structural legacies would develop into mature forests over time and would be replaced by young forests with structural legacies because of the continuous new supply of stand establishment forests with structural legacies under the No Action Alternative and Alternative 3.

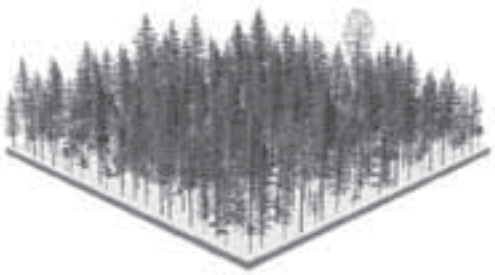
Alternatives 1 and 2 would increase the proportion of young without structural legacy forests, because almost all new young forests would develop from stand establishment without structural legacy forests.

In 100 years, the abundance of young forests on the BLM-administered lands would be slightly below the average historic conditions under the No Action Alternative and Alternative 3; equal to the average historic conditions under Alternative 1, and slightly above the average historic conditions under Alternative 2.

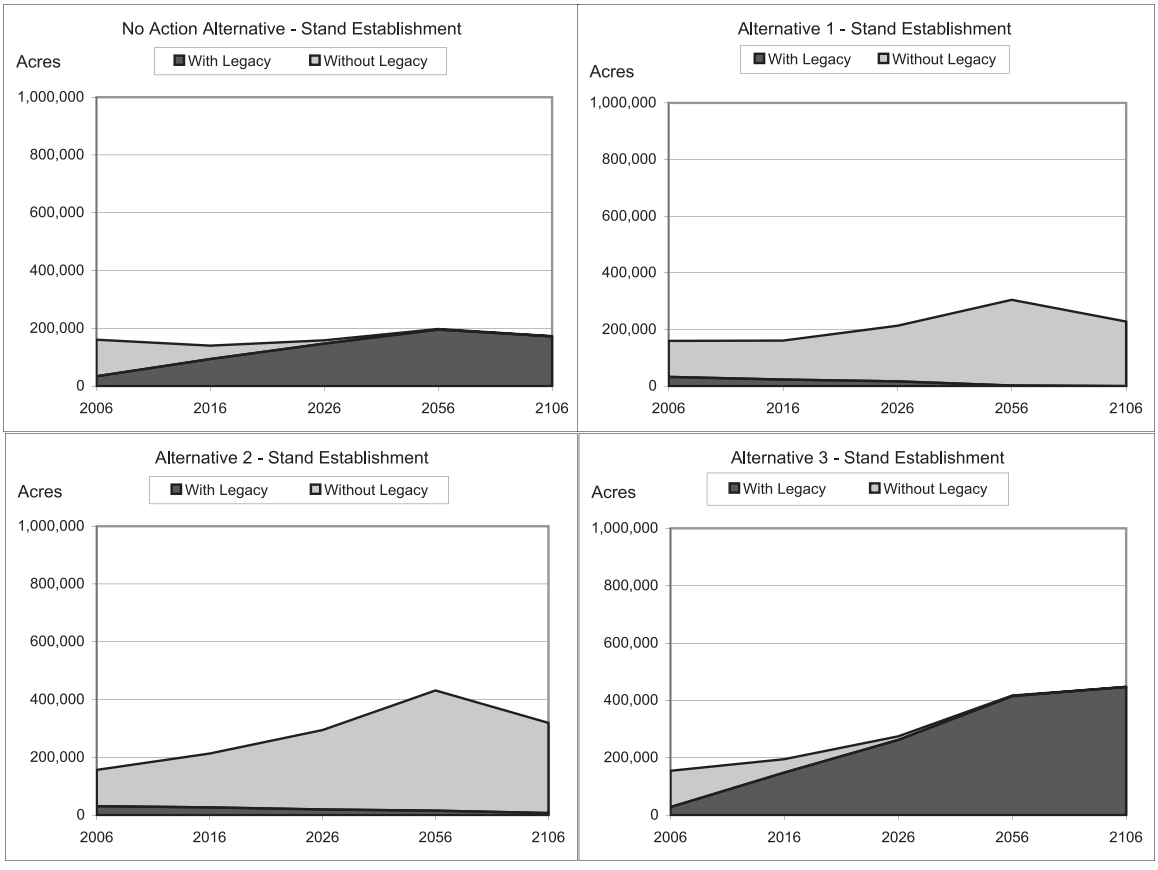
Figure 145. Stand establishment forests with and without structural legacies (e.g., retained green trees) by alternative[2]



Stand Establishment
with Structural Legacy

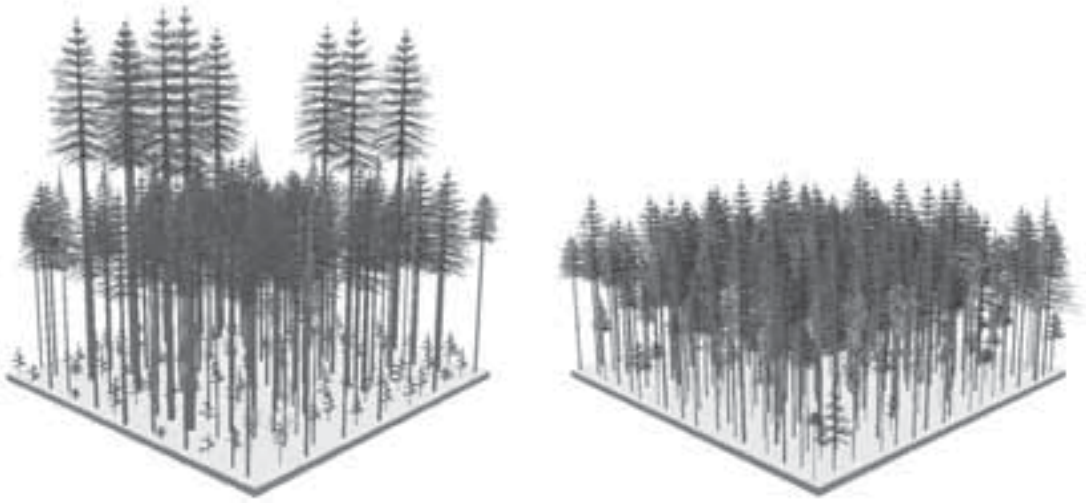


Stand Establishment
without Structural Legacy



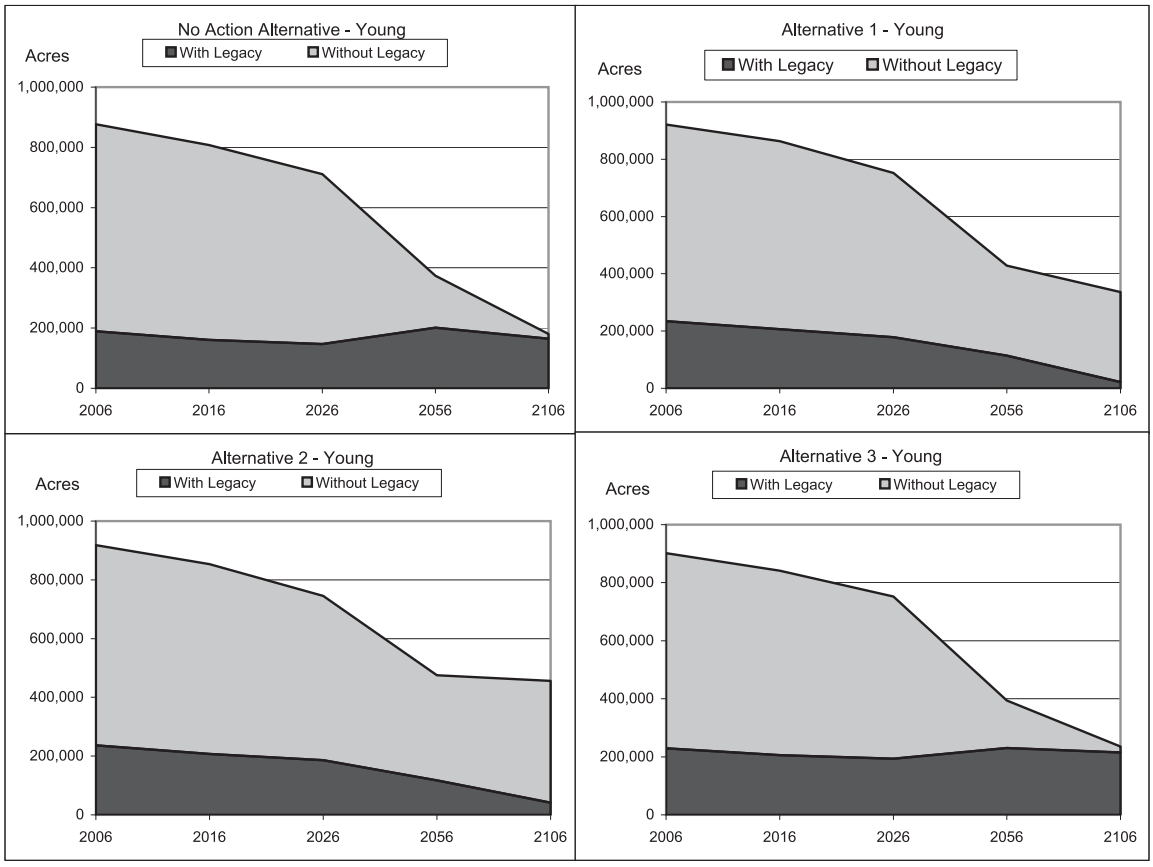
[2] This picture displays stand conditions that would develop following regeneration harvesting in No Action (general forest management area) or Alternative 3 (western hemlock retention levels). Partial harvesting under Alternative 3 would also create stand establishment with structural legacy forests, but with more overstory trees than shown here.

Figure 146. Young forests with and without structural legacies (e.g., retained green trees) by alternative[3]



Young
with Structural Legacy

Young
without Structural Legacy

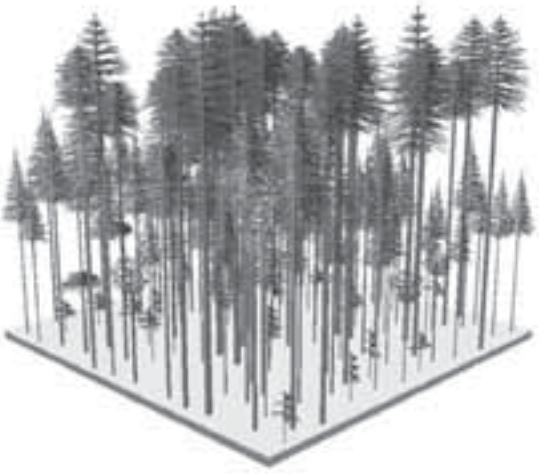


[3] This picture displays stand conditions that would develop following regeneration harvesting in No Action (general forest management area) or Alternative 3 (western hemlock retention levels). Partial harvesting under Alternative 3 would also create young with structural legacy forests, but with more overstory trees than shown here.

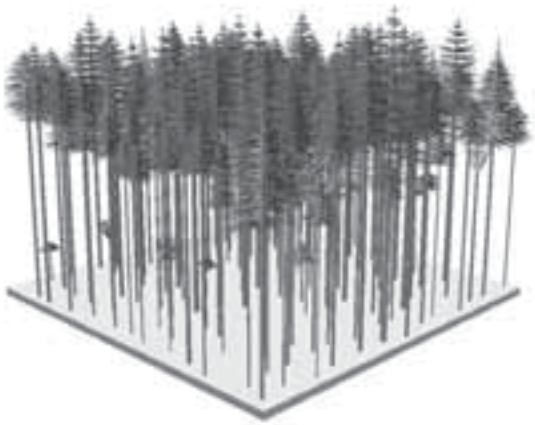
The overall abundance of mature forests would be more consistent among the alternatives than other structural stages. See *Figure 147 (Mature forest with multilayered canopies or single canopies by alternative)*. All four alternatives would result in an overall increase in the abundance of mature forests over the next 50 years (as young forests develop into mature forests), and then a decrease after 50 years. However, the alternatives would differ in the proportion of mature forests with multilayered canopies to mature forests with single canopies. Under the No Action Alternative and Alternative 3, mature forests with multilayered canopies would predominate, because of the eventual influence of green tree retention in timber harvests. Under Alternatives 1 and 2, which have no green tree retention, mature with Single Canopy forest would predominate. The influence of timber harvesting and green tree retention on mature forests is further demonstrated by the benchmark analysis of the no harvesting reference analysis, under which mature forests with single canopies would predominate (similar to Alternatives 1 and 2). The benchmark analysis of the reference analysis for intensive management on most commercial timber lands, which would have no green tree retention, would have the most extreme outcome. There would be 80% of all mature forests that would be mature with single canopies in 100 years.

In 100 years, the amount of mature forests on the BLM-administered lands would be above the average historic conditions under all four alternatives.

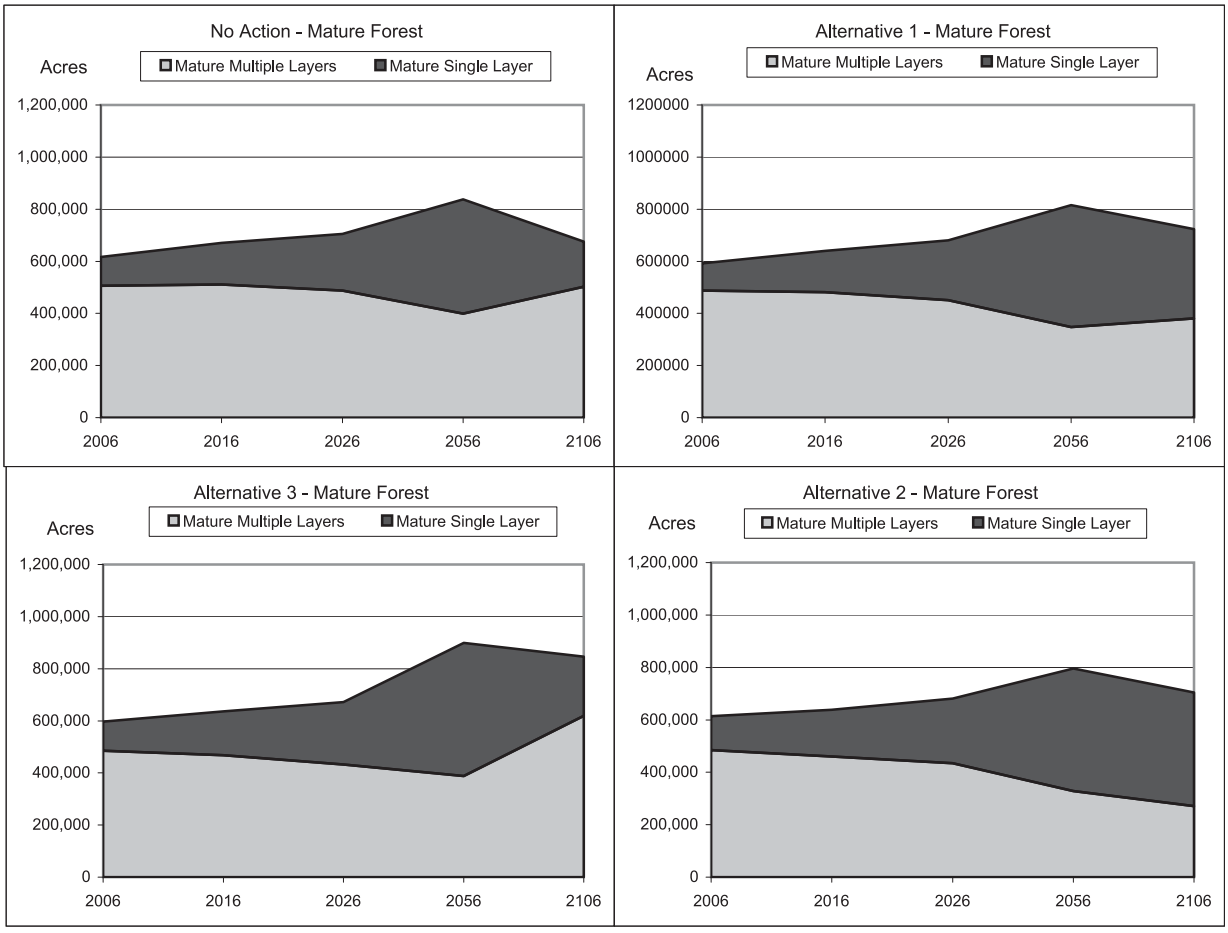
Figure 147. Mature forest with multilayered canopies or single canopies by alternative



Mature
with Multilayered Canopy



Mature
with Single Canopy



Under all four alternatives, the abundance of the structurally complex forests results from the retention of existing structurally complex forests coupled with the future development of additional structurally complex forests. However, the alternatives vary in both the amount of the existing structurally complex forest that is retained and how much additional structurally complex forest develops. Under all four alternatives, the additional structurally complex forest that would develop would initially be at the lower end of forest structural conditions that meet the definition of structurally complex forests, which is generally consistent with the pattern for the implementation of the No Action Alternative for the past decade (Moeur et al. 2005, 100).

The No Action Alternative would result in the largest increase in the abundance of the structurally complex forests of all four alternatives. The No Action Alternative would harvest less existing old forest than any other alternative, because the No Action Alternative has the smallest amount of existing old forest in the harvest land base of all four alternatives, and would harvest the lowest percentage of existing old forest in the harvest land base of all four alternatives. See *Table 151 (Outcome of existing old forest by 2106 by alternative)*. The harvest of existing old forest under the No Action Alternative would be offset by the development of far more additional structurally complex forest. The overall function of the structurally complex forests would improve under the No Action Alternative, because:

- the majority of existing old forest (86%) would remain unharvested and would continue to develop into older structurally complex forests;
- an even greater percentage (90%) of the oldest of these forests (existing very old forest) would remain unharvested and continue to develop;
- approximately 15 times the acreage of existing old forest that would be harvested would develop into new structurally complex forest by 2106; and
- the size and connectivity of the mature&structurally complex forest patches would increase from the current condition in all provinces, except Eastern Cascades. See the *Ecological Conditions on the BLM-administered Lands at the Province Scale* section later in the *Ecology* section of this chapter.

Alternative 1 would increase the abundance of the structurally complex forests more than Alternatives 2 or 3 but less than the No Action Alternative. Under Alternative 1, the structurally complex forests would be almost entirely restricted to the nonharvest land base in 100 years. Alternative 1 would harvest more existing old forest than the No Action Alternative, but less than Alternatives 2 and 3. See *Table 151 (Outcome of existing old forest by 2106 by alternative)*. The harvesting of 88,800 acres of existing old forest under Alternative 1 would be offset by the development of additional structurally complex forest for a net increase of 370,000 acres by 2106. The overall function of the structurally complex forests would improve under Alternative 1 (though less so than the No Action Alternative) because:

- the majority of existing old forest (75%) would remain unharvested and would continue to develop into older structurally complex forests;

- an even greater percentage (90%) of the oldest of these forests (existing very old forest) would remain unharvested and continue to develop;
- approximately six times the acreage of existing old forest that would be harvested would develop into new structurally complex forest by 2106; and
- the size and connectivity of the mature&structurally complex forest patches would increase from the current condition in the Coast Range province. Size and connectivity would decrease in other provinces, but less than under the other action alternatives. See the *Ecological Conditions on the BLM-administered Lands at the Province Scale* section later in the *Ecology* section of this chapter.

Under Alternative 2, the abundance of the structurally complex forests would slightly decrease in the first 50 years and eventually increase in abundance in 100 years. As under Alternative 1, the structurally complex forests would be almost entirely restricted to the nonharvest land base in 100 years. Alternative 2 would harvest more existing old forest than the No Action Alternative or Alternative 1, but less than Alternative 3. See *Table 151 (Outcome of existing old forest by 2106 by alternative)*. Of the existing old forest, 57% would be allocated to the nonharvest land base (compared to 83% for the No Action Alternative, 74% for Alternative 1, and 52% for Alternative 3). The harvesting of 152,400 acres of existing old forest under Alternative 1 would be offset by the development of additional structurally complex forest and the abundance of the structurally complex forest would remain almost constant for the first 50 years with an eventual net increase of 210,100 acres by 2106. The overall function of the structurally complex forests would increase in some aspects under Alternative 2 (though less so than the No Action Alternative and Alternative 1), and decrease in other aspects because:

- the majority of existing old forest (57%) would remain unharvested and would continue to develop into older structurally complex forests;
- a greater percentage (76%) of the oldest of these forests (existing very old forest, which are the stands that are 400 years or older in the current inventory) would remain unharvested and continue to develop;
- slightly more acres of the existing old forest that would be harvested would develop into new structurally complex forest by 2106; and
- the size of the mature&structurally complex forest patches would decrease from the current condition in all provinces, and the connectivity of the mature&structurally complex forests would decrease in all provinces, except the Coast Range province. See the *Ecological Conditions on the BLM-administered Lands at the Province Scale* section later in the *Ecology* section of this chapter.

Alternative 3 would result in the lowest acreage of the structurally complex forests of any alternative. Under Alternative 3, the amount of the structurally complex forests would decrease slightly over the first 50 years, and then eventually increase slightly from current levels. The harvesting of the structurally complex forests (including partial harvesting) would be roughly balanced by the development of additional structurally complex forest, which would result in a fluctuating total abundance over time. Alternative 3 would harvest more of the existing old forest than any other alternative. See *Table 151 (Outcome of existing old forest by 2106 by alternative)*. Alternative 3 would allocate the largest amount of the existing old forest to the harvest land base of any alternative. The harvesting of 220,000 acres of existing old forest under Alternative 3 would be offset by the development of additional structurally complex forest, but less so than other alternatives with a net increase of 122,000 acres by 2106. The overall function of the structurally complex forests would decrease from the current condition under Alternative 3, because:

- the majority of existing old forest (63%) would be harvested within 100 years;
- the majority (68%) of the oldest of these forests (existing very old forest, which are stands that are 400 years or older in the current inventory) would be harvested within 100 years;
- the total abundance of the structurally complex forest would decline slightly for the first 50 years; and
- the size and connectivity of the mature&structurally complex forest patches would decrease from the current condition in all provinces. See the *Ecological Conditions on the BLM-administered Lands at the Province Scale* section later in the *Ecology* section of this chapter.

In 100 years, the amount of the structurally complex forest on the BLM-administered lands would be approximately equal to the average historic condition under the No Action Alternative, and below the average historic condition under the three action alternatives.

Table 151. Outcome of existing old forest by 2106 by alternative

	All Land Use Allocations (% of Existing Old Forest harvested)	Harvest Land Base only (% of Existing Old Forest harvested)
No Action	48,700 acres (14%)	(83%)
Alternative 1	88,800 acres (25%)	(96%)
Alternative 2	152,400 acres (43%)	(100%)
Alternative 3	220,000 acres (63%)	(91%)
	unharvested harvested	

Note: The harvest Land Base graphs are sized approximately to reflect total acreage.

There is inadequate information to quantify the abundance of hardwood stands. See the *Ecology* section in *Chapter 3*. Furthermore, there is inadequate information about hardwood stand development, especially red alder stands, to model future stand development and transition to mixed or conifer-dominated stands. Some researchers have hypothesized that riparian red alder stands might develop into shrub-dominated areas (especially salmonberry) where conifer tree regeneration is absent (Deal 2006; Harrington 2006; Hibbs and Bower 2001). Empirical evidence for this successional pathway is generally lacking, and this successional development is most likely possible only for small patches rather than entire stands. The likely successional pathway for red alder stands in the Coast Range is to eventually develop into mixed or conifer-dominated stands (western hemlock, western red-cedar, and Douglas fir). This development into conifer stands would be accelerated where hardwood conversion actions would be implemented, but the rate of this successional development is unknown. Therefore, it is most likely that the riparian and upland hardwood stands would develop into mixed or conifer-dominated stands, except:

- where natural disturbances maintain hardwoods,
- where special management in special habitats outside of the harvest land base would be applied to maintain hardwoods, or
- where site conditions preclude succession to a conifer forest.

As a result, hardwood forest abundance would decline under all four alternatives. In addition, none of the alternatives would create additional hardwood stands because of the limited disturbance of the nonharvest land base and the intensive silvicultural practices to reestablish conifers following disturbances in the harvest land base.

Ecological Conditions on the BLM-Administered Lands by Land Use Allocation

Harvest Land Base

In the harvest land base under all four alternatives, the abundance of stand establishment forests and mature forests would increase, and the abundance of young forests and structurally complex forests would decrease. The No Action Alternative and Alternative 3 would maintain 14% of the harvest land base in structurally complex forests in 100 years (compared to the current condition of 19%). Alternatives 1 and 2 would nearly eliminate the structurally complex forests in the harvest land base (compared to the current condition of 2% and 1%, respectively).

The combined abundance of the mature&structurally complex forests in the harvest land base would stay approximately constant under the No Action Alternative, decrease under Alternatives 1 and 2, and increase under Alternative 3. The analysis of terrestrial habitats in the Northwest Forest Plan FSEIS, on which the current RMPs of the No Action Alternative relied, analyzed

the abundance and connectivity of late-successional and old-growth forests (which approximates mature&structurally complex forests in this analysis) based on the abundance and future development of forests in the nonharvest land base (FSEIS, 3&4:39-43, 3&4:238-241). That previous analysis did not account for the retention or development of late-successional and old-growth forests in the harvest land base. Nevertheless, the mature&structurally complex forest together would continue to constitute approximately half of the acres (289,000 acres) within the harvest land base over the next 100 years under the No Action Alternative. See *Figure 148 (Structural stage abundances on the forested lands in the harvest land base by alternative).*

Alternatives 1 and 2 would result in a larger increase in the stand establishment forests and a larger decrease in the structurally complex forests in the harvest land base than the No Action Alternative because of:

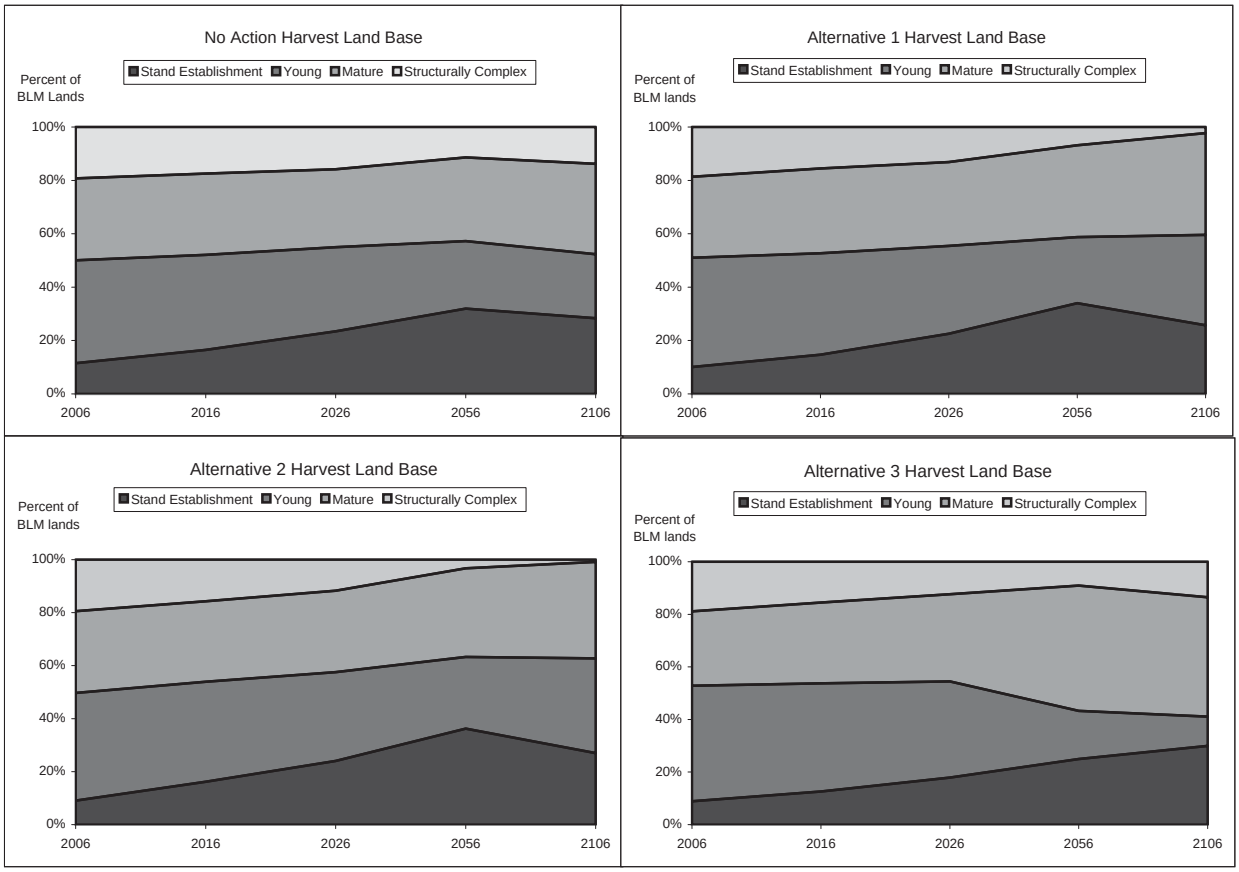
- **the higher regeneration harvest rate in the harvest land base than under the No Action Alternative.** Alternatives 1 and 2 do not have any of the standards and guidelines of the No Action Alternative that would constrain the harvesting of the structurally complex forests in the harvest land base.
- **the absence of green tree retention, which would slow the development of the structurally complex forests after harvesting.** Without green tree retention, stands would take almost twice as long to develop into structurally complex forest after regeneration harvesting.

These two factors would interact to decrease the abundance of the structurally complex forest in the harvest land base. The higher regeneration harvest rate combined with the slower development into structurally complex forests would increase the likelihood that a stand would be harvested before it would have time to develop into structurally complex forest. As a result, structurally complex forest would be almost eliminated from the harvest land base by 2106, even though the total acreage of the structurally complex forests across all land use allocations would increase under Alternatives 1 and 2.

The harvest land base under Alternative 3 would have the most stand establishment forest, the least young forest, and the most mature forest of any alternative. Alternative 3 would maintain the abundance of the structurally complex forest in the harvest land base similar to the No Action Alternative, even though Alternative 3 would harvest the most existing old forest of any alternative.

This analysis does not include estimates of future natural disturbances, but most natural disturbances in the harvest land base would have little effect on the abundance of the structural stages described here. Except in the most severe and extensive disturbances, salvaging of naturally disturbed stands would result in the same eventual effect on the overall structural stage abundances in the harvest land base as scheduled timber harvesting under all four alternatives.

Figure 148. Structural stage abundances on the forested lands in the harvest land base by alternative

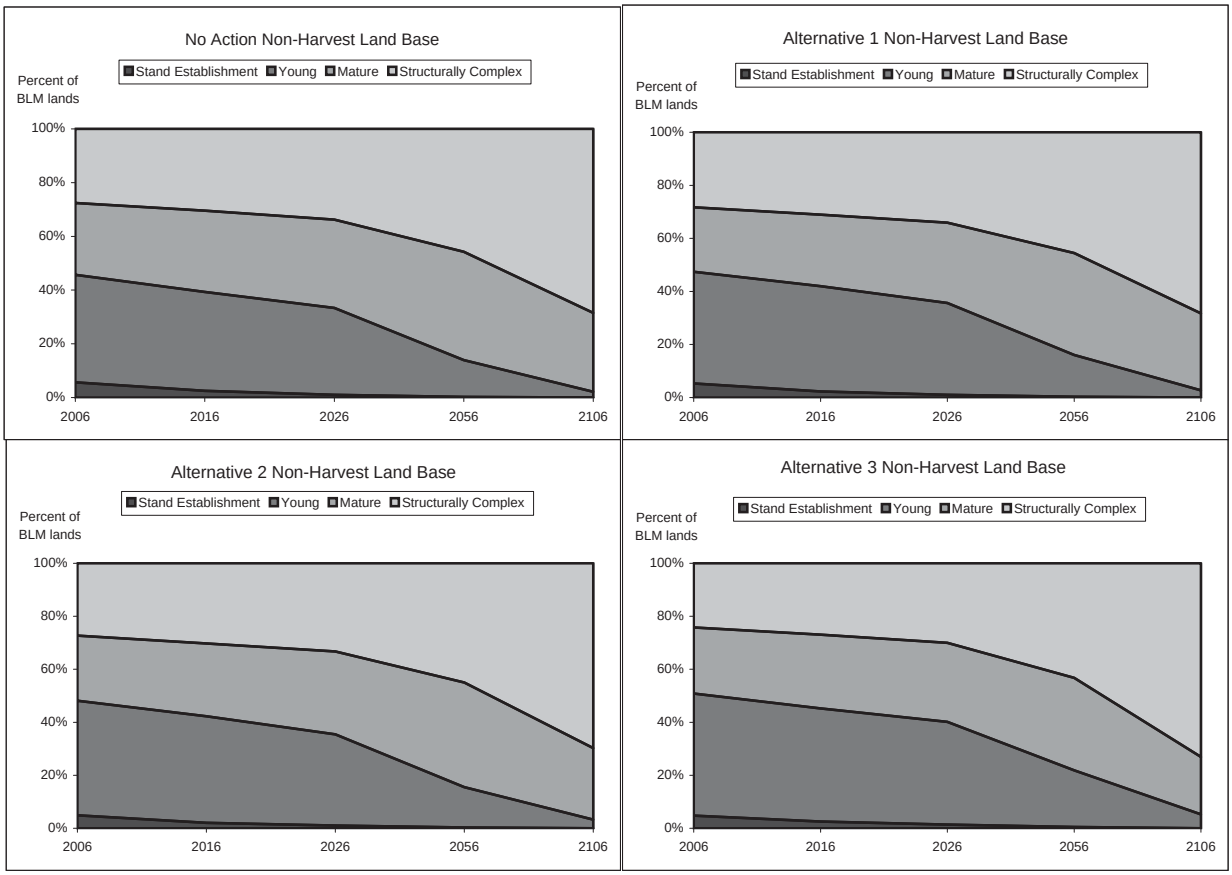


Nonharvest Land Base

The structural stage development within the nonharvest land base would be similar among all four alternatives, although the total acreage in the nonharvest land base would vary. The forest-capable portion of the nonharvest land base would become almost completely dominated by mature and structurally complex forest in 100 years. See *Figure 149 (Structural stage abundances on the forested lands in the nonharvest land base by alternative)*.

This analysis does not include estimates of future natural disturbances, but natural disturbances would increase the amount of stand establishment and young forests from the abundances described here. The Northwest Forest Plan FSEIS assumed that 2.5% of the late-successional forests in the late-successional reserves would be lost to wildfire each decade (NWFP FSEIS, 3&4:42). The rate of disturbance would likely be much lower on the BLM-administered lands because of the land ownership pattern and greater access for fire suppression.

Figure 149. Structural stage abundances on the forested lands in the nonharvest land base by alternative



Ecological Conditions on the BLM-Administered Lands at the Province Scale

The effects of the alternatives on the structural stage abundances and spatial patterns in the Coast Range, Western Cascades, and Klamath provinces generally reflect the structural stage abundances and spatial patterns described for the planning area as a whole. The effects of the alternatives in the Eastern Cascades province differs from the other provinces in many measures of the structural stage abundance and spatial pattern, in part because of the differing ecological conditions and management history. However, these different patterns have little effect on the overall pattern for the planning area, because the Eastern Cascades province makes up only 2% of the BLM-administered forest lands modeled within the planning area.

See *Figure 150*, *Figure 151*, and *Figure 152* on the next several pages.

Figure 150. Comparison of the structural stage abundances on the BLM-administered forested lands by 2106 with the current conditions and the average historic conditions by alternative by province

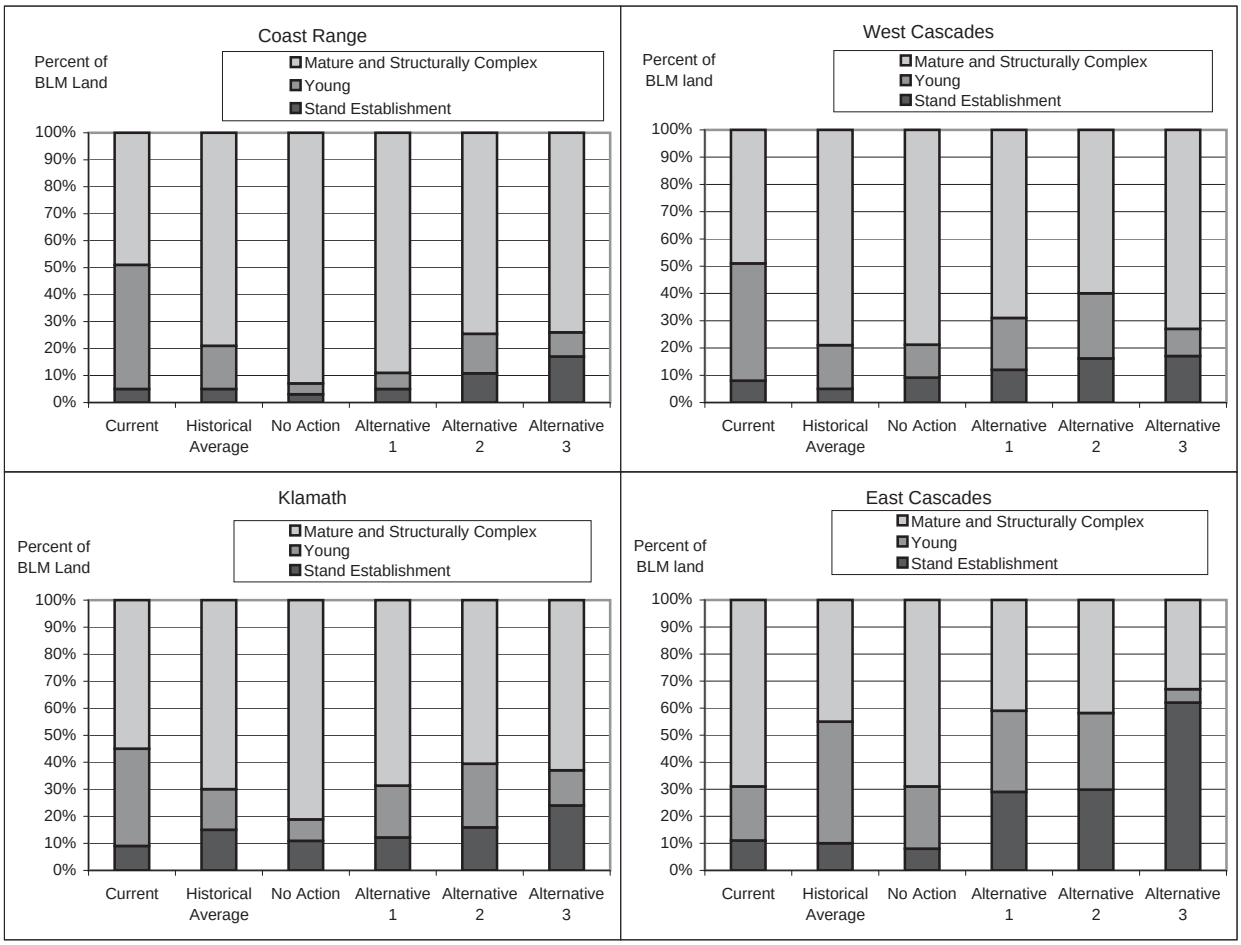


Figure 151. Change in the mean patch size from the current condition by 2106 by forest structural stage on the BLM-administered lands

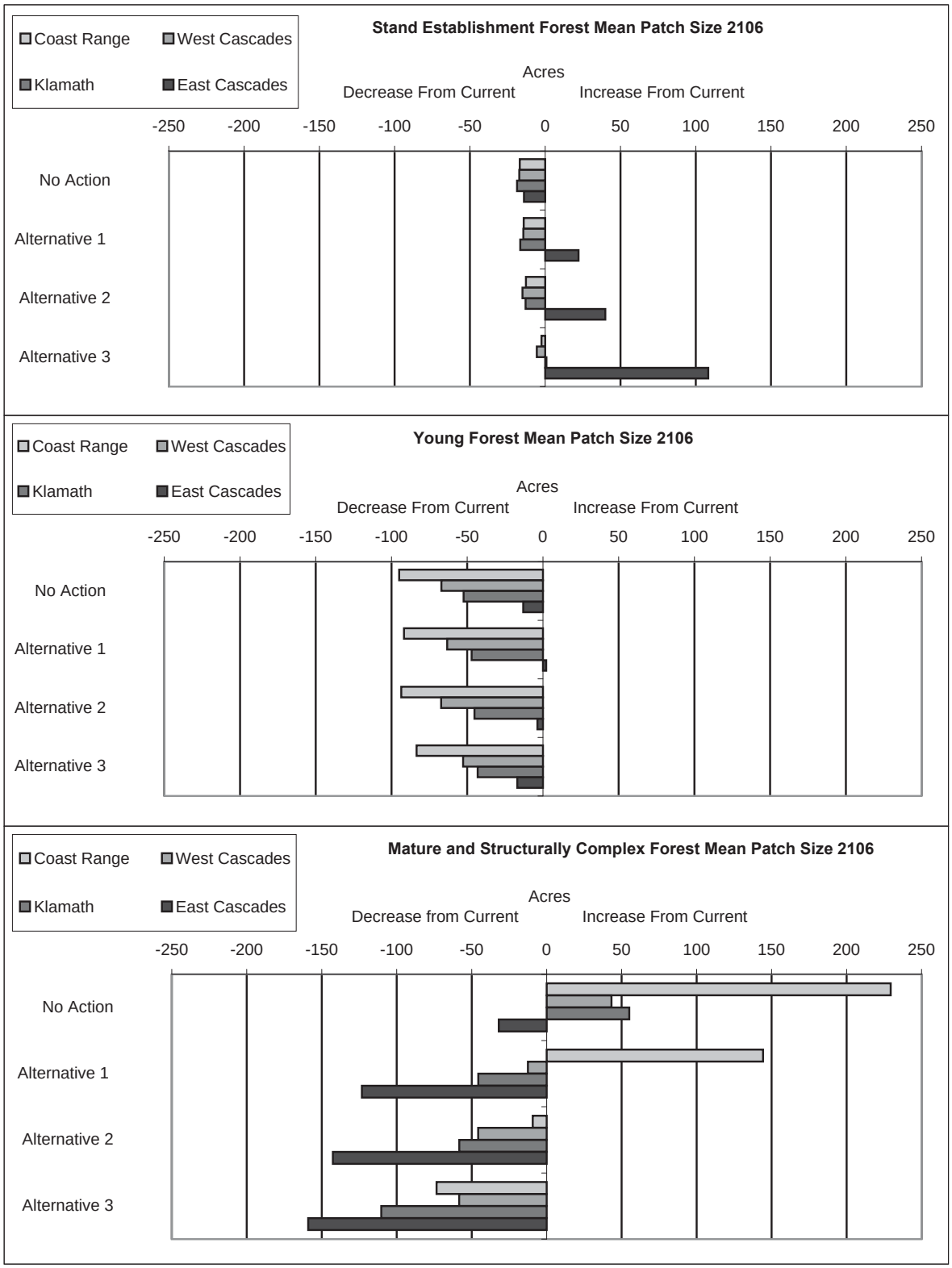
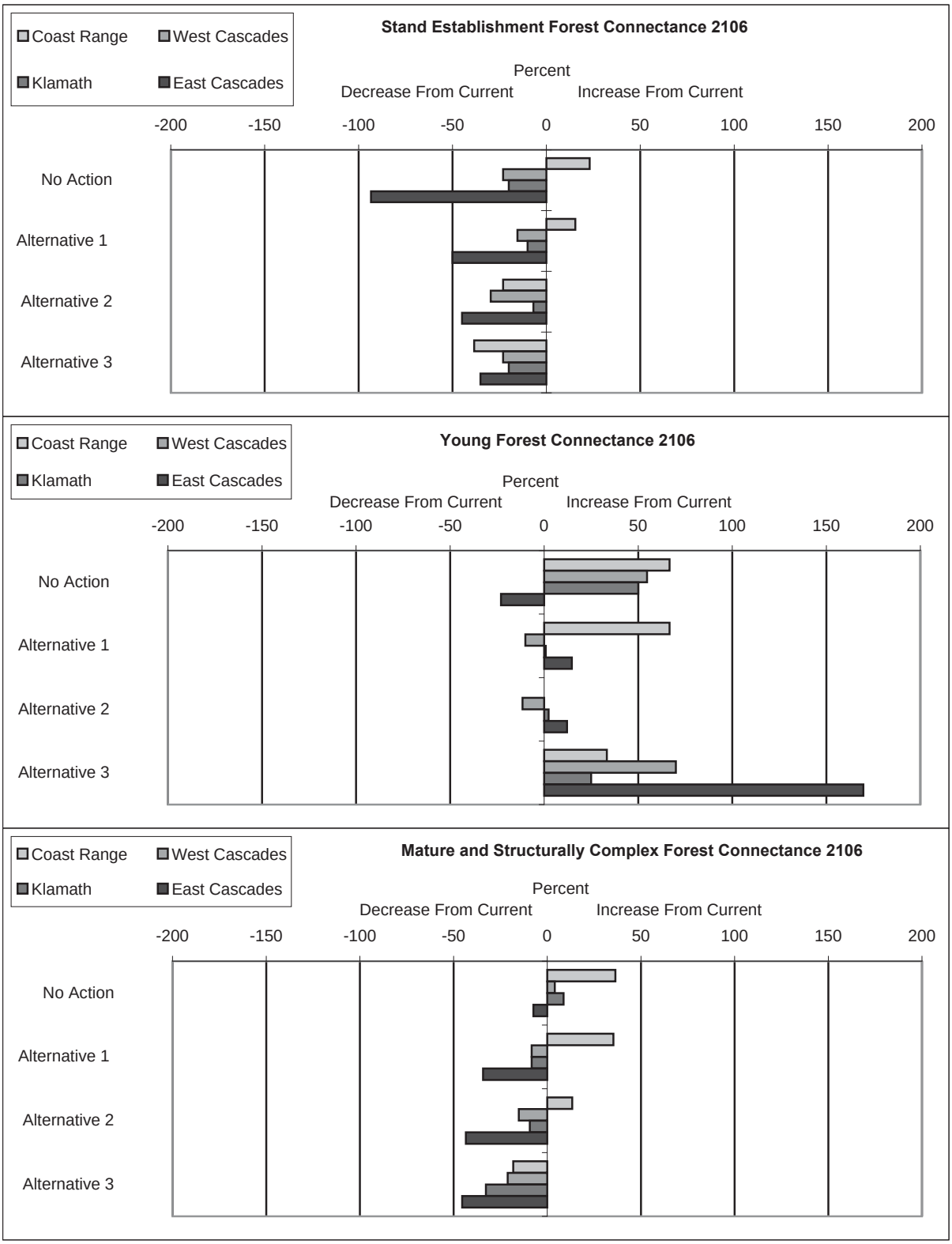


Figure 152. Change in the connectance from the current condition by 2106 by forest structural stage on the BLM-administered lands



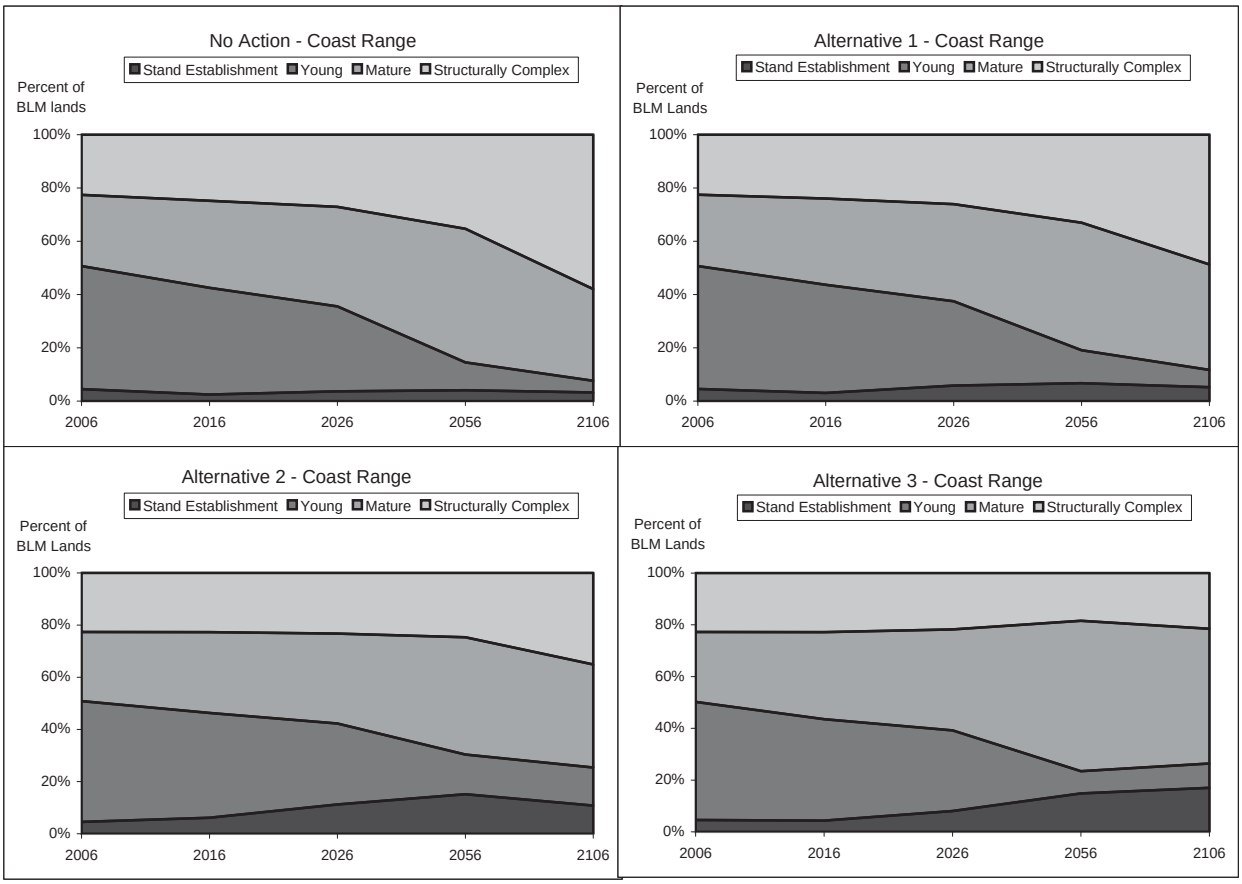
Coast Range Province

Under all four alternatives, the young forests would decrease and the mature forests would increase in abundance in the Coast Range province. See *Figure 153 (Structural stage abundances on the BLM-administered forested lands in the Coast Range province by alternative).* In the No Action Alternative and Alternative 1, the stand establishment forests would remain approximately constant in abundance and the structurally complex forests would steadily increase to become the most abundant structural stage because of the predominance of the nonharvest land base in the Coast Range. Under the No Action Alternative and Alternative 1, very little of the existing old forest (less than 10% in 100 years) would be harvested in the Coast Range province. Alternative 2 would allocate a larger harvest land base in the Coast Range province than the No Action Alternative or Alternative 1, and consequently would increase the abundance of the stand establishment forests and maintain the abundance of the structurally complex forests approximately constant for the first 50 years. Alternative 3 would allocate an even larger harvest land base in the Coast Range province than Alternative 2, and consequently would increase the abundance of the stand establishment forests more than any other alternative and would slightly decrease the abundance of the structurally complex forests. Alternative 3 would harvest the majority of the existing old forest (69% in 100 years) in the Coast Range province.

In 100 years, the No Action Alternative and Alternative 1 would result in less young forest and more mature&structurally complex forest than the average historic condition[4]. See *Figure 150 (Comparison of the structural stage abundances on the BLM-administered forested lands by 2106 with the current conditions and the average historic conditions by alternative by province).* Alternative 2 would result in a structural stage abundance that is approximately similar to the average historic condition in the Coast Range province in 100 years with slightly more stand establishment forest and slightly less mature&structurally complex forest. Alternative 3 would result in more stand establishment forest, less young forest, and slightly less mature&structurally complex forest than the average historic condition in the Coast Range province in 100 years.

[4] Note that for this analysis, the mature and structurally complex forests are combined because of the limitations in the description of the average historic conditions.

Figure 153. Structural stage abundances on the BLM-administered forested lands in the Coast Range province by alternative



All four alternatives would result in smaller patches of stand establishment forest and young forest in the Coast Range province as shown in *Figure 151.* The No Action Alternative would result in the most decrease in the size of stand establishment patches, and Alternative 3 would result in the least decrease, which is consistent with the changes in the overall structural stage abundances. All four alternatives would result in mean patch size of stand establishment and young forests that would be far below the average historic condition. Although a direct comparison of these results is problematic (see the *Ecology* section in *Chapter 3*), Nonaka and Spies (2005) reported historic mean patch sizes of stand establishment forest and young forest ranging from 183 to 264 acres, which is 10 to 20 times larger than the alternatives.

The No Action Alternative and Alternative 1 would increase the size and connectivity of the mature&structurally complex forest patches on the BLM-administered lands over the next 100 years in the Coast Range province. See *Figure 151* and *Figure 152.* Over the next 100 years, the No Action Alternative and Alternative 1 would create larger patches of mature&structurally complex forest with more interior habitat than the current condition (see *Appendix B-Ecology*). Alternative 2 would slightly decrease the size of the

mature&structurally complex forest patches and increase the connectivity from the current condition in the Coast Range province. Alternative 3 would decrease both the size and connectivity of the mature&structurally complex forest patches. Alternative 3 would move the spatial pattern of the mature&structurally complex forest further away from the historic conditions, which is consistent with the research that concluded that the restoration of historic wildfire would move the Coast Range province further away from the historic range of variability over the next 100 years (Nonaka and Spies 2005).

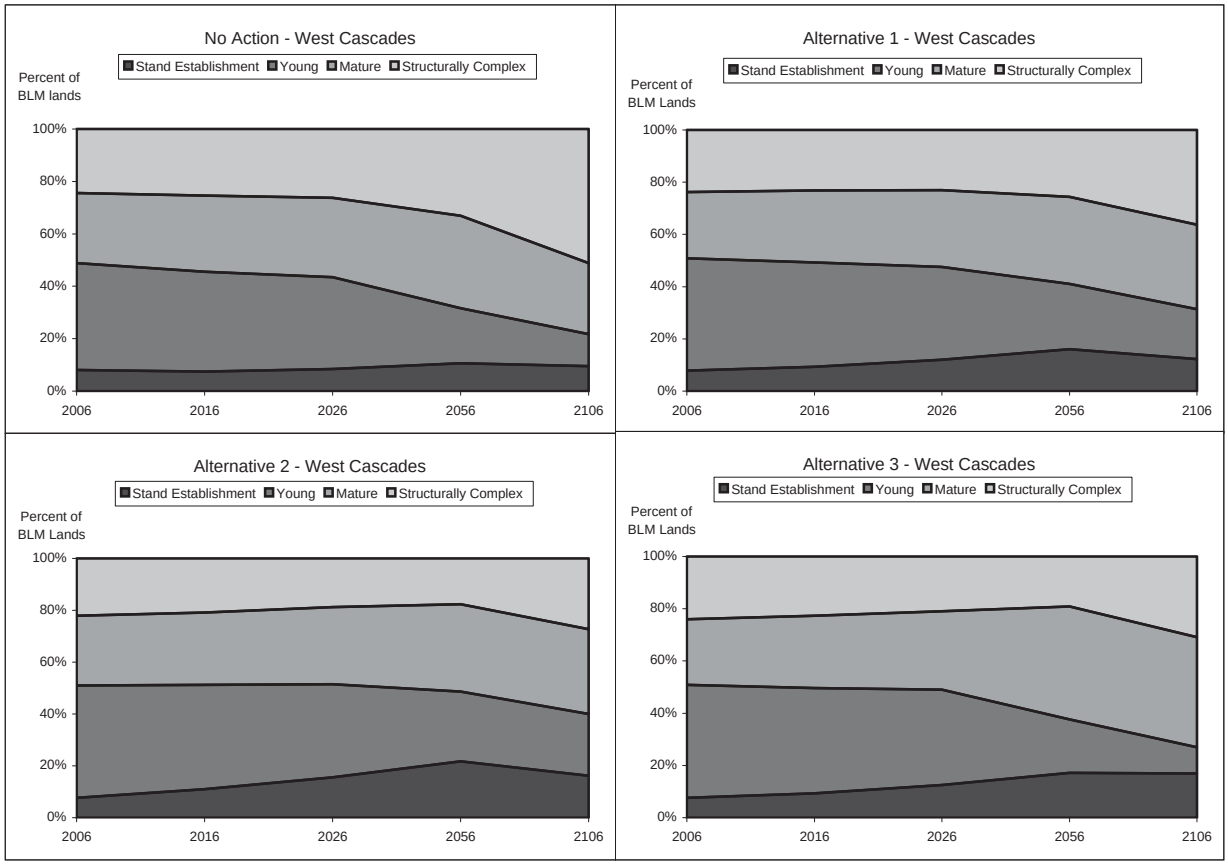
The increase in the mean patch size for the mature&structurally complex forests under the No Action Alternative and Alternative 1 would be comparable to the estimates of the average historic mature forest patch size (Nonaka and Spies 2005). In their modeling of the average historic spatial patterns in the Coast Range province, Nonaka and Spies reported the mean patch size of the mature forests as 272 acres, which is compared to a current mean patch size of 84 acres across all ownerships. From this analysis, the current mean patch size of the mature&structurally complex forest on the BLM-administered lands in the Coast Range province is currently 110.8 acres and would increase to 255.1 acres under Alternative 1 and 340.2 acres under the No Action Alternative.

Western Cascades Province

The structural stage abundance in the Western Cascades province would show the overall changes similar to the Coast Range province. See *Figure 154 (Structural stage abundances on the BLM-administered forested lands in the Western Cascades province by alternative)*. The difference among the alternatives would be less pronounced than in the Coast Range province, because the No Action Alternative and Alternative 1 would allocate a larger portion of the BLM-administered lands in the Western Cascades to the harvest land base than in the Coast Range province.

In 100 years, the No Action Alternative would result in a structural stage abundance that is approximately similar to the average historic condition in the Western Cascades with slightly more stand establishment forest and slightly less young forest. See *Figure 150 (Comparison of the structural stage abundances on the BLM-administered forested lands by 2106 with the current conditions and the average historic conditions by alternative by province)*. Alternatives 1 and 2 would result in more stand establishment forest, more young forest, and less mature&structurally complex forest than the average historic condition in the Western Cascades in 100 years. Alternative 3 would result in more stand establishment forest, less young forest, and less mature&structurally complex forest than the average historic condition in the Western Cascades in 100 years.

Figure 154. Structural stage abundances on the BLM-administered forested lands in the Western Cascades province by alternative



Most of the changes in the spatial patterns in the Western Cascades province under the alternatives would be similar to the changes in the Coast Range province, although the changes from the current condition and the differences among the alternatives would be less pronounced for all measures of spatial pattern. See *Figures 151* and *152*. The No Action Alternative is the only alternative that would increase the size and connectivity of the mature&structurally complex forest patches from the current condition in the Western Cascades province. Alternative 1 would slightly decrease the size and connectivity in the mature&structurally complex forest patches. Alternative 2 would have a larger decrease. And Alternative 3 would have the largest decrease in size and connectivity. There are no detailed studies of the historic spatial pattern in the Western Cascades province comparable to those in the Coast Range province. However, studies of fire frequency and extent suggest that the historic spatial pattern would have been larger and more connected mature&structurally complex forest patches than the current condition (Weisberg and Swanson 2003; Cissel et al. 1999). Therefore, the three action alternatives would move the spatial pattern of the mature&structurally complex forest further away from the historic conditions in the Western Cascades province.

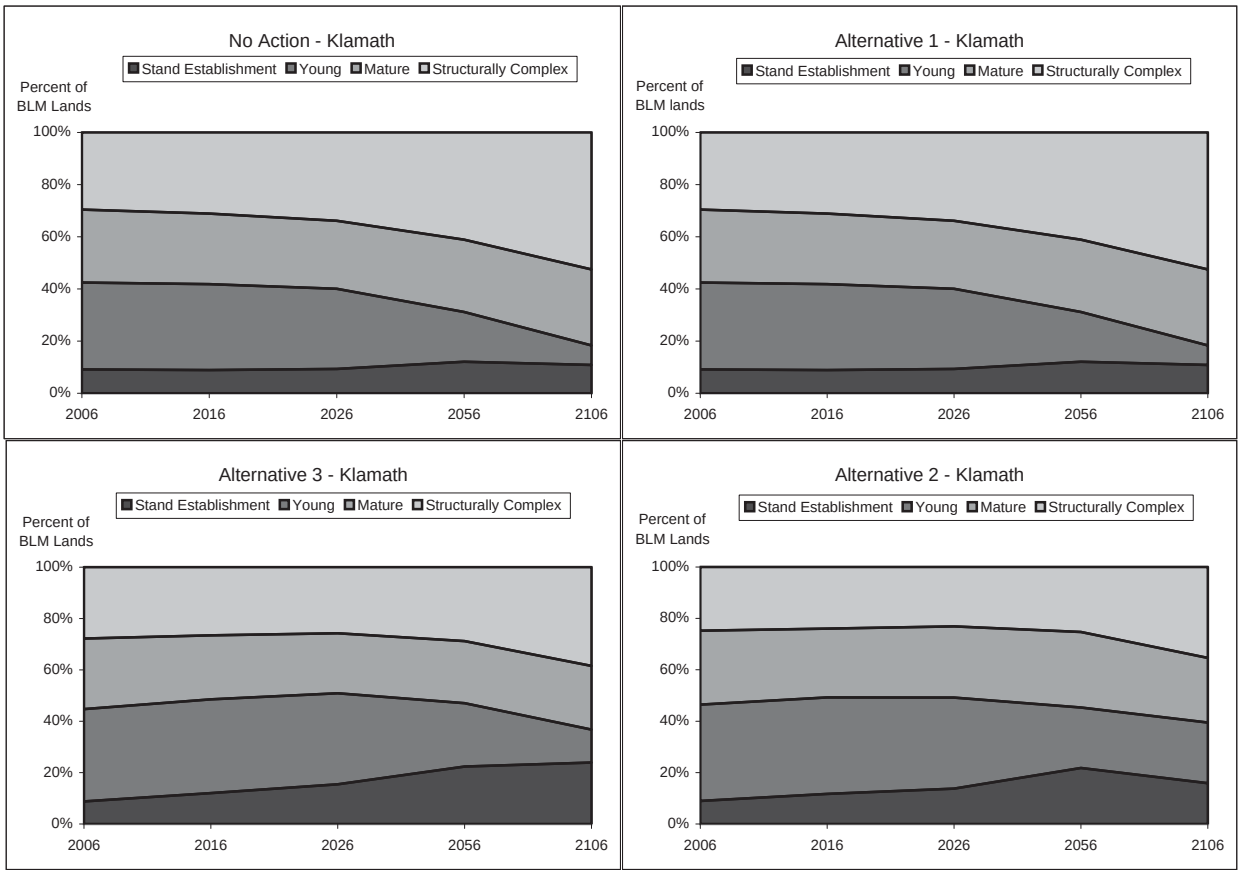
Klamath Province

The structural stage abundance in the Klamath province would show the overall changes similar to the Coast Range and Western Cascades provinces, although the mature forest would remain approximately constant in abundance under the No Action Alternative and decrease slightly under Alternative 3. See *Figure 155 (Structural stage abundances on the BLM-administered forested lands in the Klamath province by alternative)*. The difference among the alternatives in the Klamath province would be less pronounced than in the Coast Range province, because the No Action Alternative and Alternative 1 would allocate a larger portion of the Klamath province to the harvest land base than in the Coast Range province.

In 100 years, the No Action Alternative would result in less stand establishment forest, less young forest, and more mature&structurally complex forest than the average historic condition in the Klamath province. See *Figure 150 (Comparison of the structural stage abundances on the BLM-administered forested lands by 2106 with the current conditions and the average historic conditions by alternative by province)*. Alternative 1 would result in less stand establishment forest and more young forest than the average historic condition in the Klamath province in 100 years. Alternative 2 would result in more young forest and less mature&structurally complex forest than the average historic condition in the Klamath province in 100 years. Alternative 3 would result in more stand establishment forest and less mature&structurally complex forest than the average historic condition in the Klamath province in 100 years.

This analysis does not include the estimates of future natural disturbances, but natural disturbances would be more likely to alter the structural stage abundances in the nonharvest land base in the Klamath province than in the Coast Range or Western Cascades provinces. The predominant high fire frequency regime and the effects of past fire suppression increase the likelihood that wildfires would increase the amount of stand establishment and young forests in the nonharvest land base from the abundances described here. However, there remains inadequate information to estimate the acreage, location, timing, severity, and extent of such disturbances.

Figure 155. Structural stage abundances on the BLM-administered forested lands in the Klamath province by alternative



The No Action Alternative, Alternative 1, and Alternative 2 would result in more smaller patches of stand establishment and young forests in the Klamath province. See *Figure 151 (Change in the mean patch size from the current condition by 2106 by forest structural stage on the BLM-administered lands)*. Alternative 3 would create more stand establishment patches with little change in the mean patch size, which is consistent with the overall increase in the abundance of stand establishment forest. As in the Western Cascades province, the three action alternatives would decrease the size and connectivity of the mature&structurally complex forest patches compared to the current condition—Alternative 1 would result in the least decrease, and Alternative 3 would result in the most decrease. See *Figures 150* and *151*. There are no detailed studies of the historic spatial pattern in the Klamath province to compare these results to. The historic spatial patterns was likely more variable than in the Coast Range or Western Cascades provinces because of the complex interaction of highly variable geology and climate with the highly variable disturbance regimes (Taylor and Skinner 2003; Frost and Sweeney 2000).

Eastern Cascades Province

The structural stage abundances in the Eastern Cascades province would differ from the other provinces and would differ strongly among the alternatives. See *Figure 156 (Structural stage abundances on the BLM-administered forested lands in the Eastern Cascades province by alternative)*.

Under the No Action Alternative, the structural stage abundances in the Eastern Cascades province would fluctuate, but remain approximately constant. The patterns in the Eastern Cascades province would differ from the other provinces under the No Action Alternative because of the absence of the late-successional reserves and the small acreage of the riparian reserves in the Eastern Cascades province. The acreage of the riparian reserves in the Eastern Cascades province is small because 69% of the BLM-administered forested acres in the Eastern Cascades province would be in the harvest land base as compared to the planning area average of 26%. Alternatives 1 and 2 would allocate similar acreage amounts to the harvest land base and consequently would show similar structural stage abundance—increasing the stand establishment forests and decreasing the mature forests over the next 100 years. The structural stage abundance under Alternative 3 in the Eastern Cascades would show a pattern different than the other alternatives and different than Alternative 3 in the other provinces—increasing the stand establishment forest to become the most abundant structural stage and decreasing the young forest and mature forest. The uneven-aged management of the Eastern Cascades province under Alternative 3 would repeatedly reset stands to the stand establishment with structural legacies forest structural stage, which would limit or preclude the development into mature forest.

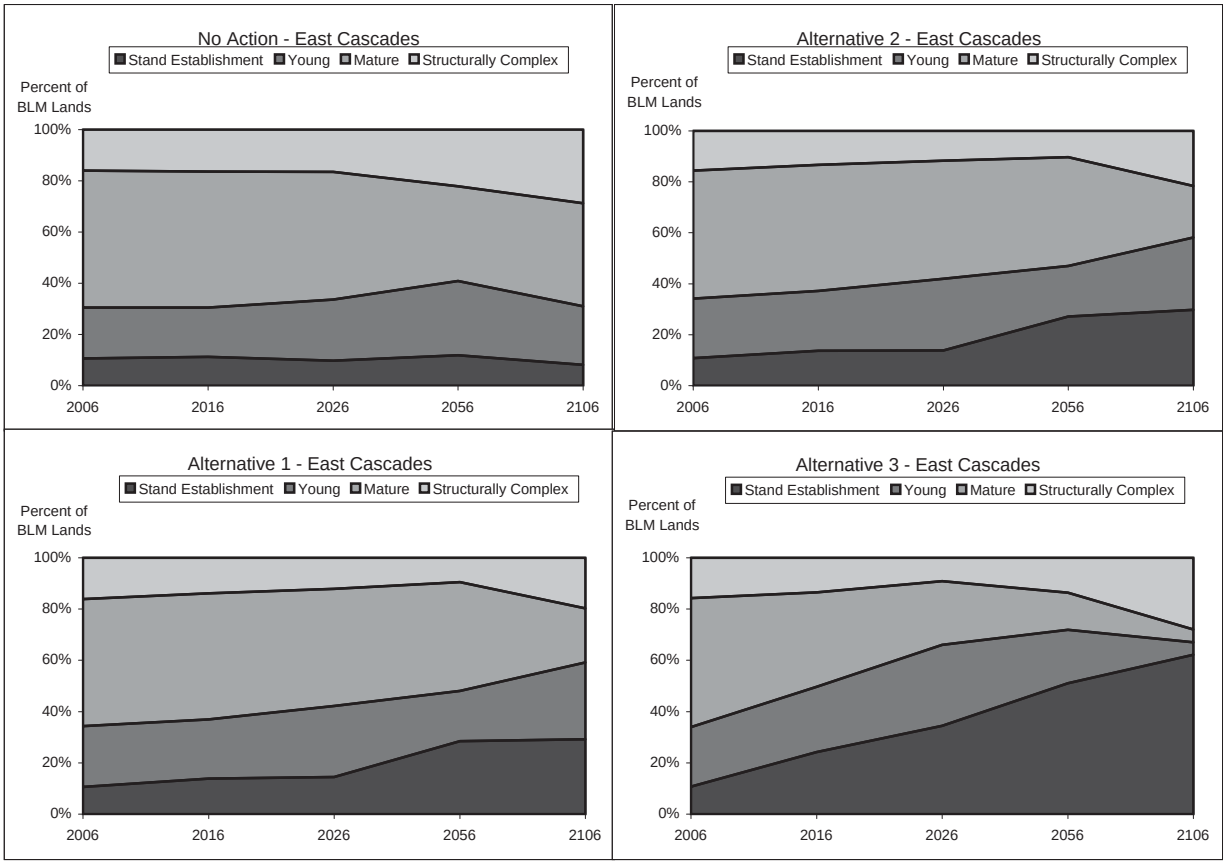
In 100 years, none of the alternatives would result in structural stage abundances that are similar to the average historic condition in the Eastern Cascades. See *Figure 150 (Comparison of the structural stage abundances on the BLM-administered forested lands by 2106 with the current conditions and the average historic conditions by alternative by province)*. The No Action Alternative would result in less young forest and more mature&structurally complex forest than the average historic condition in the Eastern Cascades province in 100 years. Alternatives 1 and 2 would result in more stand establishment forest and less young forest. Alternative 3 would result in a structural stage abundance that would be the most different from the average historic condition of all four alternatives—more stand establishment forest, less young forest, and less mature&structurally complex forest.

The classification of the forest structural stages in the Eastern Cascades province and the characterization of the average historic condition is more challenging than in any other province. The effect of partial harvesting under Alternative 3 would reset stands to stand establishment forest, which likely overestimates the

abundance of the stand establishment forests compared to the average historic condition. See the *Ecology* section in *Chapter 3*.

As in the Klamath province, natural disturbances would be more likely to alter the structural stage abundances in the nonharvest land base in the Eastern Cascades province than in the Coast Range or Western Cascades. The predominant high fire frequency regime and the effects of past fire suppression increase the likelihood that wildfires would increase the amount of the stand establishment and young forests in the nonharvest land base from the abundances described here. However, there remains inadequate information to estimate the acreage, location, timing, severity, and extent of such disturbances.

Figure 156. Structural stage abundances on the BLM-administered forested lands in the Eastern Cascades province by alternative



The No Action Alternative would decrease the size of the stand establishment forest patches in the Eastern Cascades province, and the three action alternatives would increase the size of the stand establishment forest patches, which is consistent with the changes in the overall structural stage abundance. See *Figure 151 (Change in the mean patch size from the current condition by 2106 by forest structural stage on the BLM-administered lands)*.

All four alternatives would result in only slight changes in the size of young forest patches compared to the current condition. The No Action Alternative,

Alternative 2, and Alternative 3 would slightly decrease the size of the young forest patches, and Alternatives 1 would slightly increase the size of young forest patches.

All four alternatives would decrease the size and connectivity of the mature&structurally complex forest patches in the Eastern Cascades province. See *Figures 151* and *152.* The No Action Alternative would result in the least decrease, and Alternative 3 would result in the most decrease. There are no studies of historic spatial pattern to compare to these results. However, the historic spatial pattern in the Eastern Cascades likely differed from other provinces within the planning area because of the prevalence of a low-severity/ high-frequency fire regime that would have produced a fine-grained mosaic of the forest structural stages (Frost and Sweeney 2000).

Subalternatives and Reference Analyses

Alternative 1 Subalternative: No Harvesting of Stands 80 years of age and older

This subalternative would decrease the amount of the stand establishment and young forests, and increase the amount of mature and structurally complex forests from the current condition. See *Figure 157 (Structural stage abundances of the subalternatives and the reference analyses as a percentage of the BLM-administered forested lands by 2106)* and *Table 152 (Structural stage abundances of the subalternatives and the reference analyses as a percentage of the BLM-administered forested lands by 2106)*. Without the timber harvesting of stands that are 80 years of age and older, the stand establishment and young forests would decline in abundance. Similarly to the no harvest reference analysis, the no harvesting of stands that are 80 years of age and older subalternative would result in the BLM-administered lands almost completely being dominated by the mature and structurally complex forests. The structural stage abundances under this subalternative would be more similar to the no harvesting reference analysis than Alternative 1. Like the no harvesting reference analysis, the no harvesting of stands that are 80 years of age and older subalternative would result in less stand establishment and young forests and more mature&structurally complex forests than the average historic condition.

Alternative 1 Subalternative: No Harvesting of Stands 200 years of age and older

This subalternative would increase the amount of stand establishment forests, decrease the amount of young forests, maintain the amount of mature forests, and increase the amount of the structurally complex forests compared to the current condition. See *Figure 157 (Structural stage abundances of the subalternatives*

and the reference analyses as a percentage of the BLM-administered forested lands by 2106) and *Table 152 (Structural stage abundances of the subalternatives and the reference analyses as a percentage of the BLM-administered forested lands by 2106)*. The structural stage abundances under this subalternative would be more similar to Alternative 1 than the no harvesting reference analysis or the no harvesting of stands that are 80 years of age and older subalternative. This subalternative would result in more stand establishment forests, less young forests, more mature forests, and less structurally complex forests than the average historic condition.

No Harvesting Reference Analysis

Without any timber harvesting on the BLM-administered lands, the stand establishment forests would completely disappear and the young forests would almost completely disappear from the BLM-administered lands by 2106. See *Figure 157 (Structural stage abundances of the subalternatives and the reference analyses as a percentage of the BLM-administered forested lands by 2106)* and *Table 152 (Structural stage abundances of the subalternatives and the reference analyses as a percentage of the BLM-administered forested lands by 2106)*. The mature and structurally complex forests would increase to occupy almost all the BLM-administered lands. This would result in less stand establishment and young forests and more mature and structurally complex forests on the BLM-administered lands than the average historic condition. Because the mature&structurally complex forests would occupy almost all the BLM-administered lands, the size and connectivity would increase in all provinces and far more than any alternative. See *Appendix B, Ecology*.

This analysis does not include the estimates of future natural disturbances, but natural disturbances would increase the amount of the stand establishment and young forests from the abundances described here. The Northwest Forest Plan FSEIS assumed that 2.5% of the late-successional forests in the late-successional reserves would be lost to wildfires each decade (USDA, USDI 1994b, 3&4:42). The rate of disturbance would likely be much lower on the BLM-administered lands because of the land ownership pattern and the greater access for fire suppression.

Across all ownerships, no timber harvesting on the BLM-administered lands, combined with the effect of the management on other lands, would result in a decrease in the stand establishment forests and young forests from the current condition and an increase in the mature&structurally complex forests, as in all four alternatives and the subalternatives described in this section. These changes would move the landscape in the direction of the historic average conditions. However, the structural stage abundances across all ownerships would not reach the average historic conditions in 100 years. The stand establishment forests would remain above the average historic condition and the mature&structurally complex forests would remain below the average historic condition, as they

would in all four alternatives. See *Figure 158 (Comparison of all ownerships by 2106 with average historic conditions and current conditions by alternative).*

Intensive Management on Most Commercial Timber Lands Reference Analysis

This reference analysis would result in more stand establishment forests, more young forests, and less structurally complex forests than any alternative. The structurally complex forests would be restricted almost entirely to the nonharvest land base, which would comprise 18% of the BLM-administered lands (compared to 40% under Alternative 3, which is the lowest of the alternatives). Although the mature forests would continue to comprise 33% of the BLM-administered lands, the majority (80%) would be mature with single canopy forests (far higher than any other alternative). See *Figure 147 (Mature forest with multilayered canopies or single canopies by alternative)* earlier in this section. This reference analysis would result in more stand establishment forests, more young forests, more mature forests, and less structurally complex forests than the average historic condition.

Figure 157. Structural stage abundances of the subalternatives and the reference analyses as a percentage of the BLM-administered forested lands by 2106

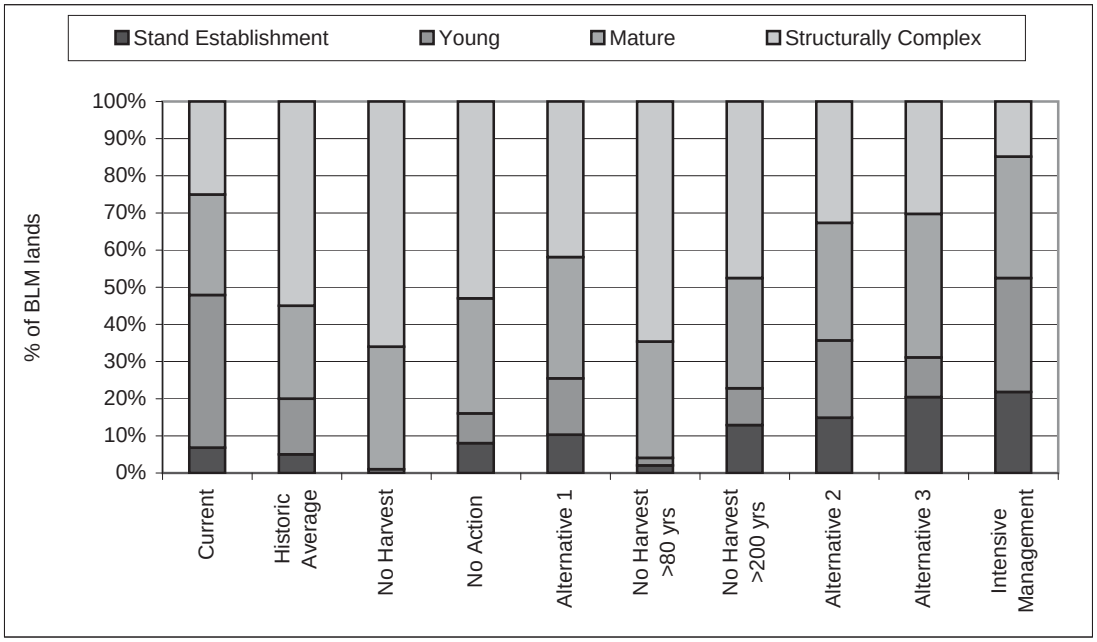


Table 152. Structural stage abundances of the subalternatives and the reference analyses as a percentage of the BLM-administered forested lands by 2106

Alternatives, Subalternatives, and Reference Analyses	Forest Structural Stages			
	Stand Establishment	Young	Mature	Structurally Complex
Average Historic Conditions	**5**	**15**	**25**	**55**
No Action Alternative	8	8	31	53
Alternative 1	10	15	33	42
Alternative 2	15	21	32	33
Alternative 3	20	11	39	30
Alternative 1 Subalternative: No harvesting of stands older than 80 years	2	2	31	64
Alternative 1 Subalternative: No harvesting of stands older than 200 years	13	10	30	48
Reference Analysis: No harvesting	0	1	33	66
Reference Analysis: Intensive management on most commercial timber lands	22	31	33	15

Note: Some percentages do not add up to 100 because of rounding.

Ecological Conditions across All Ownerships

The structural stages for all lands other than the BLM-administered lands were classified using IVMP data (see the *Ecology* section in *Chapter 3*). The IVMP data, however, only describes the current conditions. The BLM-administered lands are classified for both the current and future conditions based on modeling outputs rather than IVMP data. The modeling outputs provide the only available data on the future conditions under the different alternatives. It is not possible to conduct comparable modeling of future conditions on lands other than the BLM-administered lands. Therefore, the analysis relies on simple assumptions about the future conditions on other lands. The analysis assumes that all forest-capable lands in the U.S. Forest Service late-successional reserves, administratively withdrawn, and congressionally reserved lands would develop through the structural stages by the following progression:

- By 2016, all stand establishment forests would become young forests.
- By 2056, all young forests that were young forests by 2006 would become mature&structurally complex forests.
- By 2106, all young forests that were stand establishment forests by 2006 would become mature&structurally complex forests.

The analysis assumes that all other lands would maintain their current abundances and spatial patterns. These broad assumptions are acknowledged to be inaccurate. There is inadequate information, however, to make more accurate assumptions. The assumption

about the U.S. Forest Service reserves does not account for natural disturbances (similar to the modeling of the BLM-administered lands) or the slow structural development on poor sites. The assumption on other lands overestimates harvesting on the U.S. Forest Service harvest base lands, does not account for riparian reserves, and overestimates harvesting on state lands. The prediction of harvesting practices on private lands would be complex and largely speculative (Kennedy and Spies 2005; Nonaka and Spies 2005). Nevertheless, the broad assumptions here are sufficient to evaluate the relative effect of the different BLM management actions on the structural stage abundances and spatial patterns across all ownerships.

The value of the analysis across all ownerships is in the relative results that compare the future conditions under the different alternatives. Absolute results from the abundance and spatial analysis should be interpreted with great caution. The measurements of spatial patterns are strongly influenced by:

- the definition of the elements of the analysis (e.g., the landscape boundaries):
- the scale the spatial analysis;
- the definition of patch types; and
- the basis for delineating patches.

In addition, this analysis integrates two different data sources to construct the landscape for the analysis—modeling outputs for the BLM-administered lands and IVMP data for all other lands. These different data sources use slightly different parameters to define the structural stages and are measured at different scales, which influence the spatial pattern results. Therefore, these abundance and spatial pattern results cannot reliably be compared directly to the results from other studies, but should only be used to describe the relative effects of the different alternatives.

All four alternatives, combined with the effect of the management on other lands consistent with the assumptions described above, would contribute to a decrease in the stand establishment forests and young forests from the current condition and an increase in the mature&structurally complex forests. These changes would move the landscape in the direction of the historic average conditions. However, the structural stage abundance across all ownerships would not reach the average historic conditions in 100 years under any alternative. The stand establishment forests would remain above the average historic condition and the mature&structurally complex forests would remain below the average historic condition in all four alternatives. See *Figure 158 (Comparison of all ownerships by 2106 with average historic conditions and current conditions by alternative)*. This conclusion is consistent with the research on the Coast Range landscape conditions that modeled alternative future management scenarios on all ownerships, rather than the broad assumptions described above (Nonaka and Spies 2005).

The structural stage abundances across all ownerships would vary only slightly among the alternatives for two reasons:

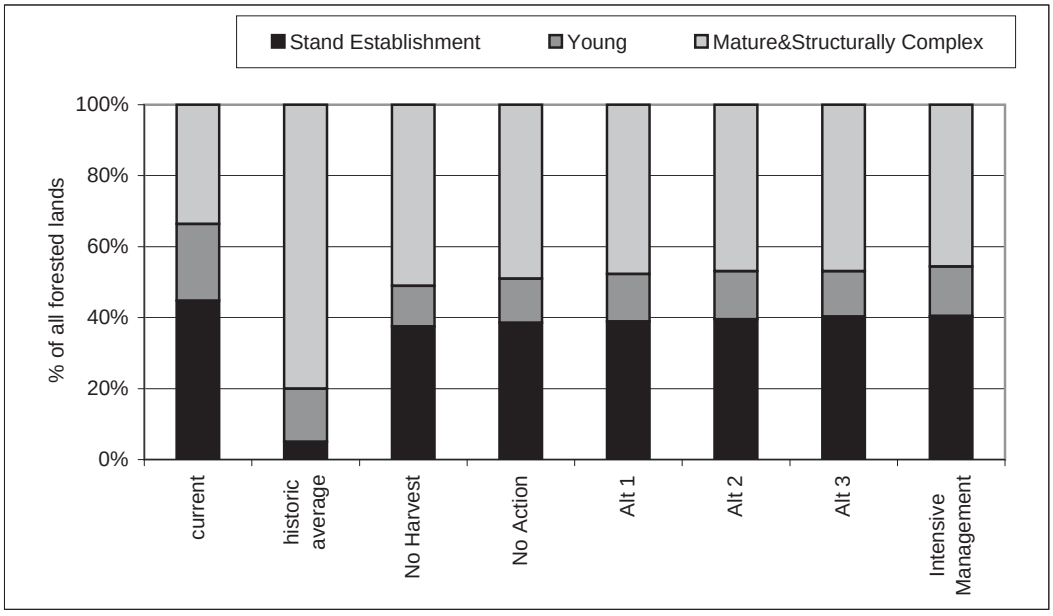
- The BLM-administered lands make up only 16% of all forested land within the planning area, which is too small an area to substantially shift the structural stage abundances across all ownerships.

- The effect of the alternatives on the BLM-administered lands, though quantitatively different, would make similar overall changes to the structural stage abundance—a decrease in the young forests and an increase in the mature&structurally complex forests.

As a result, none of the alternatives would result in more than a 1% shift in the structural stage abundances across all ownerships. Even the reference analyses of no harvesting and intensive management on most commercial timber lands would result in only an additional 1 to 2% shift in the structural stage abundances across all ownerships. There are differences among the alternatives that are masked by grouping all mature and structurally complex forests, together, and these differences are detailed in the analysis of the BLM-administered lands above. But at the broad scale of analysis across all ownerships, the management of the BLM-administered lands does not substantially alter the condition of the entire forested landscape.

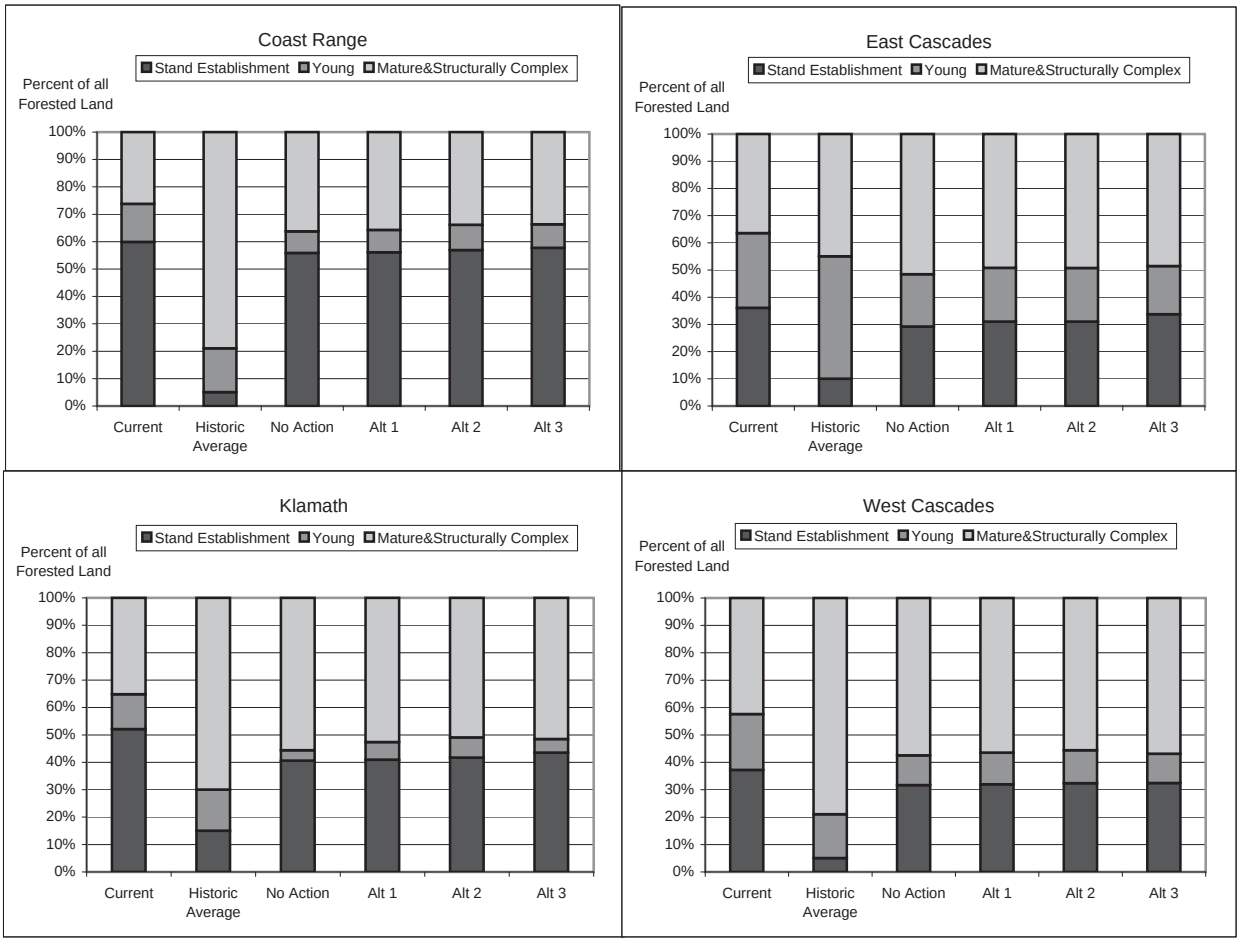
The principal controls on the condition of the entire forested landscape are the development of the U.S. Forest Service reserves into mature&structurally complex forests and the continued intensive management of the nonfederal forests. For example, the No Action Alternative would add an additional 684,000 acres of mature&structurally complex forest on the BLM-administered lands in 100 years, whereas the development of the U.S. Forest Service reserves would add more than twice that amount (1,786,000 acres) of mature&structurally complex forest over the same time period.

Figure 158. Comparison of all ownerships by 2106 with average historic conditions and current conditions by alternative



The abundances of the structural stages over time shows slightly more difference among the alternatives at the province scale than for the entire planning area. Nevertheless, the alternatives still only shift the abundances at the province scale less than 3% in 100 years. See *Figure 159 (Comparison of all ownerships by 2106 with average historic conditions and current conditions by province by alternative).*

Figure 159. Comparison of all ownerships by 2106 with average historic conditions and current conditions by province by alternative



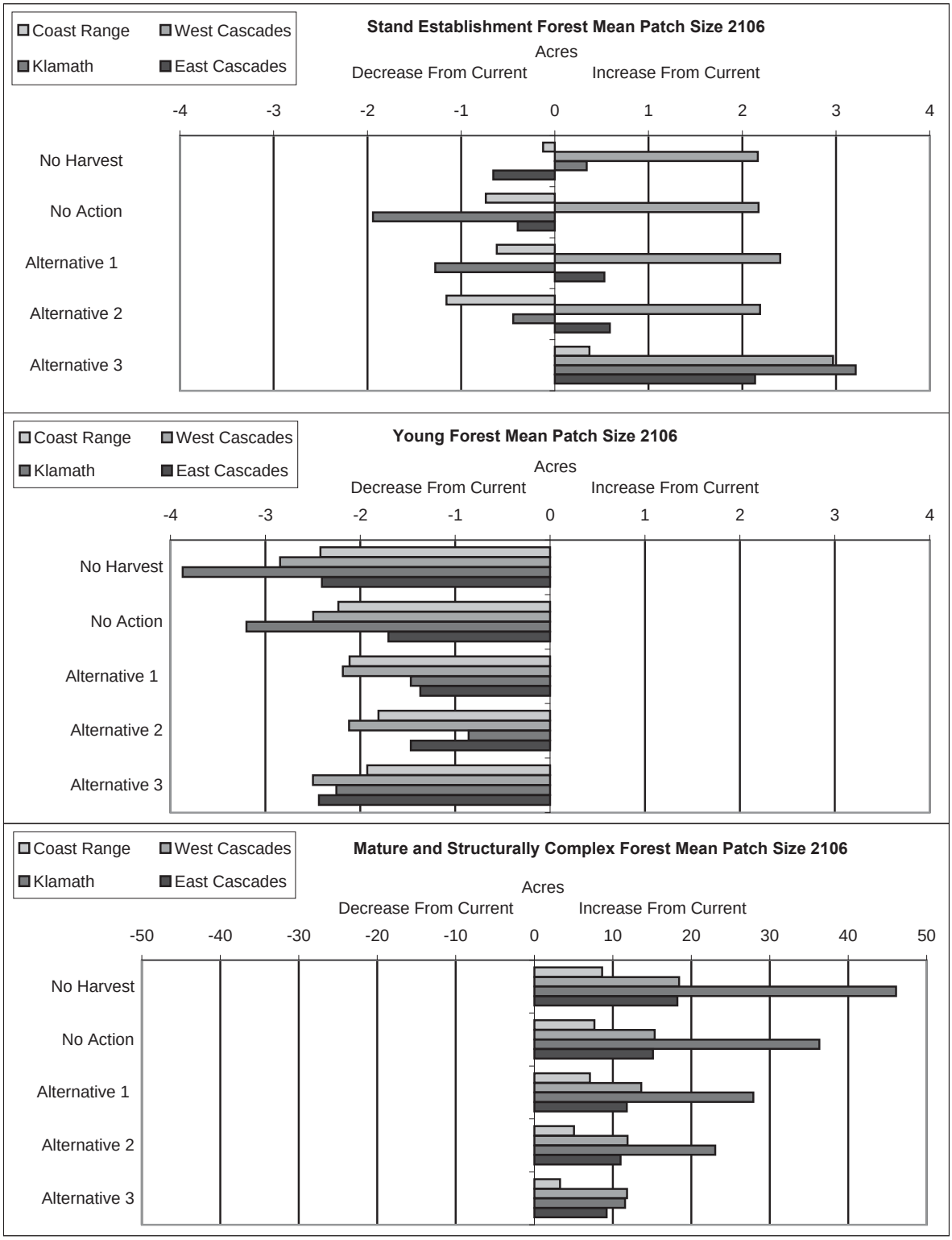
The spatial patterns of the structural stages across all ownerships would reveal more differences among the alternatives than the abundances of the structural stages.

The stand establishment forest patch sizes would decrease in some alternatives in some provinces and increase in others. See *Figure 160 (Change in the mean patch sizes from the current condition by 2106 by the forest structural stages on all ownerships).* Alternative 3 would contribute to an increase in the stand establishment patch size in all provinces. However, these relative shifts represent very slight absolute changes in the Coast Range and Western Cascades provinces, where the differences among the alternatives is less than 4% of the current mean patch size. In the Klamath and Eastern Cascades provinces, the difference among the alternatives would be greater—Alternative 3 would result in stand establishment patch sizes 12% greater than the No Action Alternative in the Klamath province, and 17% greater than the No Action Alternative in the Eastern Cascades province. This is consistent with the overall trend in the abundances across all ownerships, but the differences among the alternatives in mean patch sizes are greater than the differences in the overall abundance.

The young forest patch sizes would decrease in all four alternatives in all provinces consistent with the overall trend in abundances.

The mature&structurally complex forest patch sizes would increase in all four alternatives in all provinces consistent with the overall trend in abundances. The development of the Forest Service reserves into mature&structurally complex forests would produce very large mature&structurally complex forest patches that would contribute to the increase in mean patch size, but there would still be a measurable difference among the alternatives. Among the alternatives, the No Action Alternative would contribute to the most increase in mature&structurally complex forest patch size, and Alternative 3 would contribute to the least increase in all provinces.
The No Harvesting reference analysis would result in more difference in the mature&structurally complex forest patch size than in the overall abundance of the mature&structurally complex forest across all ownerships. The no harvesting reference analysis would result in mature&structurally complex forest mean patch sizes that are much larger than Alternative 3—35% larger in the Coast Range province, 23% larger in the Western Cascades province, 120% larger in the Klamath province, and 32% larger in the Eastern Cascades province. The differences among the alternatives would be greatest in the Klamath province, in part because the BLM-administered lands make up a higher portion of the Klamath province than any other province.

Figure 160. Change in the mean patch sizes from the current condition by 2106 by the forest structural stages on all ownerships



Note the change in scale for the mature&structurally complex forests.

Socioeconomics

This analysis examines the county-level economic impacts in terms of the jobs and income that are associated with the BLM's timber harvests, the BLM's payments to counties, the BLM's budget requirements, and the economic value of the BLM timber program that would result from the alternatives.

Key Points

- None of the alternatives would produce timber receipts that are sufficient to bring payments to the counties to the level provided by the Secure Rural Schools payments of the Secure Rural Schools and Community Self-Determination Act of 2000. Alternative 2 would produce the highest payments to the counties at 94% of the O&C portion of the 2005 Secure Rural Schools payment, while the No Action Alternative would produce the lowest payments at 37% of the O&C portion of the 2005 Secure Rural Schools payment.
- Alternative 2 would have the most favorable impact on local economies and would result in a net increase of 3,442 jobs and $136.5 million of wages. The No Action Alternative would have the least favorable impact on local economies and would result in a next decrease of 3,710 jobs and $125.5 million of wages. Economic impacts would vary by county depending on:
  - the economic structure of the economy,
  - the county's share of the Secure Rural School payments, and
  - the projected changes in the wood products industry.
- The BLM would require an increase in budget to implement all four alternatives. The increase would range from 17% under the No Action Alternative to 60% under Alternative 2.
- The present net value of the BLM timber harvest would range from $46.1 million under Alternative 3 to $962.3 million under Alternative 2.

The management of the BLM timberlands contributes to the economic activity in the western Oregon communities within the planning area. Timber harvesting and the manufacture of wood products create jobs and income in these sectors and also stimulates economic activity in other sectors of the local and regional economies. The BLM's employees and the BLM's management expenditures also contribute to local economies. Approximately 50% of the revenues received from the O&C lands, furthermore, flows directly to the county governments and is used to fund a variety of social services and investments.

The BLM lands contribute to the employment and income in industries other than those that are related to lumber and wood products. Dispersed and developed recreation, commercial fishing, hunting, special forest products, mining, and grazing all contribute to the region's economies and are affected by changes in federal forest management. Estimating the jobs and income that are associated with uses other than the wood products and government sectors is not possible because data for the evaluation of many economic aspects of the alternatives is limited for resources and uses that have no market or transaction costs. In addition, the BLM's receipts from these activities in western Oregon are relatively minor compared to the timber program and vary little between alternatives. For example, receipts from such nontimber sources as recreation ($1.2 million annually), special forest products ($300,000 annually), and grazing receipts ($30,000 to $40,000 annually) are relatively minor and would not vary between the alternatives.

While primary data is not available to measure how the alternatives would differ in economic benefits of recreation opportunities on the BLM, it is important to note that both resident and nonresident tourists contribute to local economies in the form of purchases of goods and services

of accommodations, transportation, food and beverage, retail, and commercial recreation services. Outdoor recreation on BLM-administered lands in the planning area yielded an estimated 3,953,400 visitor days in 2004, of these an estimated 24% were tourists who resided more than 50 miles from the recreation site. Using regional tourism studies for western Oregon in combination with national outdoor recreation valuation studies cited by the National Park Service and the BLM produces a conservative estimate of the value of nonresident outdoor recreation spending in the planning area. In 2004, visitors to the BLM's recreation areas spent over $68,300,000 in local communities to support their visit to the public lands. As described in the *Recreation* section of this chapter, all alternatives would continue to meet recreational demand on BLM-administered lands in the planning area with some minor effects on visitor use patterns.

The measures that are used for the comparison of the alternatives are:

- **Employment.** Those full-time equivalent jobs associated with the timber-related economic sectors.
- **Income.** The wages associated with employment.
- **Payments to counties.** The counties' share of the revenues that are paid to the BLM.
- **BLM budget.** The money that is spent for the BLM's personnel, services, equipment, etc.
- **Contract costs.** The money that is spent on contracting certain silvicultural costs.
- **Present net value.** The sum of the discounted revenues and costs associated with the timber sale program.

The volumes and revenues of harvests for this analysis were derived from the OPTIONS model. The Western Oregon Model (Adams and Latta 2007, 8-14) was used to project delivery points for the projected harvest from OPTIONS. Developed at Oregon State University, this model relies on data about processing facilities, market prices, and private inventory to project log flows and production across Western Oregon. County-level input/output models were constructed specifically for this analysis. Data specific to the economy of each county were incorporated into the model, resulting in employment and income projections tuned to the economy found in each county economy. The U.S. Forest Service's Timber Assessment Market Model was used to estimate the stumpage price impact of adding more BLM timber to the market. Revenues, employment, and income reported herein are based on the total harvest volumes including both the harvest land base (lands that contribute to the annual sale quantity) and nonharvest land base. See *Appendix C, Socioeconomics* for a more complete discussion of the analytical process and the assumptions for this analysis.

An increase in the BLM timber harvest would lead to an increase in the total timber harvest in the market area, and an increased activity in the wood processing sectors. Under all four alternatives, as the BLM sells more timber into the log market, log prices would fall and timber harvests from price-sensitive private lands or log imports from Canada and Washington would decline to some degree. Because of this price effect, the increase in the total harvest would be somewhat less than the increment of the BLM's timber. As manufacturing capacity adjusts to absorb the increased volume of the BLM's timber, prices and harvests from other owners would adjust to previous levels. See *Chapter 3* for discussion of the timber market and wood products industry.

The differences in the economic effect of the harvests between the alternatives are due not only to the differences in the volume of timber that would be harvested, but also to the differences in the location and characteristics of the timber that would be harvested. During the first 10 year period after implementation, for example, the harvest volume from Alternative 3 would be mostly from partial harvesting, whereas more regeneration harvesting would occur under Alternatives 1 and 2. Since thinning and partial harvesting costs more than regeneration harvesting, the average net revenue per thousand board feet would be highest under Alternative 2 and lowest under Alternative 3. The differences in the type of timber harvested would result in a difference in log quality. Large, peeler-grade logs, for example, would constitute more of the harvest volume under Alternative 2 than under the No Action Alternative. See *Table 153 (Distribution of harvest by harvesting type and the percentage of large, peeler-grade logs for the first 10 years)*.

Table 153. Distribution of harvest by harvesting type and percentage of large, peeler-grade logs for the first 10 years

Alternatives	Total Annual Harvest (mmbf)	Treatment Type				Percentage of Large, Peeler-Grade Logs
		Regeneration Harvesting	Thinning	Uneven-aged Harvesting	Partial Harvesting	
No Action	355	65%	35%	1%	0%	4.1%
Alternative 1	537	77%	22%	0%	0%	7.7%
Alternative 2	767	89%	11%	0%	0%	8.5%
Alternative 3	473	4%	34%	0%	62%	7.7%

As a result of the differences in the type of harvesting (thinning, partial harvesting, regeneration harvesting, and uneven-aged management) and log quality, there is a difference in the projected average stumpage prices between the alternatives. See *Table 154 (Estimated annual payments to the counties for the first 10 years)*; also see *Figure 186 (Annual stumpage value by alternative over the next 10 years)*, which is in the *Timber* section of this chapter. They show that stumpage prices within the first 10 years would range from $280 per mbf under Alternative 2 to $217 per mbf under Alternative 3.

The differences in the type and quality of logs harvested could also lead to differences in the employment projections. For example, larger and higher-quality logs can produce higher-valued specialty products that often require more labor-intensive milling procedures. Large logs, on the other hand, generally require less logging labor. Due to data limitations, this analysis does not incorporate an employment distinction based on log size or quality.

Payments to the Counties

Currently, the BLM-related revenues provide about 2.5% of the total revenue received by the O&C counties and 9.8% of the discretionary portion of the county budgets (see *Chapter 3*). These figures range from 0.1% of the total funding and 0.2% of the discretionary funding for the large metropolitan counties to 20.5% of the total funding and 70.4% of the discretionary funding for the more rural southwestern Oregon counties. See the *Socioeconomic* section of *Chapter 3*.

Since the Secure Rural Schools funding has expired, this analysis assumes that the BLM payments to the counties would be based on the preexisting formula with which the counties would receive 50% of the BLM stumpage receipts and some minor additional funding, as described in *Chapter 3*. *Table 154 (Estimated annual payments to the counties for the first 10 years)* shows that because Alternative 2 would harvest the most timber at the highest price, it would generate the highest total revenue ($215.8 million) and the highest payment to counties ($108.0 million). That is equivalent to 94% of the 2005 Secure Rural Schools funding that is associated with the BLM lands and 46% of the Secure Rural Schools funding from all federal lands.

The No Action Alternative would have the lowest total annual revenue ($83.9 million) and the lowest payment to Counties ($42.0 million). That is equivalent to 37% of the 2005 Secure Rural Schools funding that is associated with the BLM lands and 18% of the Secure Rural Schools funding from all federal lands.

Table 154. Estimated annual payments to the counties for the first 10 years

Harvests, Revenues, and Payments	Alternatives			
	No Action	Alt. 1	Alt. 2	Alt. 3
Harvest (mmbf) of short logs	355	537	767	473
Adjusted stumpage ($/mbf)	234	254	280	217
Total revenue ($ million)	83.9	137.2	215.8	103.3
Total O&C county payments ($ million)	42.0	68.7	108.0	51.7
% of 2005 BLM payments to the counties	37%	60%	94%	45%
% of 2005 BLM, USFS, and SRS* payments	18%	29%	46%	22%

*SRS (Secure Rural Schools)

Table 155 (Annual payments to the counties for the first 10 years (based on 2005 levels) shows the payments to the counties for the first 10 years. The bulk of the projected payments is based on 50% of the BLM stumpage receipts. That revenue is distributed between the counties based on historic valuation. The distribution of other revenues is fixed at the 2005 level and does not change between alternatives. Since this is a minor amount of revenue, the distribution of the total revenue between the counties on a percentage basis would be nearly identical under any alternative.

Table 155. Annual payments to the counties for the first 10 years (based on 2005 levels)

Counties	SRS[a] Payments ($ million)			Alternatives ($ million)			
	BLM	USFS	Totals[b]	No Action	Alt. 1	Alt. 2	Alt. 3
Benton	3.2	0.5	3.7	1.2	1.9	3.0	1.5
Clackamas	6.3	7.2	13.5	2.3	3.8	6.0	2.9
Columbia	2.3	0.0	2.3	0.9	1.4	2.2	1.1
Coos	7.6	0.8	7.5	2.5	4.1	6.4	3.0
Curry	4.2	5.6	9.8	1.5	2.5	3.9	1.9
Douglas	28.7	22.7	51.2	10.5	17.2	27.0	12.9
Jackson	17.8	6.4	24.3	6.6	10.8	16.9	8.1
Josephine	13.8	3.1	16.8	5.1	8.3	13.0	6.2
Klamath	2.7	17.2	19.9	1.0	1.6	2.6	1.3
Lane	17.4	34.2	51.5	6.4	10.5	16.5	7.9
Lincoln	0.4	5.3	5.7	0.2	0.2	0.4	0.2
Linn	3.0	11.4	14.4	1.1	1.8	2.8	1.4
Marion	1.7	4.3	5.9	0.6	1.0	1.6	0.8
Multnomah	1.2	1.1	2.3	0.5	0.7	1.2	0.6
Polk	2.5	0.0	2.5	0.9	1.5	2.3	1.1
Tillamook	0.6	2.8	3.5	0.2	0.4	0.6	0.3
Washington	0.7	0.0	0.7	0.3	0.4	0.7	0.3
Yamhill	0.8	0.8	1.6	0.3	0.5	0.8	0.4
Totals[b]	**114.9**	**123.3**	**237.1**	**42.0**	**68.7**	**108.0**	**51.7**

[a]SRS (Secure Rural Schools)
[b]Totals do not add precisely due to the rounding of numbers.

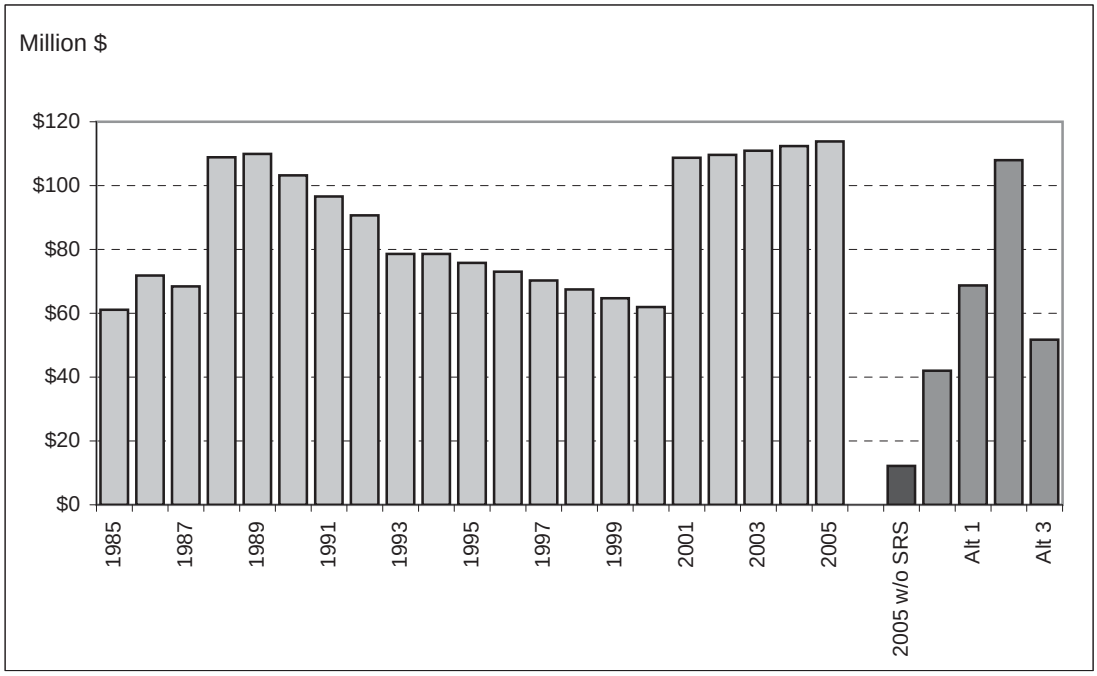
Table 155 also shows that the Secure Rural Schools funding that is associated with the BLM lands accounted for slightly less than half of the total Secure Rural Schools funding with the Secure Rural Schools funding that is associated with the U.S. Forest Service lands accounting for the other half. The distribution of U.S. Forest Service-related Secure Rural Schools funding differs from the distribution of the BLM-related Secure Rural School funding. The analysis of the impacts on jobs and income is based on the assumption that there would no longer be any of the BLM- or U.S. Forest Service-related Secure Rural Schools funding. While this analysis does not include a projection of future U.S. Forest Service payments to counties (25% of timber sale revenue), the amount of the annual payment would have averaged $4.2 million over the period of 2000-2004. Projecting a similar amount of payment into the future would not make any substantive difference in the projection of the effects of the BLM's alternatives.

Assumption

There would no longer be any BLM- or U.S. Forest Service-related Secure Rural Schools funding.

Figure 161 (Historic and projected BLM payments to the counties for the first 10 years) compares the projected BLM payments to counties to the historic BLM payments. The No Action Alternative and Alternative 3 would provide payments less than the lowest year in the 20-year history. Alternative 1 would provide payments in the range seen during the late 1990s. Alternative 2 would provide payments in the range seen in the late 1980s and again after the passage of the Secure Rural Schools legislation, which started in fiscal year 2001.

Figure 161. Historic and projected BLM payments to the counties for the first 10 years



Employment and income

The economic impact estimates for all four alternatives were calculated from county-level input/output models. These models were tailored and field-calibrated to specifically address the types of impacts that are expected from the potential changes in the BLM timber harvest levels.

The economic impacts include the combination of direct effects due to:

- the changes in BLM management and county payments,
- the indirect effects that are associated with inter-industry transactions, and
- the induced effects from payroll spending.

The total effects are described in terms of the changes in employment and earnings. Changes that would result from the alternatives are compared to a 2005 estimated baseline (labeled *current* in the following tables). The term (current) describes the amount of each county's 2005 economy that could be attributed to the combination of the BLM

management actions and the Secure Rural Schools payments that are associated with both the BLM and the U.S. Forest Service.

This analysis considers six principal sources of direct economic impacts on the O&C counties, which are:

- the loss of current Secure Rural Schools payments to counties;
- the change in the BLM timber harvesting and associated changes in logging and log hauling under the alternatives;
- the change in administrative expenditures by the BLM offices;
- the changes in sawmill operations in response to changes in timber harvesting;
- the changes in the output of plywood mills; and
- the changes in board and pulp mill operations as more chips and sawmill residuals come on the market.

Each of these changes is considered at the county level. To project economic impacts at the county level, the Western Oregon Model, developed at Oregon State University, was used to project where the BLM timber harvested under each alternative would be manufactured into products (Adams and Latta 2007, 8-14). See *Table 156 (Sources of economic effects by alternative)* for a regional summary of direct effects for each alternative.

Table 156. Sources of economic effects by alternative

Sources of Economic Effects	Current	Changes by Alternatives			
		No Action	Alt. 1	Alt. 2	Alt. 3
Payments to the counties ($ million)	237	**-195**	**-168**	**-129**	**-185**
Timber harvest (mmbf)	117	238	420	650	356
BLM expenditures ($ million)	141	26	55	91	45
Lumber production (mmbf)	6,084	454	720	1,060	656
Plywood production (mmbf 3/8 in.)	2,838	**-441**	**-428**	**-395**	**-433**
Board mill output ($ million)	26	32	53	83	51
Pulp mill output ($ million)	18	38	67	104	60

Notes: Current represents a 2005 estimated baseline.

Two of these effects are dominant sources of economic impacts to the county economies throughout western Oregon. The Western Oregon Model projects a continuing shift in the panel markets away from plywood to less-expensive oriented strand board (OSB). This shift would occur despite increased BLM timber harvests under the alternatives. Plywood production would decline by about 15% by 2009 under any of the alternatives.

Variations in BLM harvest are not a causal factor in the decline of plywood production in that projected declines are due to national market factors. Plywood production declines would occur even under the alternatives that would substantially increase the BLM's timber harvest. The projected decline in plywood production would reduce industry output over $400 million under all four alternatives. In addition, approximately 1,500 to 2,000 plywood and veneer jobs would be lost plus additional job losses from a multiplier effect as a result of the decline in plywood production.

Historically, counties shared in federal timber sales receipts. Western Oregon counties received 25% of U.S. Forest Service receipts and O&C counties received 50% from the BLM's timber sale receipts. Under the Northwest Forest Plan, federal timber sales and shared receipts dropped. The Secure Rural Schools funding that had compensated for lost timber sharing ended in 2006. These annual county payments had ranged from $0.7 million in Washington County to $51.5 million in Lane County.

This analysis assumes that no reauthorization of the Secure Rural Schools and Community Self-Determination Act, or new similar legislation, would occur. The projections of the payments to the counties include shared receipts that are primarily expected from timber sales under the alternatives. All four alternatives would have an off-setting effect to the loss of payments. Western Oregon counties would lose between 2,500 to 3,500 local government jobs from the loss of Secure Rural School payments and multiplier effects would double the total job loss. Losses would be the largest in the timber-dependent counties that have large federal land acreages. For example, under the No Action Alternative, Douglas County would lose over 700 jobs in local government due to changes in county payments and another 350 jobs in plywood manufacturing. Rural county economies typically have a narrower economic base and lower resilience than metropolitan counties.

The increase in the BLM harvests would range between 208% and 560% under the proposed alternatives. These increased harvests would create between 800 and 1,500 jobs in logging, trucking, and additional jobs in the sectors that are linked to logging. Increased BLM harvests, plus the projected increased private harvests (estimated by the Western Oregon Model), would allow sawmills, board mills, and pulp mills to increase output. This increase would not be one-for-one, as some substitution of the additional BLM timber harvest for private timber harvest would occur.

The BLM's land management, coupled with Secure Rural Schools payments, has played a large role in many western Oregon counties (refer to *Sources of economic effects by alternative)*. Together, in 2005, they accounted for 8,948 regional jobs and $319 million in earnings. See *Table 157 (Total economic impacts that are associated with BLM timber harvests by alternative)*. Under all four alternatives, economic losses would be greatest in southwestern Oregon where the O&C lands are concentrated. In Jackson and Douglas counties, revenues that are associated with the BLM's lands currently account for over 3,000 jobs. Timber harvested from the BLM's lands also plays important roles in the Eugene-Springfield, Albany, Medford, Coos Bay, and Grants Pass economies.

Table 157. Total economic impacts that are associated with BLM timber harvests by alternative

Economic impacts	Current	Changes in O&C County Totals by Alternative			
		No Action	Alt. 1	Alt. 2	Alt. 3
Jobs (number of)	8,948	**-3,770**	**-516**	3,442	**-1,275**
Earnings ($ million)	319.4	**-125.5**	**-7.3**	136.5	**-34.7**

Note: Current represents a 2005 estimated baseline.

Under all four alternatives, timber harvesting would increase. There would be an increase in jobs and income along with a multiplier as impacts ripple through other sectors in the affected county economies. The economic effects would vary in proportion to the increased timber harvest volumes. The economic effects would also vary with the amount of a county's concentration of its economy in the wood products sector. Economic activity in other sectors (caused indirectly by multipliers) would be based on the county's economic diversity and its self-sufficiency as a trade center. Under all but Alternative 2, however, the loss of Secure Rural Schools funding, coupled with the reduction in the plywood industry, would be greater than the increased employment and earnings linked to the increased BLM harvest levels. *Table 157* therefore, shows that under the No Action Alternative and Alternatives 1 and 3, there would be a net reduction in jobs and income. The higher harvest level and higher stumpage price for Alternative 2 would more than compensate the economic losses due to changes in the plywood sector and the loss of Secure Rural School funding.

The loss of Secure Rural Schools payments under the No Action Alternative would reduce regional earnings by about one-third. These reductions would be compounded by contraction in the plywood subsector of the wood products industry in Curry, Douglas, Jackson, Josephine, Linn, and Klamath counties.

Under Alternative 1, the increase of the BLM timber harvest by 364% would generate relatively small net economic impacts in western Oregon. Under Alternative 1, the jobs lost in some counties (Coos, Jackson, Lane, Linn, and Marion) would be offset by the jobs created in most other counties. However, Douglas and Klamath counties would have such large losses of jobs and earnings that there would still be a net loss overall in western Oregon.

Under Alternative 2, increased jobs and earnings would offset declines in most counties that would be caused by changes in the wood products industry and loss of Secure Rural Schools payments. Under Alternative 2, about 3,500 new jobs would be created and income would be increased by $137 million across western Oregon. Substantial increases would occur in Clackamas, Coos, Jackson, Lane, Linn, Marion, and Yamhill counties. However, the projected 560% increase in the BLM's harvest under Alternative 2 would still not be sufficient economic stimulus to overcome job losses in Curry, Douglas, Josephine, Klamath, and Lincoln counties. The job losses in these counties would be primarily in local government resulting mostly from losses of payments to the counties and contraction in the plywood sectors unrelated to the BLM's harvests.

For most counties, the economic impacts under Alternative 3 would be similar to those that would occur under Alternative 1. The exception would be Lane County, which would have considerably more jobs created in logging and wood products manufacturing. Under Alternative 3, there would be a net income loss of about $35 million across western Oregon. The most substantial county losses would occur in southwestern Oregon (Curry, Douglas, Josephine, and Klamath counties). For example, Douglas County would lose about $40 million in earnings. In the remaining counties, there would be enough economic increases resulting from the BLM's harvest to generally offset the loss of

Secure Rural School payments. Nevertheless, many individual sectors, particularly those linked to plywood production, would still have income losses.

Only under Alternative 2 would there be sufficient economic gains from increased harvesting to offset the loss of Secure Rural Schools payments and the projected contractions in the plywood sub-sector. In some alternatives, particularly Alternative 2, the increased employment and income that is associated with the increased harvesting would be sufficiently large enough to offset the decreased employment and income that is associated with the loss of Secure Rural Schools funding and the reduction in the plywood industry.

Jobs are an important indicator of the magnitude of the economic impact of the alternatives. A large set of O&C counties would generally show net gains under all four alternatives. See *Table 158 (Counties in which the alternatives would compensate for other job losses)*. Note that under the No Action Alternative, however, harvest increases would be relatively small, so job losses which would result from other factors, would not be offset in Coos and Jackson counties.

Table 158. Counties in which the alternatives would compensate for other job losses

Counties with Net Gains	Current Jobs	Changes in Jobs by Alternative			
		No Action	Alt. 1	Alt. 2	Alt. 3
Benton	118	13	53	132	39
Clackamas	265	51	250	460	211
Columbia	52	77	120	204	88
Coos	410	**-39**	100	358	75
Jackson	1,612	**-351**	211	672	16
Marion	272	**-2**	124	219	95
Polk	54	87	160	139	139
Tillamook	79	6	27	93	43
Washington	22	57	76	112	60
Yamhill	59	54	151	216	106

Harvesting under any of the alternatives would not create sufficient jobs to compensate for job losses caused by the loss of Secure Rural Schools payments and the decline in plywood production in a number of counties. See *Table 159 (Counties in which the alternatives would not compensate for other job losses)*. The group of counties shown in *Table 159* is characterized by large losses in Secure Rural Schools payments and the presence of a large plywood subsector.

Table 159. Counties in which the alternatives would not compensate for other job losses

Counties with Net Losses	Current Jobs	Changes in Jobs by Alternative			
		No Action	Alt. 1	Alt. 2	Alt. 3
Curry	235	**-190**	**-196**	**-30**	**-230**
Douglas	2,204	**-2,012**	**-1,436**	**-494**	**-1,351**
Josephine	470	**- 306**	**-165**	**-4**	**-208**
Klamath	571	**-251**	**-278**	**-237**	**-257**
Lane	1,987	**-766**	184	1,261	**-113**
Lincoln	143	**-115**	**-102**	**-91**	**-105**
Linn	396	**-82**	205	432	117

Douglas County would have the largest economic loss among all the O&C counties, because it would lose large Secure Rural Schools payments ($51.2 million annually from the USFS and BLM) and because it has a large plywood subsector.

A closer look at the estimated job impacts in Douglas County under the No Action Alternative illustrates the importance of considering all of the reasonably foreseeable sources of economic impact. If the economic analysis considered just the impacts of the changes to the harvest levels, the analysis would show that Douglas County employment would increase by 645 jobs simply as a result of increased harvest levels. If the analysis considered just the increased harvest levels and the contraction of the plywood industry, then the analysis would show a net loss of 936 jobs, because the plywood industry is heavily concentrated in Douglas County. If the analysis considered only the changes to the harvest levels and the loss of the Secure Rural Schools payments, then there would be a net increase of 163 jobs, which would result from an increase in the wood products sector offsetting losses in the government sector. When all three factors—the loss of the Secure Rural Schools payments, the contraction of the plywood industry, and the increase in BLM harvest levels—are taken together, there would be a net loss of 2,021 jobs. In other words, the increased employment in the wood products sector, specifically the sawmilling industry, would not be nearly enough to offset losses to the government sector and the plywood industry. Similar relationships would occur in each county under each alternative—the magnitude depending on the unique economic structure of each county and the specific harvest configuration of each alternative.

There would be a spectrum of county economic responses to timber harvest increases under the alternatives. For the purpose of analysis and discussion, counties are clustered into five categories that reflect the sensitivity of individual county economies. A county may fall into one or more of these categories.

Sensitivity Categories of County Economies

Type 1

These counties would receive little or no influence from the alternatives. This is caused by having small Secure Rural School payments, few BLM lands, or having economies with little reliance

on the wood products industries. Benton County and Polk County are examples. Clatsop County has so few connections to all of the impact sources that it was not modeled.

Type 2

These counties have large diversified economies. Here, the economic effects of the alternatives would be small relative to the jobs and incomes generated by other sectors. Columbia and Washington counties have positive wood products sector responses, but they are primarily commuter adjuncts to Portland. Marion County is dominated by state and federal government sectors. The Portland metropolitan economy is so large that the Multnomah County model was not used.

Type 3

These are counties in which the effects of the alternatives would be large enough to compensate for the loss of Secure Rural Schools payments—mostly from the higher levels of activity in the sawmill sectors and its multipliers. See *Table 160 (Wood products counties with gains concentrated in sawmills)*. These counties would face internal trade-offs between job and budget losses in their county governments and labor gains as sawmills expand. In some cases, resource-based economies, such as Lincoln and Tillamook counties, are reliant on non-BLM timber sources, so they would be only peripherally affected by the BLM timber harvest changes under the alternatives. The plywood counties (see Type 5) are shown here to indicate that some may have sawmill gains even when plywood jobs are declining.

Table 160. Wood products counties with gains concentrated in sawmills

Counties with Concentrated Sawmill Gains	Current	Changes in Sawmill Sector Industrial Output ($1,000) by Alternative			
		No Action	Alt. 1	Alt. 2	Alt. 3
Clackamas	4,913	14,717	27,702	40,412	25,541
Columbia	339	17,274	21,767	32,962	19,409
Coos	2,638	6,185	11,781	16,782	11,083
Curry	222	3,307	6,386	9,103	5,905
Douglas	12,892	18,895	36,493	56,132	34,257
Jackson	8,305	4,656	8,993	13,162	8,557
Josephine	1,569	1,741	3,363	4,793	3,109
Lane	15,711	30,573	58,205	91,352	55,606
Linn	2,392	13,197	16,790	23,936	14,881
Polk	462	9,160	11,905	16,588	10,504
Tillamook	726	11,854	14,926	23,471	14,311

Type 4

These counties have a large federal forest land base and significant wood products sectors. All counties had some reliance on federal Secure Rural Schools payments. The BLM's harvest revenue sharing would offset losses somewhat under all four alternatives. However, seven of these counties (Clackamas, Douglas, Jackson, Josephine, Klamath, Lane, and Linn) would be at large fiscal risk even considering higher BLM harvests. See *Table 161 (Counties losing more than $10 million per year in Secure Rural Schools payments)*. Job and budget losses would be concentrated in the county government sector and any multipliers tied to that sector.

Table 161. Counties losing more than $10 million per year in Secure Rural Schools (SRS) payments

Counties with Large SRS Funding Losses	Current ($ million)	Changes in Secure Rural Schools Payments ($ million) by Alternative			
		No Action	Alt. 1	Alt. 2	Alt. 3
Clackamas	13.5	**-11.2**	**-9.7**	**-7.5**	**-10.8**
Douglas	51.1	**-40.7**	**-34.0**	**-24.1**	**-39.0**
Jackson	24.3	**-17.7**	**-13.5**	**-7.4**	**-16.7**
Josephine	16.8	**-11.7**	**-8.5**	**-3.8**	**-11.0**
Klamath	19.9	**-18.9**	**-18.3**	**-17.3**	**-18.7**
Lane	51.5	**-45.1**	**-41.1**	**-35.1**	**-44.2**
Linn	14.4	**-13.3**	**-12.6**	**-11.6**	**-13.1**

Counties with large sawmill production value increases (e.g., Clackamas) and relatively small plywood subsectors would be most likely to have a neutral economic effect. Plywood counties have compounded economic losses from losses of payments to counties and adjustments in the wood products industry.

Type 5

These are counties that would have substantial or moderate losses from the alternatives. Three plywood counties (Douglas, Jackson, Lane) would have substantial economic losses. Four other counties (Coos, Curry, Josephine, and Linn) would have moderate economic losses where the plywood industry supplements instead of characterizes the wood products sectors. Large projected reductions in plywood and veneer output values worsen the Secure Rural Schools payment losses. See *Table 162 (County plywood output contraction by alternative)*.

Table 162. County plywood output contraction by alternative

Counties with Plywood Output Contraction	Current Output	Changes in Plywood Output ($ million) by Alternative			
		No Action	Alt. 1	Alt. 2	Alt. 3
Coos	78.5	-12.2	-12.2	-12.2	-12.2
Curry	42.9	-6.6	-5.9	-5.9	-6.6
Douglas	438.7	-68.1	-65.9	-60.4	-67.2
Jackson	271.4	-42.0	-39.8	-37.3	-39.7
Josephine	59.9	-9.3	-9.3	-8.3	-9.3
Lane	211.2	-32.7	-32.7	-29.0	-32.7
Linn	55.6	-8.9	-8.7	-8.1	-8.7

This pattern of economic response would be caused by large compounded economic losses from two sources. The elimination of Secure Rural Schools payments concentrates economic impacts in county government employment and budgets. The plywood contraction projection reduces highly paid jobs and high value-added production. BLM harvests directly increase logging, transportation, sawmill, pulpmill, and board plant jobs only where these subsectors exist. As each of these sectors has different patterns of purchases from other sectors, many of these counties have unique multiplier effects.

A discussion of the overall economic impacts does not capture the subtleties of the impacts within the individual counties or the specific sectors, such as the plywood and sawmill industries. Under all four alternatives, Douglas County would have the most severe economic losses. It would have a sharp decline in plywood production and local government, along with secondary effects in other such sectors as logging and the retail trade. Most of these economic losses would occur in the Roseburg vicinity, where government and plywood manufacturing are concentrated.

Economic losses in Curry County would not be as large as those in the larger Douglas County economy, but would still be substantial. There would be an increase in logging and sawmill operations in Brookings, but these increases would be offset by declines in plywood manufacturing. The loss of government jobs would be most severe in Gold Beach, the county seat. The loss of local governmental services would be particularly difficult for this county because of the high proportion of retirees who need such specialized services as home health care. Only 10 counties in the United States have higher retiree proportions than Curry County (Census 2000, 2006).

Klamath County would also experience substantial economic losses under all four alternatives because of its large losses of Secure Rural Schools payment and small amount of BLM-administered timber lands. Job losses in Klamath County under all four alternatives would range from 237 to 278 jobs. Klamath County is a major producer of plywood, so these job losses would be compounded by job losses resulting in adjustments in the wood products industry.

Josephine County and Jackson County have close economic ties and similarities. Both counties have plywood manufacturing operations that are projected to lose jobs; both counties have a large share of the O&C lands; and both county governments received large Secure Rural Schools payments. Grants Pass would experience economic losses under all four alternatives due to the loss of county payments. Cave Junction would experience improvements in its economy due to increased timber harvests from both the BLM and private forests. The Medford area is a major plywood manufacturing area and would experience large reductions in employment. Some of these economic losses would be offset by increased industry output in sawmills and board mills in White City. Local government services in both counties would shrink. The Medford economy is sufficiently diverse and robust that these job losses would be offset by growth in other economic sectors.

Lincoln County would experience economic losses under all four alternatives. Almost all of these losses would be in local government, which would lose about 100 jobs. Newport would experience the most loss.

Lane and Linn County would experience similar economic losses, but Lane County's economic losses would be mostly the result of the loss of $39.3 million in Secure Rural Schools payments. The logging and sawmill sectors in these counties would grow by 2009, particularly under Alternative 2, with both counties showing large economic gains in that part of the wood products sector but both counties would concurrently experience losses associated with the decline in plywood production. There would be a large economic loss to local government in these two counties, especially in both county seats (Eugene and Albany). These larger, more urban economies, however, are more resilient than the county seats in more rural areas. Plywood mill closures in communities such as Lebanon are more likely to produce long-term localized changes than those caused by changes in the BLM's timber harvesting.

The two other coastal counties, Coos and Tillamook, would experience improvements in their logging and sawmill sectors, particularly under Alternative 2. In Coos County, these economic gains would be partially offset by losses in plywood manufacturing. Coos County has a much larger proportion of federal lands, so increased federal jobs would offset the reduction in local government funding and services resulting in little net government sector change. There would be a proportionally larger economic loss to Coquille compared to other communities because it has both a plywood plant and it is the county seat.

Counties in and near the Portland metropolitan area (Clackamas, Washington, Yamhill, and Columbia) are part of a diversified and rapidly growing economy. None of these counties have a large proportion of federal lands; none are timber dependent; and none are dependent on Secure Rural School funds, even though Clackamas would lose $11.3 million from this source. Economic impacts on these counties would be minimal and almost unrelated to the BLM's timber harvest changes. There are, however, some smaller communities within those counties that do have wood products-based economies. Willamena, Molalla, St. Helens, and Rainier would experience economic gain of varying degrees under all four alternatives.

Central Willamette Valley counties (Benton, Marion, and Polk) would not experience a substantive economic effect as a result of any of the alternatives. They have only lost $2.4 million to $4.6 million each from the termination of Secure Rural Schools payments. These counties are not major wood products processing counties and do not have significant shares of the O&C lands.

Community Well-Being

Donoghue et al. (USDA, U. S. Forest Service 2006c) calculated a socioeconomic well-being index for 433 communities in western Oregon and noted how the index changed between 1990 and 2000 (see the *Socioeconomic* section of *Chapter 3).* The results suggest those communities with low and or declining socioeconomic well being scores are more typically found in the more rural and more southern counties.

The county-level analysis of jobs and income indicates that the counties with the greatest potential net loss of jobs and income under any alternative are similarly more rural and more southern.

The analysis of the economic impacts of the alternatives describes net changes in county-level jobs and income. Because employees in one sector of an economy often require specialized skills and knowledge, employees may not be able to move easily from a declining sector to a growing sector. While job creation in one sector does not offset all of the social costs of job losses in another sector, a more detailed analysis of these social effects is beyond the scope of this analysis.

The BLM Budget

The BLM's budget requirements would be higher under all four alternatives, due to the administrative costs of implementing higher timber harvest levels. For this analysis, budget requirements for nontimber resource programs and the state office—about 78% of the 2006 fiscal year budget—were held constant between alternatives. See *Table 163 (BLM budget)* for budget requirements at full harvest levels under each alternative. It is assumed that it would take a transition of two years before full harvest level would be achieved under the action alternatives.

All four alternatives would require an increase from the current BLM's budget to implement the increased levels of timber harvesting. Compared to the current level, the BLM budget would increase 17% under the No Action Alternative, 37% under Alternative 1, 60% under Alternative 2, and 29% under Alternative 3.

Table 163. BLM budget

BLM Districts	2006 Fiscal Year	Changes in the BLM Budget by Alternative ($ million)			
		No Action	Alt. 1	Alt. 2	Alt. 3
Salem	16.1	21.3	30.7	38.9	28.5
Eugene	11.9	17.6	27.0	34.2	19.2
Roseburg	14.7	17.9	18.7	25.3	22.3
Coos Bay	12.8	18.2	20.5	30.4	19.1
Medford	33.9	39.6	46.3	50.8	44.2
Lakeview*	13.5	14.2	14.7	14.7	14.5
State Office	51.3	51.3	51.3	51.3	51.3
Totals	**154.2**	**180.2**	**209.1**	**245.6**	**199.1**

*This represents the entire budget for the Lakeview District of which only a part is used for the Klamath Falls Resource Area, which is the only portion of the Lakeview District that is within the planning area.

In addition to the costs above, expenditures (shown in *Table 164*) for contractors to perform silvicultural treatments (planting, fertilization, pruning, etc.) would increase as well. These expenditures vary by alternative based on the types of harvest anticipated under each alternative. Alternative 2 would require the highest expenditure, since it includes the most regeneration harvesting.

Table 164. Annual expenditures for silviculture for the first 10 years by district

BLM Districts	Annual Expenditures for Silviculture by Alternative ($ million) (first 10 years)			
	No Action	Alt. 1	Alt. 2	Alt. 3
Salem	0.5	0.9	1.2	1.0
Eugene	0.8	1.2	1.6	1.1
Roseburg	1.5	1.6	2.3	2.8
Coos Bay	1.2	1.2	2.3	0.6
Medford	3.0	4.1	4.9	3.1
Lakeview*	0.1	0.3	0.3	0.1
Totals	**7.2**	**9.3**	**12.7**	**8.6**

*This represents the expenditures for the entire Lakeview District of which only a part applies to the Klamath Falls Resource Area, which is the only portion of the Lakeview District that is within the planning area.

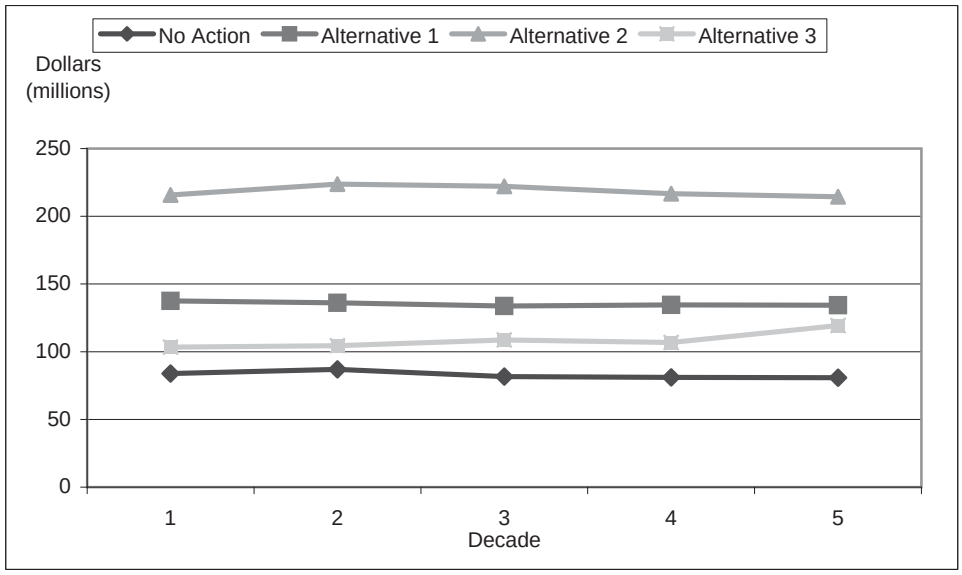
Present Net Value of the Timber Program

Present net value is a measure of economic return. Future revenues and costs over a 50-year period are discounted back to the present using a 5% discount rate.

Projections of the stumpage revenue for each alternative reflect the amount of timber harvested, the type of harvest (regeneration harvesting, partial harvesting, or thinning), and the age or size of the timber that would be harvested. Stumpage revenues would change over time, reflecting changes in the nature of the sale program under each alternative. See *Figure 162 (Average annual stumpage revenues)*. These revenues include volume from both the harvest land base (from which the

annual sale quantity is calculated) and volume from the nonharvest land base during the first five decades after implementation.

Figure 162. Average annual stumpage revenues



For the No Action Alternative, Alternatives 1, and Alternative 2, for example, harvests past the first decade would have less thinning volume from the late-successional management areas, thereby reducing the total volume and value of timber harvests over time. Under Alternatives 1 and 2, higher-valued harvests from the structurally complex forests would drop off after the first couple of decades, and the harvests would shift to more mature and less structurally complex forest types, thereby reducing the average harvest value. Under Alternative 3, harvesting would shift from partial harvesting to regeneration harvesting with an accompanying reduction in costs, resulting in an increase in stumpage revenue.

Revenue projections are based on the 2005 average log price and do not include any future real price increase. Revenues under all four alternatives are based on an assumption that stumpage prices in the market area would fall slightly as the BLM adds more timber into the market. By the second decade, it is assumed that mill capacity would adjust to absorb the additional capacity, and the market adjustment is removed.

Under all four alternatives, the cost of the BLM timber program is estimated to be $200 per mbf. This covers all of the work that is associated with preparing, offering, and administering timber sales. It includes work done by members of a timber sale interdisciplinary Team, National Environmental Policy Act compliance work, overhead, etc. The additional silvicultural costs that are specific to each alternative are also included in the calculation. See *Table 164 (Annual expenditures for silviculture for the first 10 years by district)* in the previous section (*BLM Budget*).

See *Figure 163 (Revenues, costs, and net revenues for the first 10 years)* for a comparison of the revenues, costs, and net revenues for the first 10 years. See *Table 165 (Revenues and costs for the first 10 years and the present net value over 50 years by alternative)* for the present net value calculated over a 50-year period.

Figure 163. Revenues, costs, and net revenues for the first 10 years

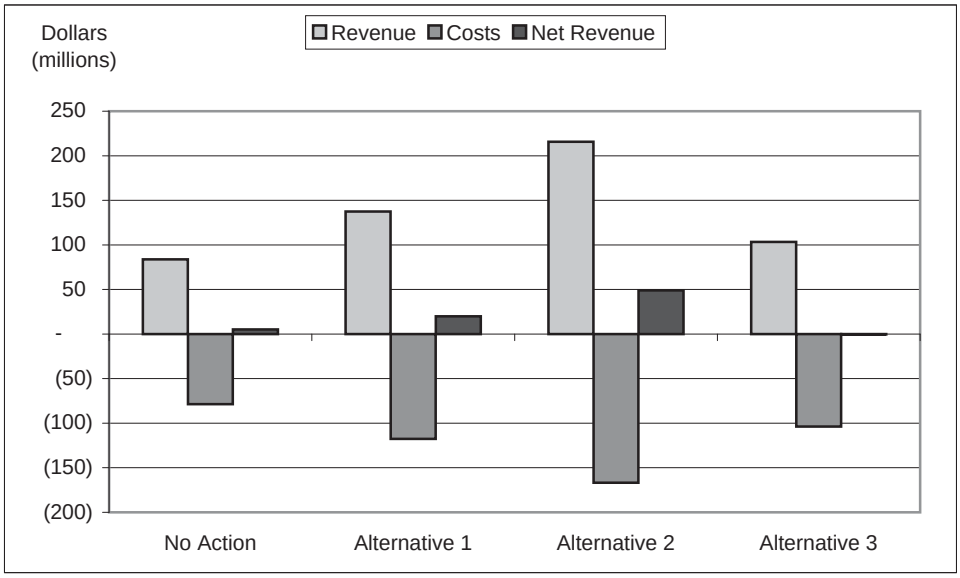


Table 165. Revenues and costs for the first 10 years and the present net value over 50 years by alternative

Alternatives	Decade 1			Present Net Value Over 50 years ($ million)
	Total Revenues ($ million)	Total Costs ($ million)	Net Revenues ($ million)	
No Action	83.9	-78.7	5.2	107.5
Alternative 1	137.5	-117.7	19.8	342.8
Alternative 2	215.8	-166.9	48.9	962.3
Alternative 3	103.3	-103.8	-0.4	46.1

Alternative 2 would have the highest total revenue of all four alternatives because it would have both the highest harvest level and the highest stumpage value. First decade revenues under the No Action Alternative would be the lowest of all four alternatives. This is because even though the No Action Alternative would have an 8% higher average stumpage value than Alternative 3, it would have 33% less harvest volume.

The alternatives are ranked differently with respect to the 50-year present net value calculation. From the highest to lowest present net value, the alternatives would be ranked Alternative 2, Alternative 1, the No Action Alternative, and Alternative 3. Because the average first decadal stumpage price under Alternative 3 is close to the average timber program cost, the net revenue under Alternative 3 would be negative in the first 10 years. Net revenues in subsequent decades would be slightly positive as capacity adjusted to the additional BLM volume and stumpage prices rebounded.

The present net value calculation shown here is based only on the costs and revenue of timber harvests. It does not include the value of the standing inventory, which would increase under all four alternatives. (Growth would exceed harvest because of the amount of lands allocated to the nonharvest land base.) Nor does the present net value include the cash revenues and costs that are associated with nontimber outputs, such as special forest products, nor any economic value associated with other commodity or amenity values.

Environmental Justice

This analysis examines the disproportionate impacts on low-income and minority populations that would result from the alternatives.

Key Points
• No high or adverse human health or environmental effects have been identified for any of the alternatives. • The effects of the alternatives are not expected to fall disproportionately on minority or low income populations.

Federal agencies are required to "identify and address . . . [the] disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations in the United States" in accordance with Executive Order 12898 regarding environmental justice.

The guidelines described by the Council on Environmental Quality (CEQ 1997) were used to guide the analysis of the potential environmental justice issues that are associated with the western Oregon resource management plan revisions. The analysis included:

- A determination of the geographic distribution of low-income populations and minority populations within the affected area (i.e., the planning area).
- An assessment of whether the impacts of the alternatives produce impacts that are high and adverse.
- If impacts are high and adverse, a determination as to whether these impacts would disproportionately impact low-income populations or minority populations.

The following Council on Environmental Quality guidelines (CEQ 1997) are used to identify what are minority and low-income populations.

- **Minority population.** A minority population is identified for a geographic unit if the number of minority persons (Hispanic/Latino, Black/African American, American Indian/Alaskan Native, Asian, Native Hawaiian/Other Pacific Islander, or some other race) is:
  - greater than 50% of the total population of that geographic unit, or
  - meaningfully greater than the percentage of the minority population in the reference unit for that geographic unit.

  For this analysis, each county is a geographic unit and the state of Oregon is the reference unit.

  The first part of the Council on Environmental Quality's guidance on minority population provides a numeric measure—the number of minority persons must exceed 50% of the total population for an affected area (i.e., a geographic unit). The remainder of the guidance calls for a judgment in evaluating the potential for environmental justice concerns. It is important to consider the circumstances of any one group that resides within the affected area, in addition to considering the percentage of the affected community that is composed of minority persons (EPA 1998).

- **Low-income population.** Low-income individuals are defined as individuals who fall below the poverty line. The poverty line takes into account the size of the family and the age of individuals in the family. In 1999, for example, the poverty line for a family of five with three children below the age of 18 was $19,882. For any given family below the poverty line, all family members are considered as being below the poverty line for the purposes of analysis (Proctor and Dalaker 2002).

  While there are no quantitative guidelines by the Council on Environmental Quality regarding the percentages of low-income populations in reference to larger populations, the Council on Environmental Quality does suggest a screen to determine if low-income populations are unevenly distributed in an affected area compared to the larger population.

See *Table 166 (Current composition of minority and low-income populations of the counties within the planning area compared to the state of Oregon)* for the current composition of the minority and low-income populations for each of the 18 counties within the planning area and the state of Oregon based on 2000 census data and the Council on Environmental Quality's guidelines. Counties that exceed the state-wide averages for minority or low-income populations are highlighted.

According to *Table 166*:

- For minority populations:
  - None of the minority populations in the counties exceeds 50% of the total population of the county.
  - There are three counties that exceed the state average for the percentage of minorities. The percentage of minority individuals in these three counties exceeds the state average by 6 to 7 percentage points.
  - These three counties are within large metropolitan areas with diverse economies (Portland and Salem). For these three counties, the BLM lands constitute less than 3% of the county area.
- For low-income populations:
  - There are 12 counties that exceed the state average for the percentage of low-income populations. They exceed the state average by 0.1 to 5.4 percentage points.
  - One of the 12 counties (Klamath County) is more than 5 percentage points above the state average. Approximately 7% of the lands within Klamath County are the BLM lands. These BLM lands are largely public domain lands east of the Cascade Mountains and are close to unincorporated populations. Low-income populations are not expected to be unevenly distributed in relationship to the BLM lands.

No high or adverse human health or environmental effects have been identified for any of the alternatives and effects are not expected to fall disproportionately on minority or low-income populations.

Table 166. Current composition of minority and low-income populations of the counties within the planning area compared to the state of Oregon

Counties within the Planning Area	Total Populations	White	Hispanic/ Latino	Black/ African American	American Indian/ Alaskan Native	Asian	Native Hawaiian/ Other Pacific Islander	Some other race	2+ Races	Total Minority	Percent Minority	Total Low-Income	Percent Low-Income
Benton	78,153	67,816	3,645	637	556	3,493	175	173	1,658	10,337	13.2	10,655	14.6
Clackamas	338,391	301,548	16,744	2,056	2,090	8,216	521	317	6,899	36,843	10.9	21,969	6.6
Columbia	43,560	40,576	1,093	97	540	246	39	43	926	2,984	6.9	3,910	9.1
Coos	62,779	56,616	2,133	169	1,412	553	99	66	1,731	6,163	9.8	9,257	15.0
Curry	21,137	19,206	761	31	408	144	21	29	537	1,931	9.1	2,554	12.2
Douglas	100,399	92,302	3,283	165	1,446	601	83	86	2,433	8,097	8.1	12,999	13.1
Jackson	181,269	160,795	12,126	674	1,782	1,583	291	198	3,820	20,474	11.3	22,269	12.5
Josephine	75,726	69,233	3,229	192	844	460	78	52	1,638	6,493	8.6	11,193	15.0
Klamath	63,775	53,659	4,961	362	2,443	482	72	96	1,700	10,116	15.9	10,515	16.8
Lane	322,959	286,075	14,874	2,391	3,268	6,390	562	534	8,865	36,884	11.4	45,423	14.4
Lincoln	44,479	39,260	2,119	113	1,296	412	66	31	1,182	5,219	11.7	6,084	13.9
Linn	103,069	94,012	4,514	285	1,192	789	125	92	2,060	9,057	8.8	11,618	11.4
Marion	284,834	217,880	48,714	2,274	3,326	4,905	967	337	6,431	66,954	23.5	37,104	13.5
Multnomah	660,486	505,492	49,607	35,592	5,754	37,344	2,206	1,216	22,275	154,994	23.5	81,711	12.7
Polk	62,380	53,394	5,480	229	1,078	671	152	57	1,319	8,986	14.4	6,943	11.5
Tillamook	24,262	22,086	1,244	42	273	154	50	9	404	2,176	9.0	2,718	11.2
Washington	445,342	346,251	49,735	4,778	2,335	29,552	1,249	650	10,792	99,091	22.3	32,575	7.4
Yamhill	84,992	71,684	9.017	592	1,134	889	91	76	1,509	13,308	15.7	7,336	9.2
Oregon	3,421,399	2,857,656	275,314	53,325	40,130	100,333	7,398	4,550	82,733	563,743	16.5	388,740	11.4

Source: U.S. BLM of the Census (2000)

Timber

This analysis examines timber harvest levels, the size of the harvest land base, the value of the harvest, the acres of harvest activities, and changes to the forest inventory and forest stand conditions that would result from the alternatives.

Key Points

- The annual allowable sale quantity would range from a high of 727 mmbf under Alternative 2 to a low of 268 mmbf under the No Action Alternative.
- Prohibiting harvesting in certain types of stands or changing the intensity of management would all have substantial effects on the allowable sale quantity.
- Over the next 10 years, volume from thinnings in the nonharvest land base would range from a high of 87 mmbf under the No Action Alternative to virtually no volume under Alternative 3.
- The harvest land base varies between the alternatives from a high of 1.4 million acres, which is 65% of the forested acres, under Alternative 3 to a low of 608,000 acres, which is 27% of the forested acres, under the No Action Alternative.
- The estimated sale price of timber sold during the first 10 years after implementation would range from a high of $2.16 billion under Alternative 2 to a low of $839 million under the No Action Alternative.
- The annual timber harvest acres of all harvest types would range from approximately 16,000 acres for the No Action Alternative to 29,000 acres for Alternative 3.

The annual productive capacity of the sustained yield units is determined by the productivity of the land, the quantity of acres in the harvest land base, and the management intensity. The O&C Act requires the determination and declaration of an annual productive capacity. It also requires the sale annually of an amount equal to this level, which is the allowable sale quantity. The term allowable sale quantity is used to describe the annual level of sustainable harvest under each alternative. See *Chapter 3* for a discussion of forest inventory. As areas are removed from or added to the harvest land base under the alternatives, the quantity, location, and the productivity of the harvest land base would vary.

Timber Harvest Levels

Allowable Sale Quantity

Variation in the acres of different age classes within the harvest land base affects the allowable sale quantity. Harvest scheduling by treatment type also affects the allowable sale quantity. See *Appendix Q – Vegetation Modeling* for detailed information on how harvests were modeled.

Alternative 3 would restrict regeneration harvesting until landscape thresholds are met. Since the long-term allowable sale quantity is based upon the eventual harvest of all the areas that are within the harvest land base, this landscape threshold would temporarily suppress the allowable sale quantity. The allowable sale quantity shown below in the following figures and table for Alternative 3 is the initial reduced level.

The No Action Alternative would also restrict harvest levels. For example, connectivity/diversity blocks would limit the level of harvest within a decade. Regeneration harvesting of older forest would be deferred within watersheds in which federal forest lands are comprised of 15% or less of late-successional forest.

Requirements for the retention of green trees in regeneration harvests would affect the productivity of forest stands. Retention trees would reduce the available volume and thus the allowable sale quantity. These retention trees would reduce the growth of the subsequent stand. This reduction varies by stand type, site quality, retention levels, and other factors but is expected to be in the range of 10 to 25%. The No Action Alternative and Alternative 3 contain green tree retention requirements

The allowable sale quantity for the planning area is shown in *Figure 164 (Total allowable sale quantity by alternative for the planning area)*. The allowable sale quantity by district is shown in *Figure 165 (Allowable sale quantity by district and alternative)*. See *Table 167 (Allowable sale quantity by district and alternative)* for the allowable sale quantity by district and alternative.

The eastern management lands of the Klamath Falls resource area do not have an allowable sale quantity because these lands are not covered by the O&C act. Any harvest would occur only to meet forest stand health needs. Under all alternatives, the annual harvest to meet forest health needs would not exceed the modeled annual productive capacity of 2 MMBF/year. With the exception of the maximum allowable annual volume that may be harvested, and the expected miles of road constructed, these eastern management lands are not shown in the subsequent analysis of ASQ.

Figure 164. Total allowable sale quantity by alternative for the planning area

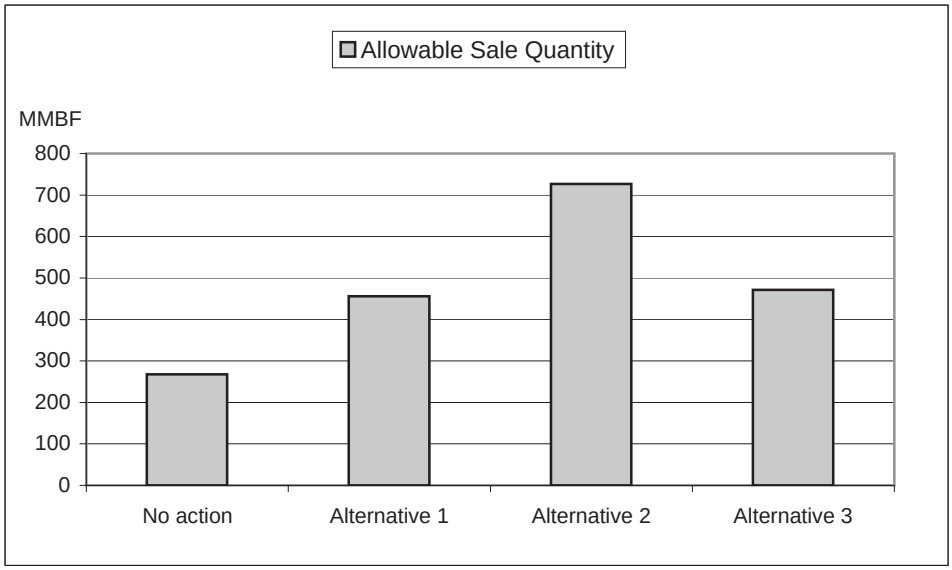


Figure 165. Allowable sale quantity by district and alternative

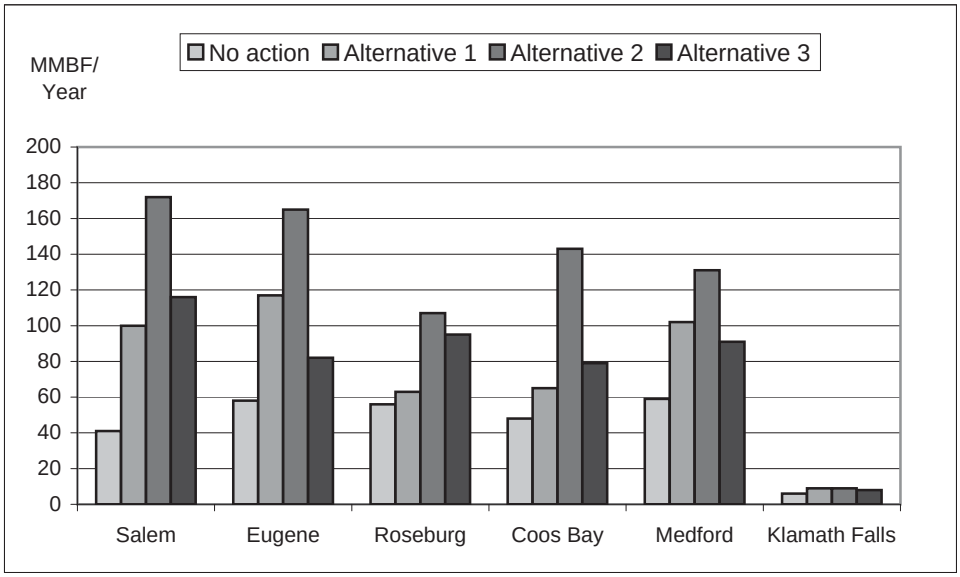


Table 167. Allowable sale quantity by district by alternative

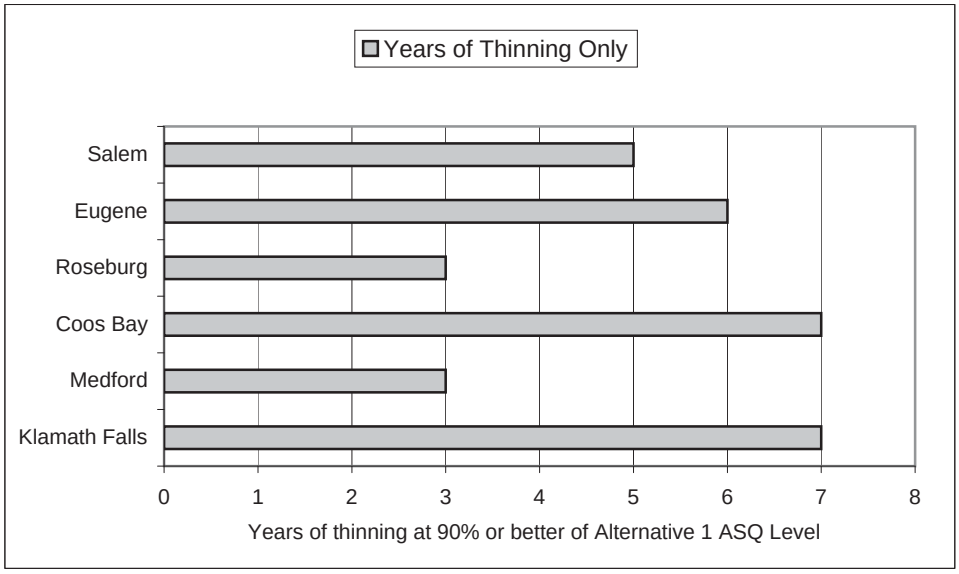
BLM Districts	Allowable Sale Quantity by Alternative (mmbf/year)			
	No Action	Alt. 1	Alt. 2	Alt. 3
Salem	41	100	172	116
Eugene	58	117	165	82
Roseburg	56	63	107	95
Coos Bay	48	65	143	79
Medford	59	102	131	91
Klamath Falls Resource Area (Lakeview District)	6	9	9	8

Subalternatives to Alternative 1 address four questions of how the allowable sale quantity would change in response to variations in available stands and harvest method. Subalternatives were also analyzed for Alternatives 2 and 3.

Alternative 1: Subalternative 1

The first of these subalternatives examined how long a harvest level similar to Alternative 1 would be maintained by only thinning stands that were of an appropriate age and density. A minimum thinning harvest level of 90% of the Alternative 1 allowable sale quantity level was used as a threshold. The results are shown below in *Figure 166 (Alternative 1, Subalternative 1: Allow no regeneration harvesting until thinning opportunities are exhausted)*.

Figure 166. Alternative 1, Subalternative 1: Allow no regeneration harvesting until thinning opportunities are exhausted

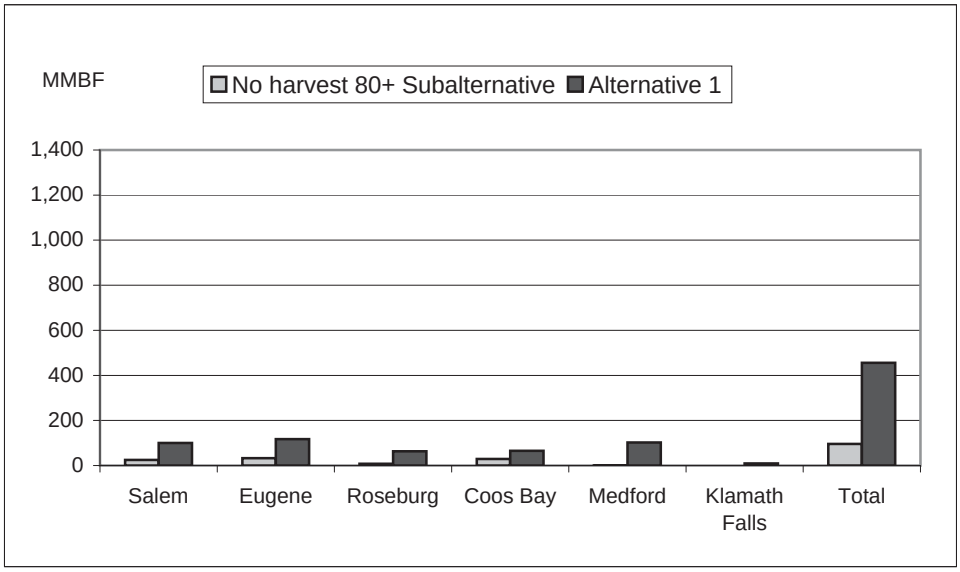


In less than a decade, thinning would no longer be maintained at 90% of the allowable sale quantity. This subalternative demonstrates that high levels of thinning cannot be maintained for extended periods to sustain an allowable sale quantity level.

Alternative 1: Subalternative 2

The second subalternative analyzed for Alternative 1 addressed the effect on the allowable sale quantity if stands currently 80 years of age and older were reserved from harvesting. The sustainable levels of allowable sale quantity are shown below in *Figure 167 (Alternative 1, Subalternative 2: Allow no harvesting of stands that are 80 years of age and older)*.

Figure 167. Alternative 1, Subalternative 2: Allow no harvesting of stands that are 80 years of age and older



The substantial decline in the allowable sale quantity in all districts indicates that the harvest of stands over 80 years of age would be essential to attain the Alternative 1 level of volume harvested. If stands currently over 80 years of age were reserved from harvesting, the allowable sale quantity for the planning area would fall to 96 mmbf per year, which would be 21% of Alternative 1's allowable sale quantity. Specifically:

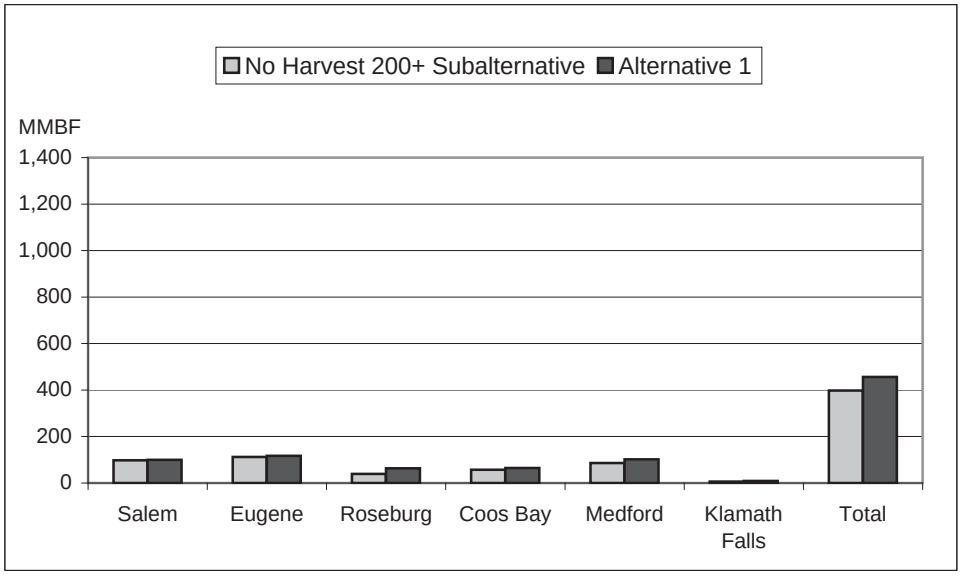
- The effects would vary by district with the highest harvest level being in the Eugene District at 33 mmbf per year.
- The highest percentage level would be in the Coos Bay District where the allowable sale quantity would be 29 mmbf per year, which would be 45% of Alternative 1's allowable sale quantity.

- The Roseburg and Medford districts would be greatly affected with the allowable sale quantity in the Roseburg District dropping to 8 mmbf per year, which would be 13% of Alternative 1's allowable sale quantity.
- The allowable sale quantity in the Medford District would drop to 1 mmbf per year, which would be less than 1% of Alternative 1's allowable sale quantity.

Alternative 1: Subalternative 3

The third subalternative analyzed for Alternative 1 addressed the effect on the allowable sale quantity if stands currently 200 years of age and older were reserved from harvesting. The allowable sale quantity is shown in *Figure 168 (Alternative 1, Subalternative 3: Allow no harvesting of stands that are 200 years of age and older).*

Figure 168. Alternative 1, Subalternative 3: Allow no harvesting of stands that are 200 years of age and older



Under this subalternative, the allowable sale quantity for the planning area would drop to 398 mmbf per year, which is 87% of Alternative 1's allowable sale quantity. Specifically:

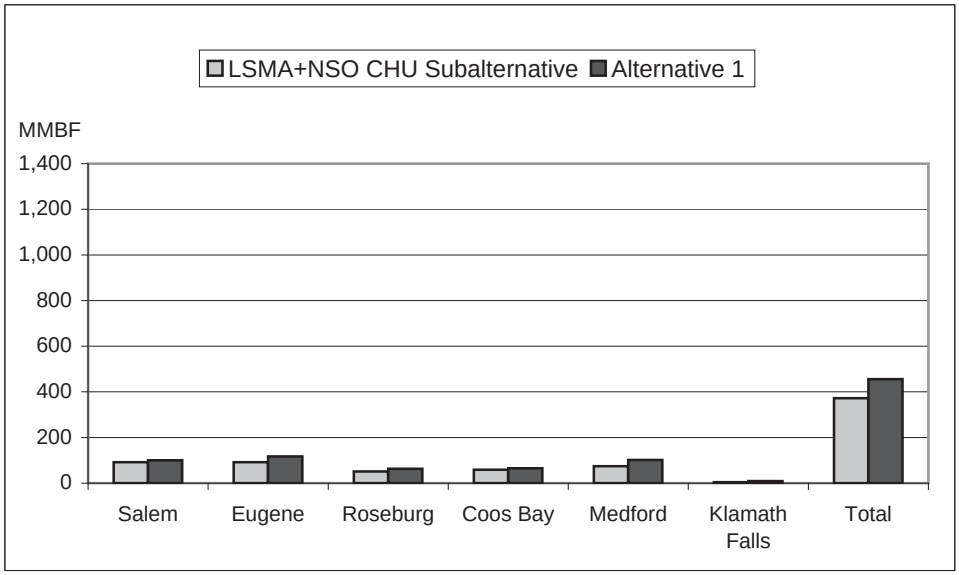
- The Salem District's allowable sale quantity would be the least affected as a percentage by retaining 98 mmbf per year, which would be 98% of Alternative 1's allowable sale quantity, because the Salem District has a substantial acreage of stands between 80 and 200 years of age.
- The Roseburg District would have the greatest percentage drop in allowable sale quantity with the allowable sale quantity dropping to 39 mmbf per year, which is 61% of Alternative 1's allowable sale quantity.

- The Medford District allowable sale quantity would not be as greatly reduced because the Medford District has a substantial acreage of stands between 80 and 200 years of age that could be harvested. Harvest in the Medford District would only drop to 86 mmbf per year, which would be 84% of Alternative 1's allowable sale quantity.

Alternative 1: Subalternative 4

The fourth subalternative examined the consequences of adding the acres of the northern spotted owl critical habitat units that are not already within the late-successional management area to the late-successional management area under Alternative 1. This would reduce the harvest land base acres. The allowable sale quantity for this subalternative is shown in *Figure 169 (Alternative 1, Subalternative 4: Increase the size of the late-successional management area to include all critical habitat of the northern spotted owl).*

Figure 169. Alternative 1, Subalternative 4: Increase the size of the late-successional management area to include all critical habitat of the northern spotted owl



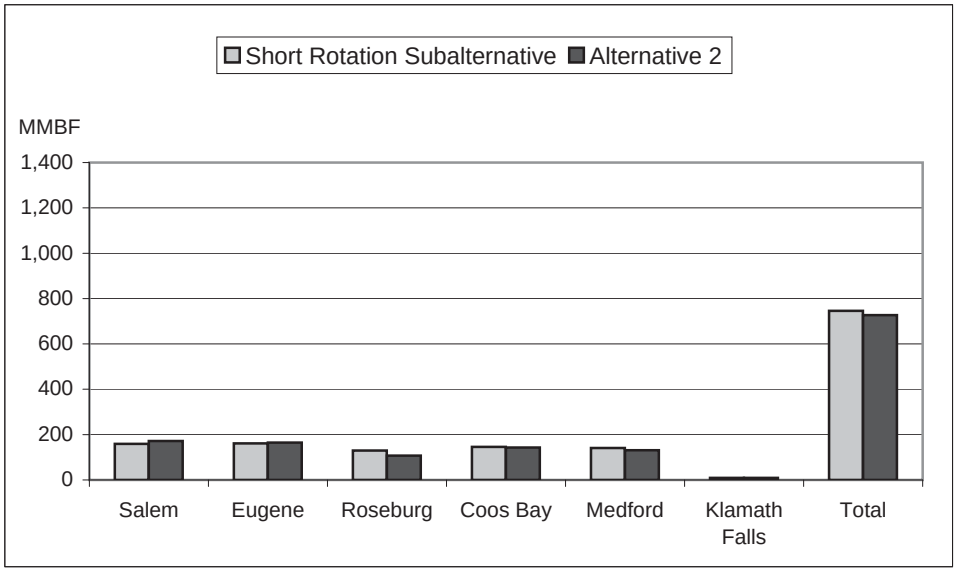
Under this subalternative, the allowable sale quantity for planning area would be reduced to 372 mmbf per year, which would be 82% of Alternative 1's allowable sale quantity. Specifically:

- The Klamath Falls Resource Area would be the most affected with a harvest level of 4 mmbf, which would be 44% of Alternative 1's allowable sale quantity.
- The Salem District would be the least affected with a harvest level of 92 MMBF per year, which would be 92% of Alternative 1's allowable sale quantity.

Alternative 2: Subalternative 1

This subalternative examined the consequences under Alternative 2 of reducing the minimum harvest age to more closely resemble current industrial forest management and removing commercial thinning. The allowable sale quantity of this subalternative is shown in *Figure 170 (Alternative 2, Subalternative 1: Change the rotation to emulate the timber industry's short rotation)*.

Figure 170. Alternative 2, Subalternative 1: Change the rotation to emulate the timber industry's short rotation



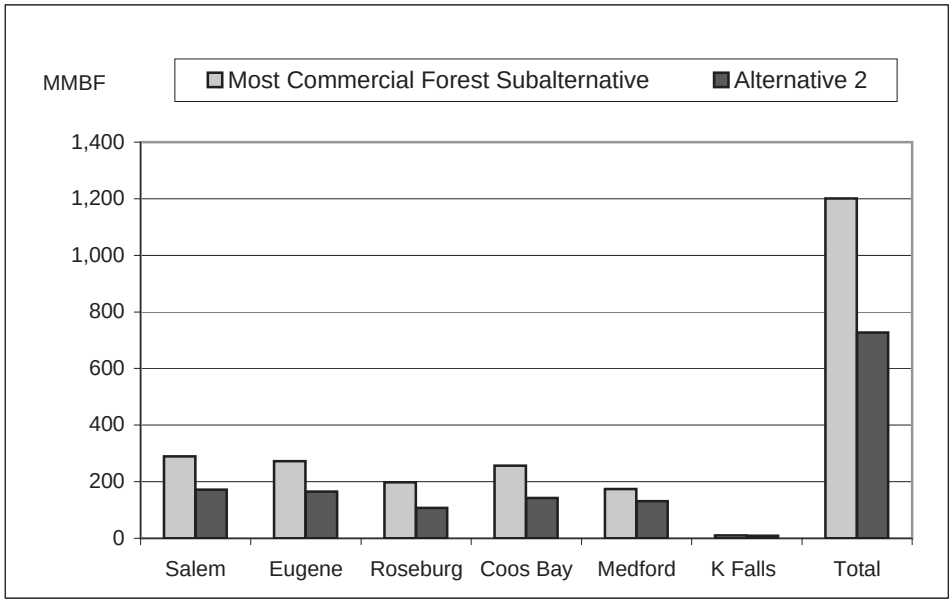
This subalternative would increase the allowable sale quantity to 746 mmbf per year, which would be 103% of Alternative 2's allowable sale quantity. However, the consequences would be different for different districts with the Salem and Eugene districts decreasing in allowable sale quantity, and the Roseburg, Coos Bay, and Medford districts increasing. The existing stand age class distributions of the districts respond differently in this subalternative.

Reference Analysis

A reference analysis of managing most commercial forest lands for timber production was completed.

The results that would occur are shown in *Figure 171 (Reference Analysis: Manage most commercial forest lands for timber production).*

Figure 171. Reference Analysis: Manage most commercial forest lands for timber production



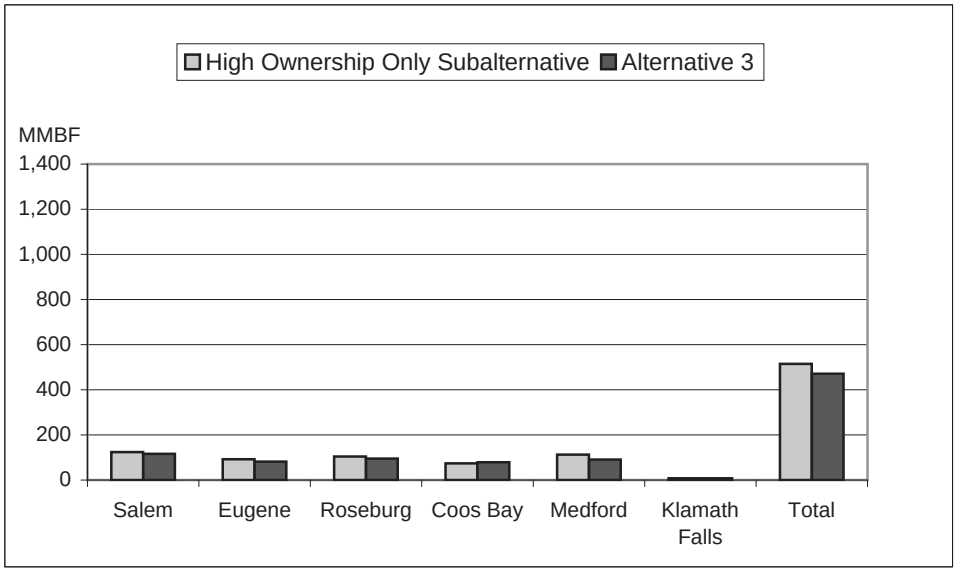
The allowable sale quantity under all of the alternatives is substantially lower than the reference analysis of managing most commercial forest lands for timber production. The total for the planning area would be 1,201 mmbf per year, which would be 165% of Alternative 2's allowable sale quantity. That would be an increase of 474 mmbf per year.

The allowable sale quantities for all four alternatives would be 22%, 38%, 61%, and 39% of the allowable sale quantity of the manage most lands for commercial timber production for the No Action Alternative, Alternative 1, Alternative 2, and Alternative 3, respectively.

Alternative 3: Subalternative 1

This subalternative examined the consequences under Alternative 3 of using landscape thresholds for regeneration harvests, but only in the areas of high BLM ownership. The results are shown in *Figure 172 (Alternative 3, Subalternative 1: Apply the landscape target of 50% in late-successional habitat condition to only those areas where the government land is half or more of the total ownership).*

Figure 172. Alternative 3, Subalternative 1: Apply the landscape target of 50% in late successional habitat condition to only those areas where the government land ownership is half or more of the total ownership



This subalternative increases the allowable sale quantity from Alternative 3 to 515 mmbf per year, which would be 109% of Alternative 3's allowable sale quantity. That would be an increase of 44 mmbf per year.

Changes from 1995 Harvest Land Base and ASQ

The alternatives would vary the portion of the forest allocated to the harvest land base, which has a direct effect on the harvest level by increasing or decreasing the acreage of lands available for sustained harvest.

In 1995, it was estimated that the riparian reserves contained approximately 522,000 acres. Improved riparian reserve estimations, which were completed for these plan revisions, have shown that riparian reserves under the No Action Alternative contain 364,000 acres. Over the past 10 years, the extent of the hydrology network has been more fully mapped and the information regarding fish presence has increased. This improved data of the BLM lands allowed for GIS modeling of the extent of riparian reserves that was not feasible 10 years ago. See *Geographic Information System Data* in the *Introduction* to this chapter.

The allowable sale quantity for the planning area is based on the improved GIS mapping of allocations, new inventory data, and revised growth and yield information. Given the low level of harvests in the last decade, the total standing volume has increased since the 1995 estimations. Therefore, the allowable sale quantity for the No Action Alternative would be 268 mmbf per year, which would be 32% greater than the 203 mmbf per year that was declared as the allowable sale quantity in the 1995 resource management plans.

Nonharvest Land Base Volume

Under the alternatives, timber would be offered each year as allowable sale quantity. In addition, volume from the nonharvest land base would be added to the allowable sale quantity and offered for sale each year. The nonharvest land base volume would result from applying thinning treatments in young stands to accelerate the development of mature and structurally complex forest for stands not in the harvest land base (see the *Introduction* section of this chapter). These thinning harvests would not be sustainable and would decline over time as the young stands in the nonharvest land base become too old for treatment. Under the alternatives, thinnings treatments would occur in:

- the late-successional reserves and riparian reserves under the No Action Alternative,
- the late-successional management areas and riparian management areas under Alternatives 1 and 2, and
- the riparian management areas under Alternative 3.

For some areas in the nonharvest land base, such as National Landscape Conservation System lands, or lands not suitable for sustained timber harvesting, no thinning harvesting is planned. See *Figure 173 (Nonharvest land base volume over time)* for the volume and duration of harvest from the nonharvest land base for all four alternatives.

Figure 173. Nonharvest land base volume over time

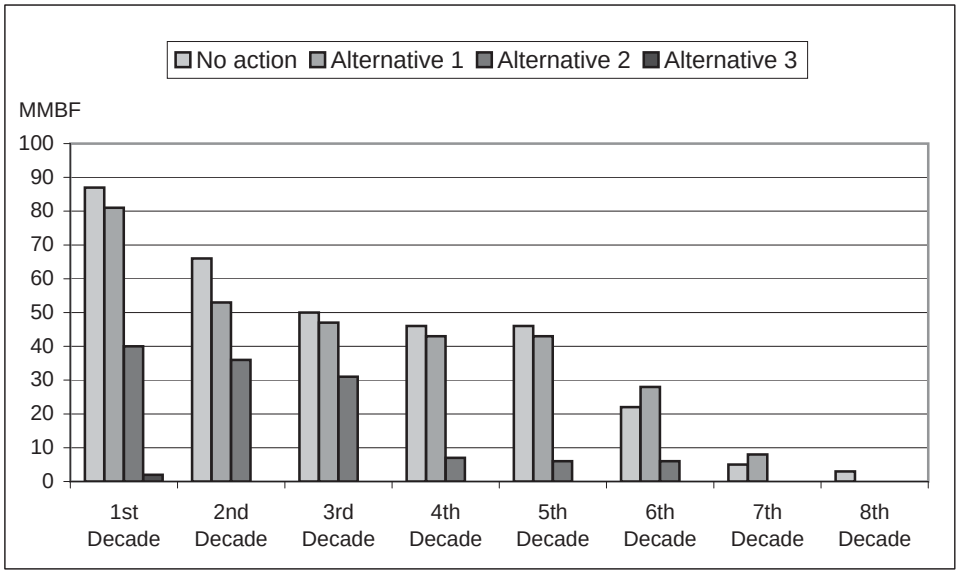


Figure 173 shows that for all four alternatives, the nonharvest land base harvest volume would decline over the entire planning area and would cease by the end of the eighth decade.

See Table 168 (*Nonharvest land base volume over the next 10 years)* for the first decade level of nonharvest land base volume that would occur for the alternatives.

Table 168. Nonharvest land base volume over the next 10 years

BLM Districts	First Decadal Nonharvest Land Base Volume (mmbf)			
	No Action	Alt. 1	Alt. 2	Alt. 3
Salem	32	32	12	2
Eugene	14	14	12	0
Roseburg	12	9	7	0
Coos Bay	26	24	8	0
Medford	3	2	1	0
Klamath Falls Resource Area	0	0	0	0
Totals	**87**	**81**	**40**	**2**

Volume harvested from the nonharvest land base volume is added to the computed allowable sale quantity to determine the total volume that would be annually harvested under the alternatives.

The No Action Alternative would thin more timber volume from the nonharvest land base than the other alternatives because the No Action Alternative would have the largest acreage in the nonharvest land base of all four alternatives. The additional volume from these lands outside the harvest land base would be an additional 32% of the allowable sale quantity for the No Action Alternative. The No Action Alternative would restrict thinning to stands less than 80 years of age (except for the North Coast Adaptive Management Area, where the limit would be 110 years). Alternatives 1, 2, and 3 would not restrict nonharvest land base thinning by stand age. Through thinning, Alternative 1 would generate an additional 18% above the allowable sale quantity. The level of Alternative 2 would be 5% and Alternative 3 would be less than 1%.

In addition to the allowable sale quantity and nonharvest land base volume, the eastern management lands of the Klamath Falls Resource Area would add an additional 2 mmbf under all four alternatives.

Total Harvest Volume Level

The allowable sale quantity, the nonharvest base volume, and the eastern management land volume comprise the total harvest volume level. This level is shown below by district and alternative for the first decade in *Figure 174 (Total annual volume level by alternative over the next 10 years),* and in *Table 169 (Total annual volume by district over the next 10 years).*

Figure 174. Total annual volume level by alternative over the next 10 years

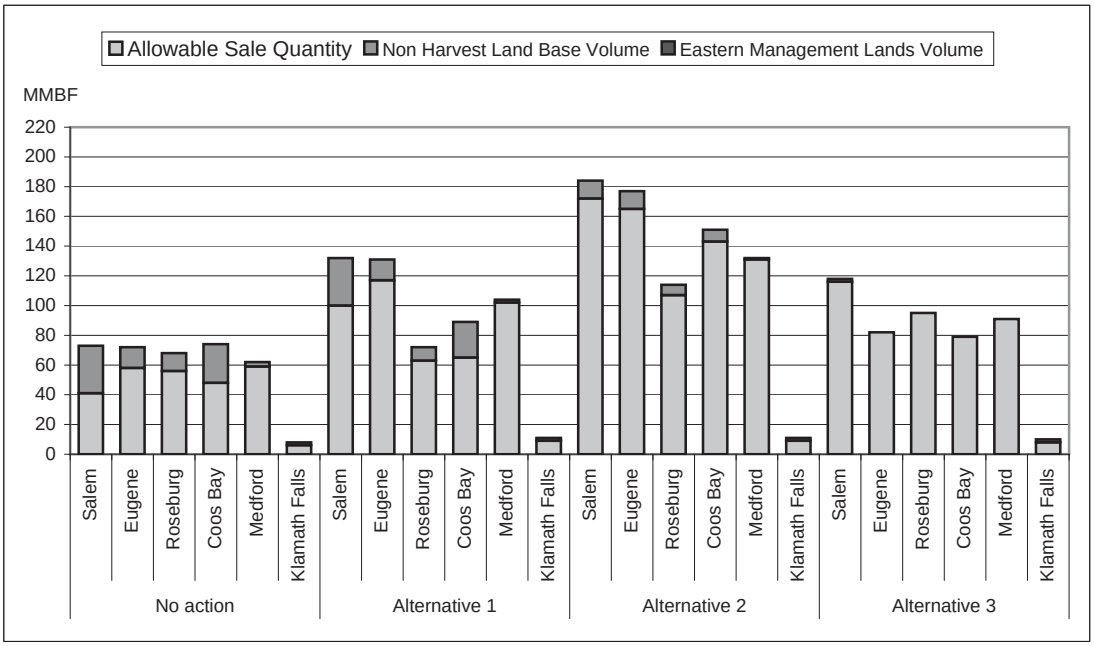
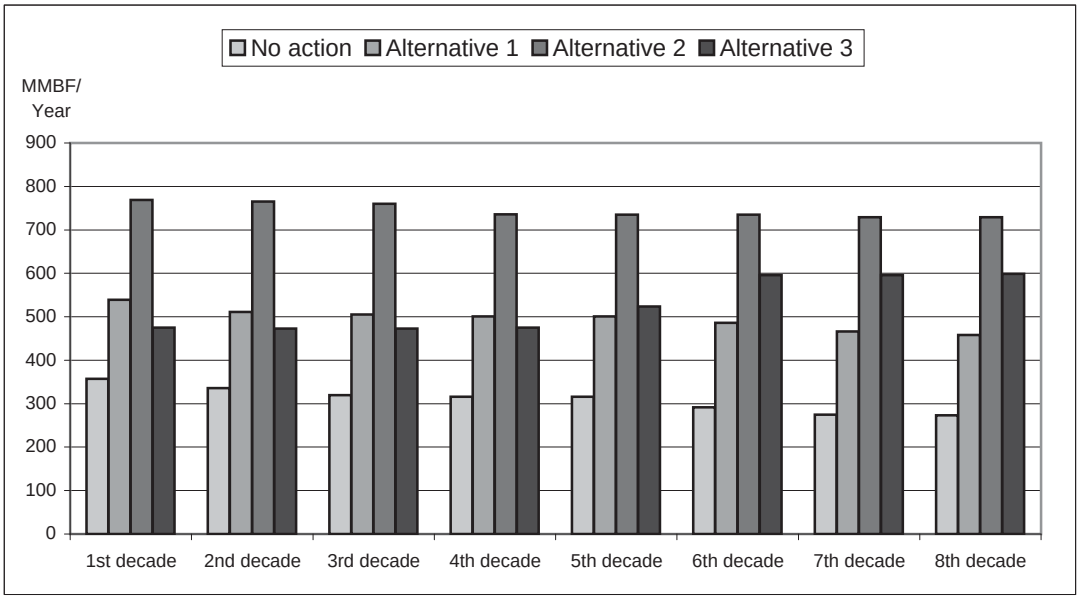


Table 169. Total annual volume by district over the next 10 years

Alternatives	First Decadal Annual Harvested Volume by BLM District (mmbf)						Totals
	Salem	Eugene	Roseburg	Coos Bay	Medford	Klamath Falls	
No Action	73	72	68	74	62	8	357
Alternative 1	132	131	72	89	104	11	539
Alternative 2	184	177	114	151	132	11	769
Alternative 3	118	82	95	79	91	10	475

As a result of the declining nonharvest land base volume, the total volume harvested would decrease over the first eight decades, except for Alternative 3 where the attainment of landscape objectives would permit the sustainable allowable sale quantity to increase. The volume harvested by decade is shown in *Figure 175 (Total harvest volume by decade and alternative).*

Figure 175. Total harvest volume by decade and alternative



Age of Stands Harvested

The ages of the stands that would be harvested vary by alternative. The No Action Alternative would harvest proportionally less mature and structurally complex forest and a higher amount of younger forest than the action alternatives. Specifically:

- Under the No Action Alternative, the allowable sale quantity harvest volume from forests older than 200 years during the first decade would be 19 mmbf per year, which would be 7% of the allowable sale quantity harvest volume.
- Under Alternatives 1, 2, and 3, the allowable sale quantity from forests older than 200 years during the first decade would be 98 mmbf per year (21 %), 175 mmbf per year (24%), and 99 mmbf per year (21%), respectively.

The following four figures (*Figures 176* through *Figure 179*) show the volumes that would be harvested by age class by alternative during the first decade. These figures include both allowable sale quantity and nonharvest land base volumes.

Figure 176. Timber volume harvest by age class under the No Action Alternative over the next 10 years

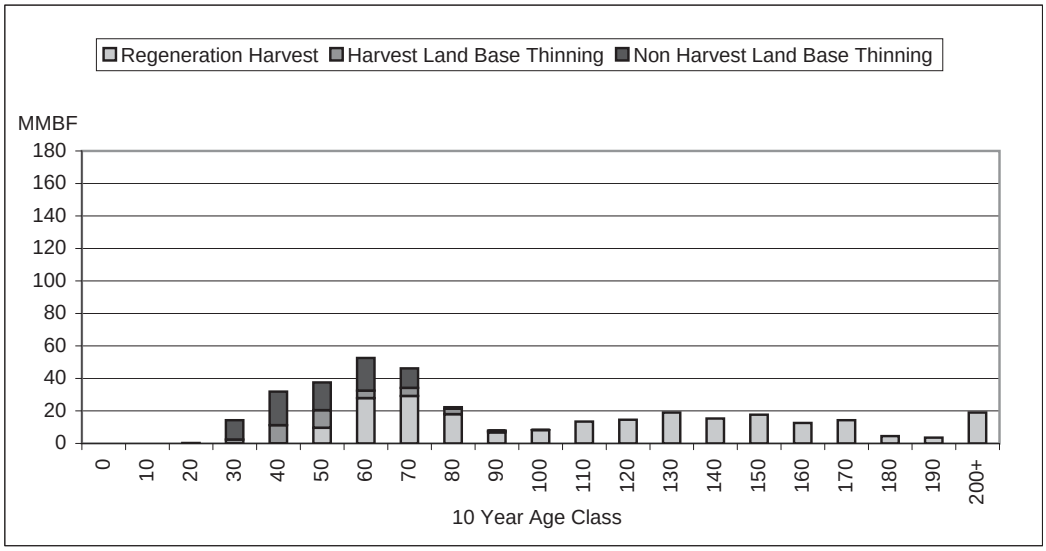


Figure 177. Timber volume harvest by age class under Alternative 1 over the next 10 years

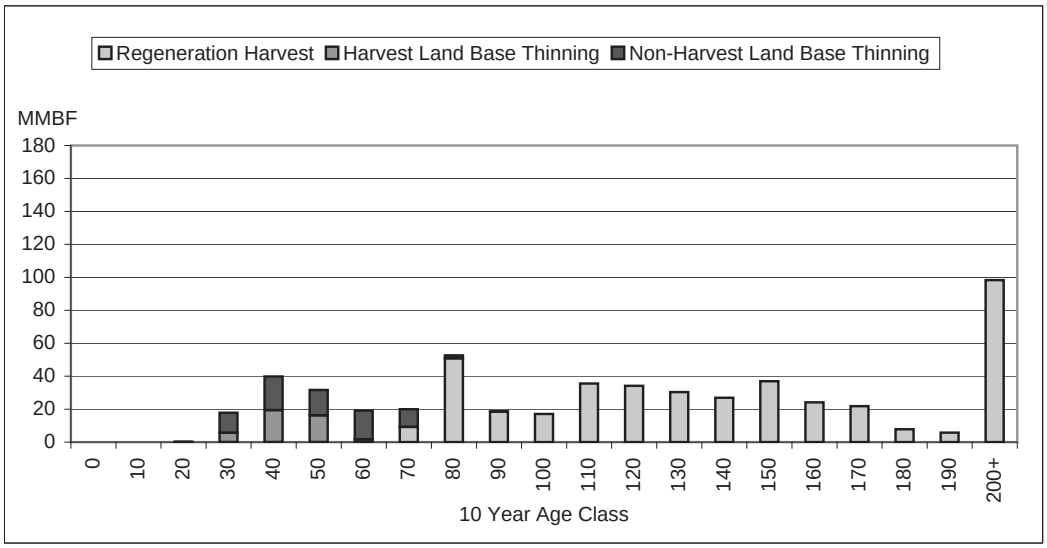


Figure 178. Timber volume harvest by age class under Alternative 2 over the next 10 years

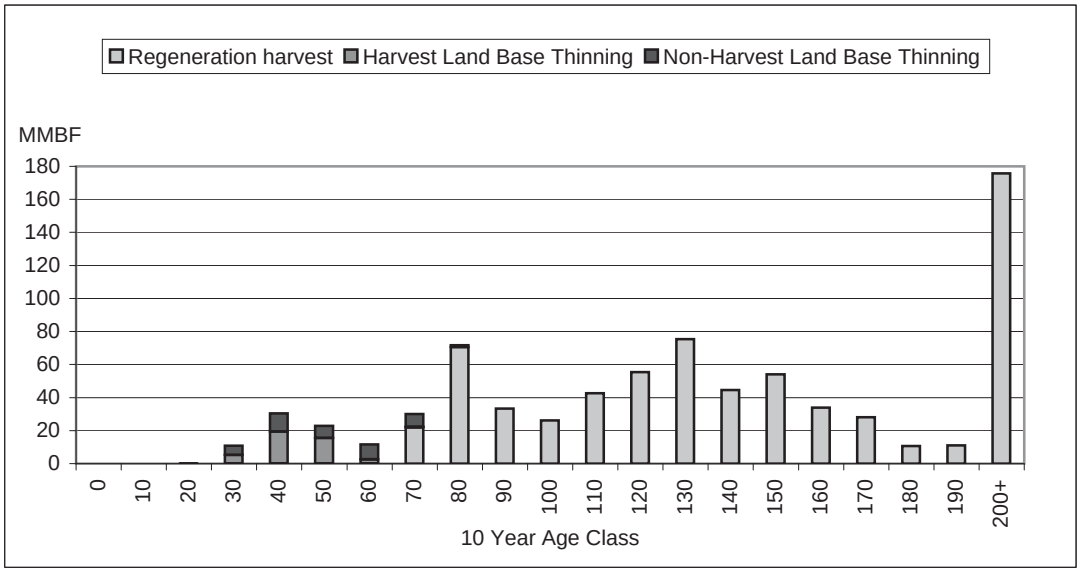
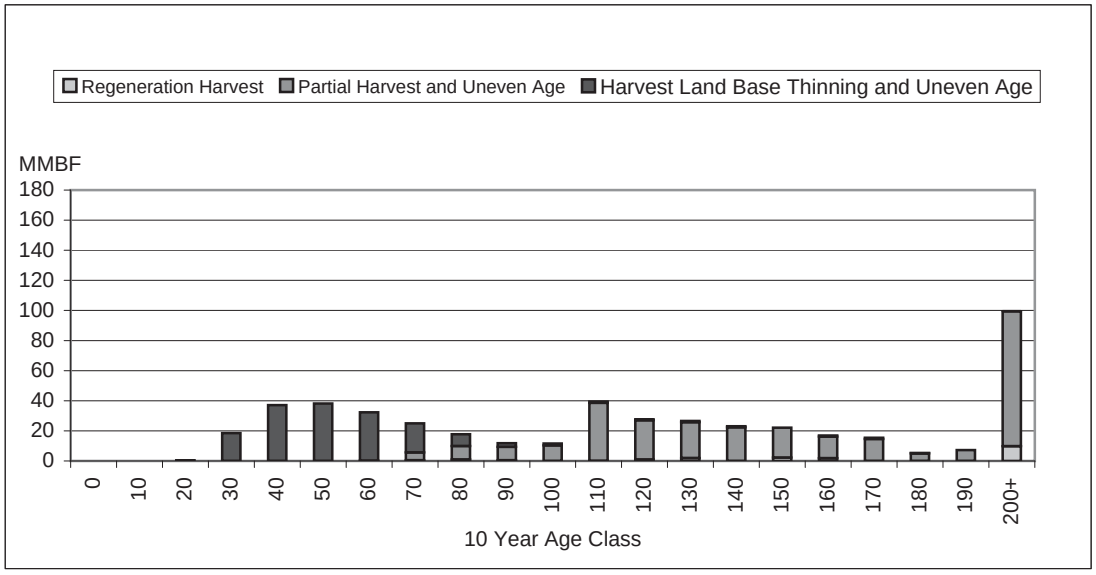


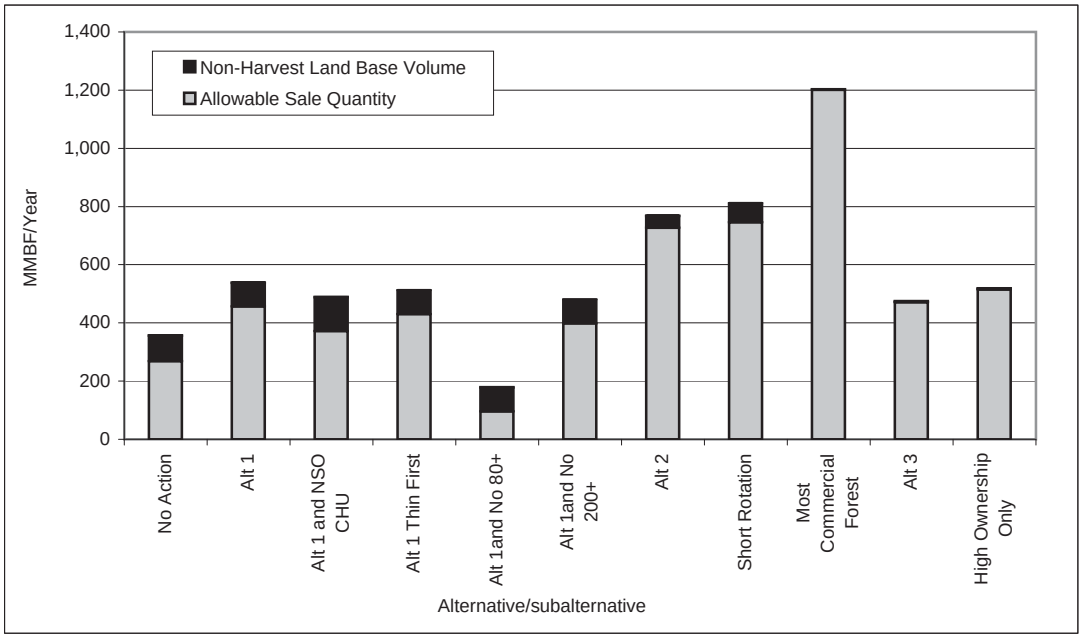
Figure 179. Timber volume harvest by age class under Alternative 3 over the next 10 years



Summary of Timber Harvest levels

The total volume harvested annually would vary substantially between the subalternatives and alternatives. Subalternatives change not only in the allowable sale quantity but also the amount on nonharvest base volume that would be produced. The total volume for the alternatives and subalternatives is shown in *Figure 180 (Total volume harvested for all four alternatives and subalternatives).*

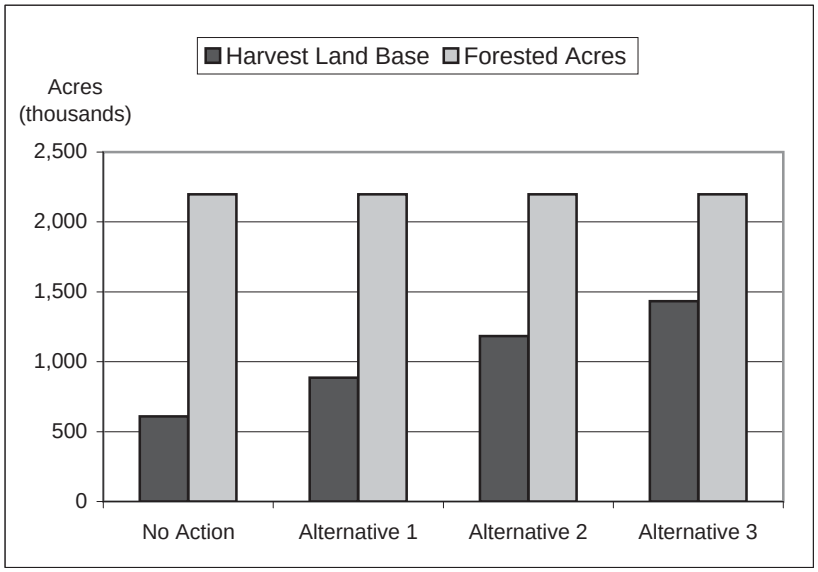
Figure 180. Total volume harvested for all four alternatives and subalternatives



Harvest Land Base

The harvest land base varies by alternative. The No Action Alternative has the lowest number of acres within the harvest land base. This alternative has 27% of the forested acres contained within the harvest land base (nearly 608,000 acres). Alternative 3 has the highest amount with 65% of the forested acres being contained within the harvest land base (1.4 million acres). *Figure 181 (Acres in the harvest land base by alternative)* displays the acres for the alternatives contrasted with the total forested acres.

Figure 181. Acres in the harvest land base by alternative



Value of the Harvest

Log Quality

The differences in the ages of the stands and the species composition of those stands that would be harvested under the alternatives would result in different types and grades of logs being removed. The structural stage classification described in the *Ecology* section of *Chapter 3* is used as one basis for determining the log quality and the value resulting from these harvests. The differences in species that occur in each district would also affect the value of the harvests for each alternative. Historical sales data has been used to estimate the percentage of harvest volume by species or groups of species. Individual species have been consolidated into groupings that are typical of those quoted for prices, such as true firs and hemlock being grouped into whitewoods. Historical sales data has also been used to estimate the amount of different log grades that would result from harvesting each structural stage. See *Appendix D – Timber* for further discussion on the methodology to value the timber that would be produced under each alternative.

The percentages of volume by structural stage that would be harvested are shown in *Figure 182 (Percent volume by structural stage)* as the average annual level for the first 10-year period. Volume is from both the harvest land base and nonharvest land base. The volumes of harvest by structural stage are shown in *Figure 183 (Volume by structural stage and alternative).*

Figure 182. Percent volume by structural stage

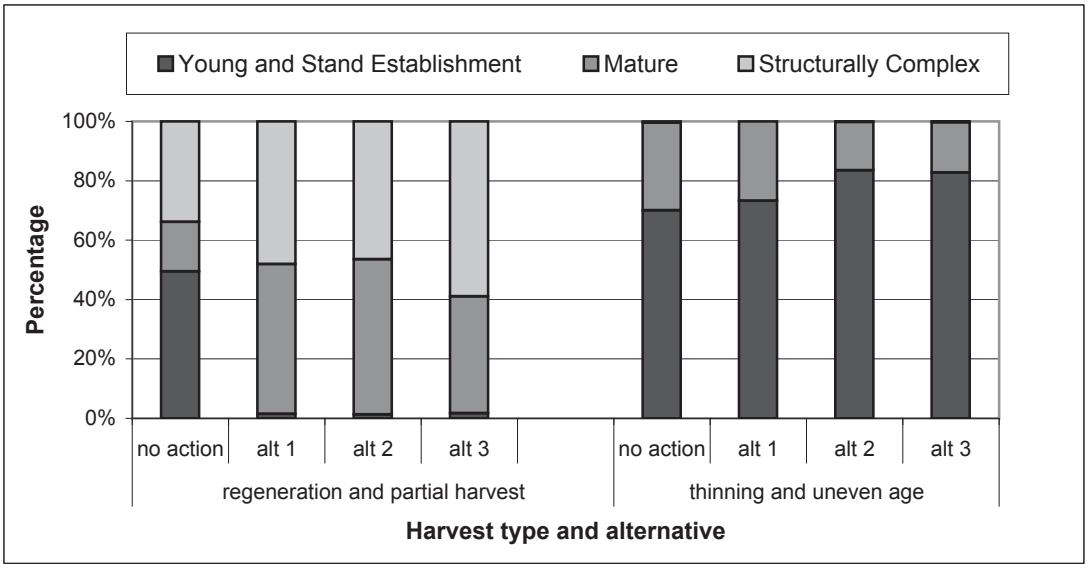
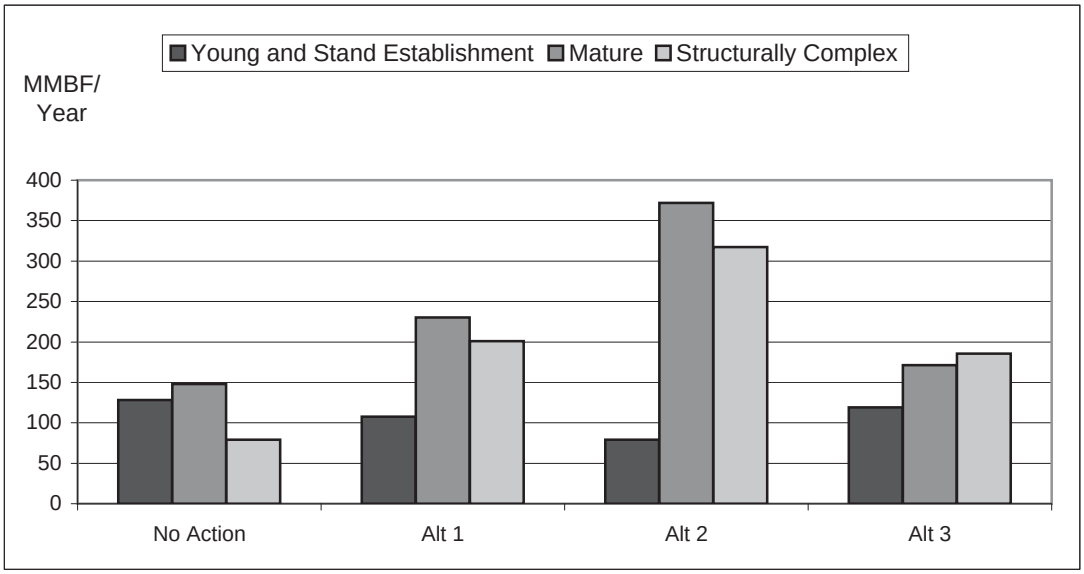


Figure 183. Volume by structural stage and alternative



Both as a percentage and in quantity, the No Action Alternative would harvest less structurally complex forest than the action alternatives. Under the No Action Alternative, there would be substantially more regeneration harvesting of young forest than for the action alternatives.

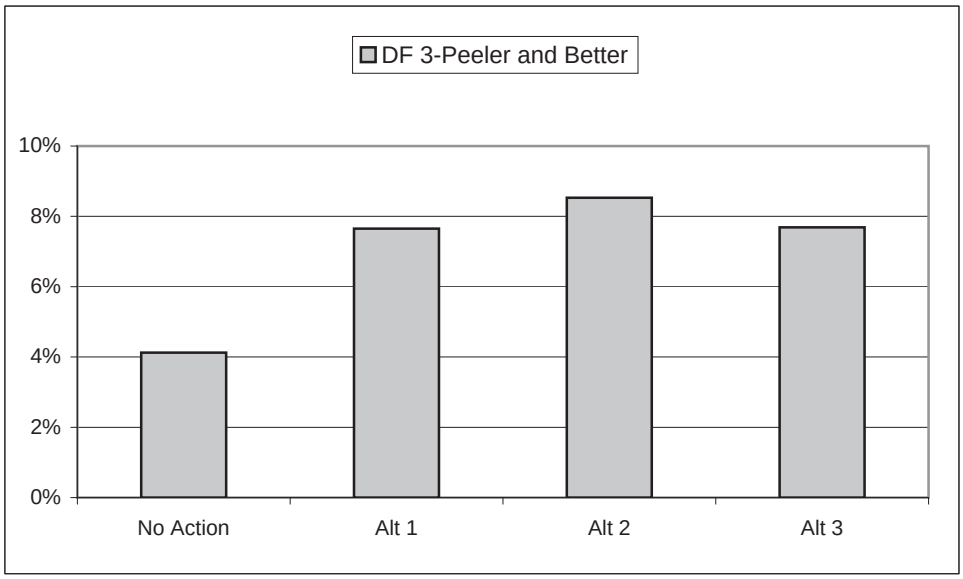
The action alternatives would all have similar percentage levels of harvest from structurally complex forest, but would vary in quantity. As a result, the percentage levels of higher-grade logs (number 3, peeler-grade and better Douglas fir) would be higher under the action alternatives than the No Action Alternative. The action alternatives would harvest similar percentages of peeler grade Douglas fir logs in the first decade.

Log quality for the first 10 year period is determined only for Douglas fir due to the dominance of Douglas fir in all districts. Historically, except for the Klamath Falls Resource Area, Douglas fir has been approximately 80% of the volume of timber sold. Two log grade groups are used for log quality analysis:

- number 3, peeler-grade and better
- sawlog grade

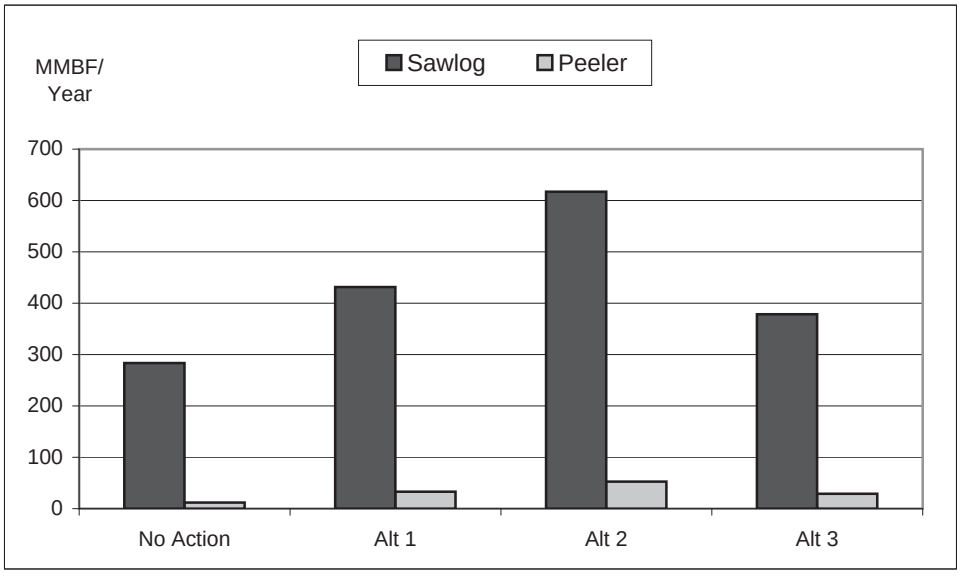
The percentage level of Douglas fir volume by peeler grade that would be harvested by alternative is shown in *Figure 184 (Percentage of number 3, peeler-grade and better Douglas fir logs by alternative).*

Figure 184. Percentage of number 3, peeler-grade and better Douglas fir logs by alternative



Under the alternatives, there are differing levels of harvest volume. The quantities of peeler-grade logs compared to sawlog-grade logs are shown in *Figure 185 (Douglas fir log volumes by peeler grade and sawlog grade by alternative)*.

Figure 185. Douglas fir log volumes by peeler grade and sawlog grade by alternative



Under the No Action Alternative, there would be a reduced level in the quality of logs as a percentage and in the quantity harvested compared to the action alternatives because of the higher proportion of thinning and the lower proportion of the structurally complex forest that would be harvested compared to the action alternatives.

Stumpage Value

The value of the timber harvests for each alternative is the product of the harvest levels and the anticipated stumpage price.

The anticipated stumpage price is influenced by the pond value and the cost associated with harvesting.

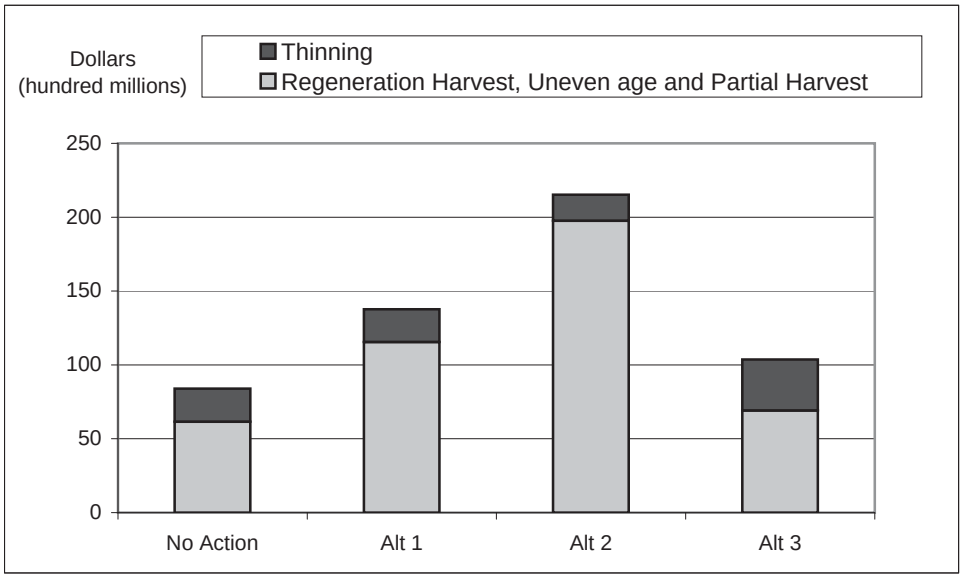
The pond value is the market value of the logs at a processing facility. The pond value is affected by the quality and species of harvested logs. Douglas fir is the primary commercial species within the planning area. In the Medford District and Klamath Falls Resource Area, ponderosa pine, white fir, and sugar pine are also important. Only these species have been divided by grade as a part of valuation. Other species have not been split by grade because of low occurrence, or because they are typically purchased as "camp run" where one price is quoted for all sizes and grades. Historical information indicates that other than the four above species, the level of higher grade logs was low relative to the total volume of other species.

The costs associated with harvesting, such as falling, logging, transportation, and road construction, reduce the price received for timber that would be sold. Stumpage is the residual value after the costs to get the log from the standing tree in the forest to where it is manufactured are subtracted from the pond value. The costs of such requirements as road construction that is needed to access timber have been estimated using costs from actual sales with a base period of 1995 through 2006. See *Appendix D – Timber* for further information.

The stumpage value of the harvests over the first 10 years is the product of the volumes for each type of harvest (i.e., thinning, partial harvesting, regeneration harvesting, and uneven-aged management) and structural stage (i.e., stand establishment, young, mature, and structurally complex) multiplied by the expected stumpage price for each harvest type. Stumpage prices for each harvest type are developed from historical costs and log prices.

The values shown in *Figure 186 (Annual stumpage value by alternative over the next 10 years)* are calculated using 2005 log prices. Values are in 2005 dollars without adjustment for inflation.

Figure 186. Annual stumpage value by alternative over the next 10 years

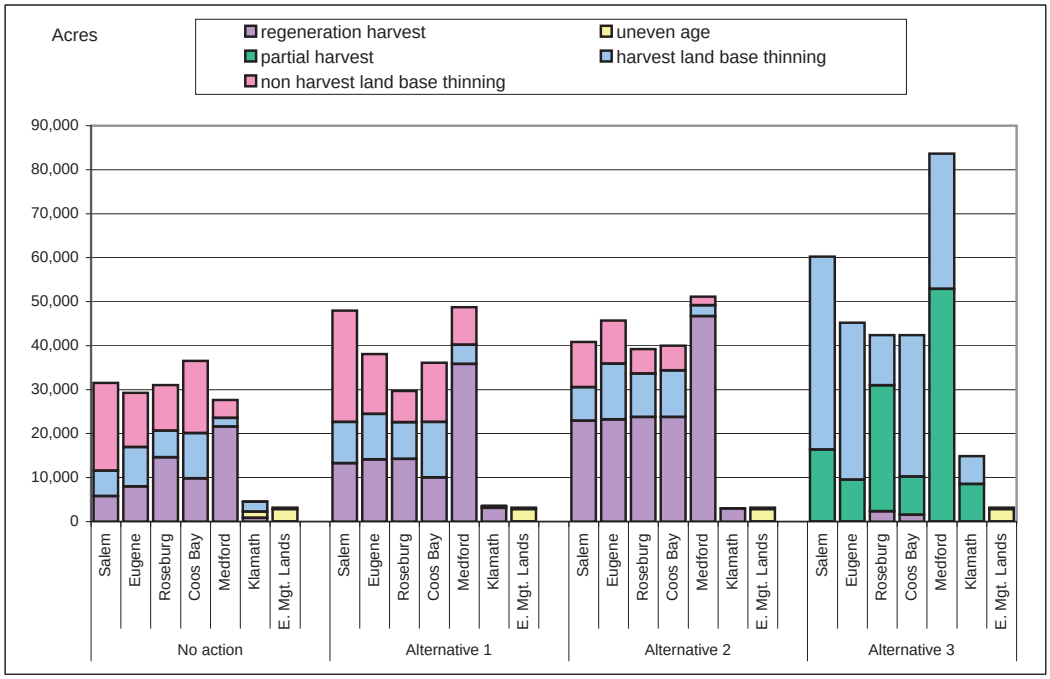


Type of Harvest

The different types of harvest that occur under the alternatives include thinning, uneven-aged management, partial harvesting, and regeneration harvest. Thinning can occur in both the harvest land base and the nonharvest land base.

The harvest levels by harvest type under each alternative over the next 10 years are shown in *Figure 187 (Harvest acres by harvest type over the next 10 years).*

Figure 187. Harvest acres by harvest type over the next 10 years



The different alternatives would vary in the age classes that receive regeneration harvesting, partial harvesting, uneven-aged management, or thinning. The acres harvested over the next 10 years by age class are shown in the next four figures (*Figure 188* through *Figure 191*) and the next four tables (*Table 170* through *Table 173*).

During the first decade under the No Action Alternative, approximately 10% of the harvest land base would be regeneration harvested, which is 2.7% of the total forested acres within the planning area. Harvest land base thinning would occur on 6% of the harvested land base with both types of thinning (harvest land base and nonharvest land base) occurring on 4.6% of the forested acres. See *Figure 188* and *Table 170*.

Figure 188. Harvest acres by age class under the No Action Alternative

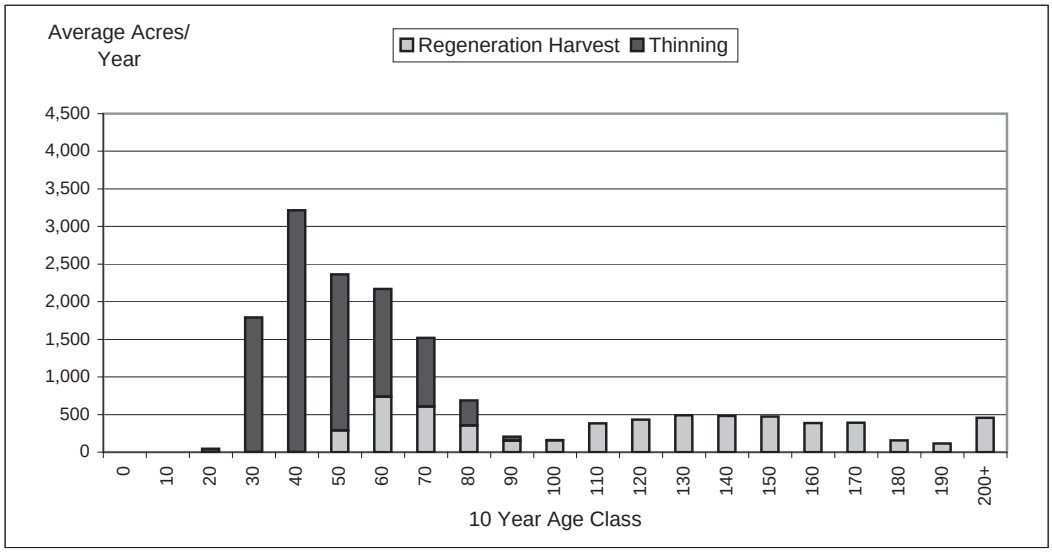


Table 170. Acres harvested by age group compared with the size of the total harvest land base under the No Action Alternative

No Action Alternative		First Decade Harvest		
Age Group (years)	Total Harvest Land Base (acres)	Harvest Land Base		Nonharvest Land Base
		Regeneration Harvesting (acres)	Thinning (acres)	Thinning (acres)
0 to 30	151,800	0	3,200	15,100
40 to 70	190,900	16,300	28,900	47,500
80 to 110	101,000	10,400	3,700	600
120 to 150	71,800	18,700	400	0
160 to 190	33,300	10,500	100	0
200+	58,800	4,600	500	0
Totals	**607,600**	**60,500**	**36,800**	**63,200**

During the first decade under Alternative 1, approximately 10% of the harvest land base would be regeneration harvested, which is 4.1% of the total forested acres within the planning area. Harvest land base thinning would occur on 5% of the harvested land base with both types of thinning (harvest land base and nonharvest land base) occurring on 5.1% of the forested acres. See *Figure 189* and *Table 171*.

Figure 189. Harvest acres by age class under Alternative 1

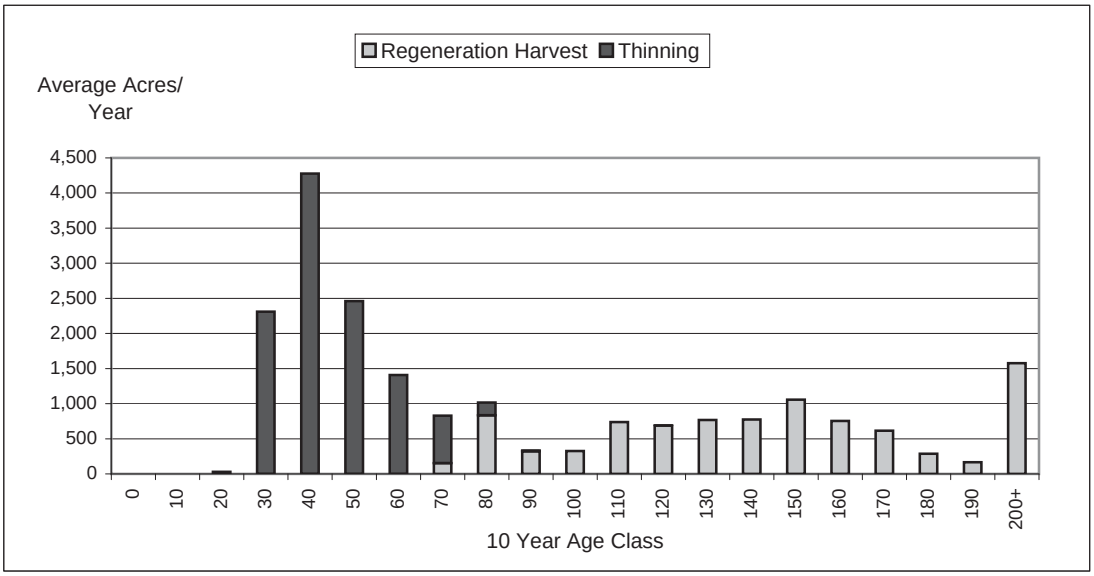


Table 171. Acres harvested by age group compared with the size of the total harvest land base under Alternative 1

Alternative 1		First Decade Harvest		
Age Group (years)	Total Harvest Land Base (acres)	Harvest Land Base		Nonharvest Land Base
		Regeneration Harvesting (acres)	Thinning (acres)	Thinning (acres)
0 to 30	204,600	0	7,400	16,000
40 to 70	282,400	1,500	37,500	50,600
80 to 110	144,100	22,200	500	1,400
120 to 150	109,500	32,900	0	0
160 to 190	53,100	18,200	0	0
200+	92,100	15,800	0	0
Totals	**885,800**	**90,600**	**45,400**	**68,000**

During the first decade under Alternative 2, approximately 12% of the harvest land base would be regeneration harvested, which is 6.5% of the total forested acres in the planning area. Harvest land base thinning would occur on 3.6% of the harvested land base with both types of thinning (harvest land base and nonharvest land base) occurring on 3.5% of the forested acres. See *Figure 190* and *Table 172*.

Figure 190. Harvest acres by age class under Alternative 2

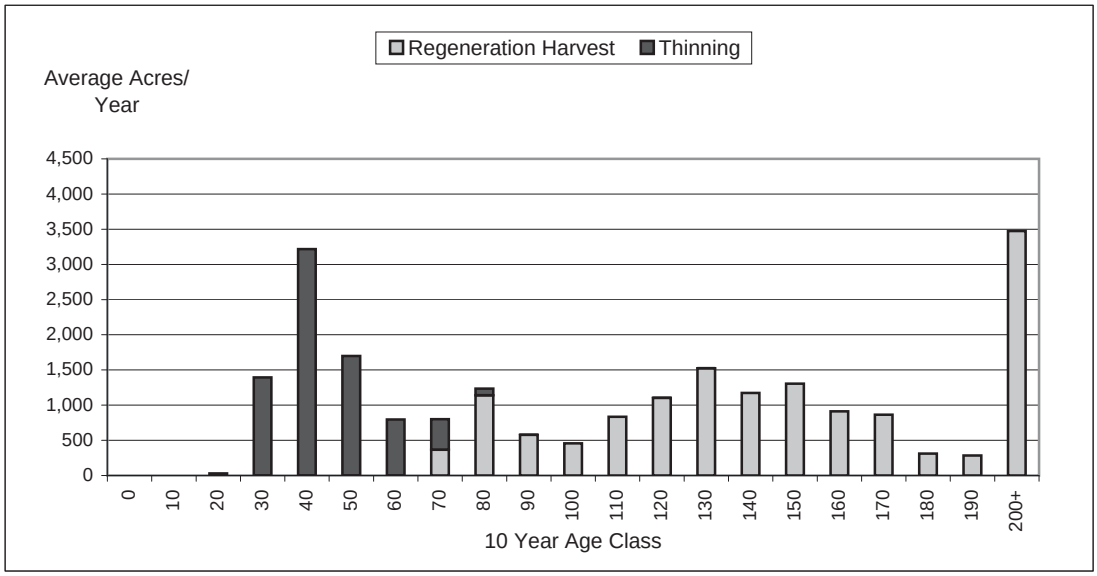


Table 172. Acres harvested by age group compared with the size of the total harvest land base under Alternative 2

Alternative 2		First Decade Harvest		
		Harvest Land Base		Nonharvest Land Base
Age Group (years)	Total Harvest Land Base (acres)	Regeneration Harvesting (acres)	Thinning (acres)	Thinning (acres)
0 to 30	279,000	0	6,800	7,400
40 to 70	346,600	3,700	36,300	25,200
80 to 110	169,300	30,100	200	800
120 to 150	163,600	51,100	0	0
160 to 190	72,100	23,700	0	0
200+	152,400	34,800	0	0
Totals	**1,183,000**	**143,400**	**43,300**	**33,400**

During the first decade under Alternative 3, approximately 0.3% of the harvest land base would be regeneration harvested, which is 0.2% of the total forested acres within the planning area. Partial harvesting would occur on 8.7% of the harvest land base, which is 5.7% of the forested acres. And harvest land base thinning would occur on 11% of the harvest land base, which is 7.3% of the forested acres. See *Figure 191* and *Table 173*.

Figure 191. Harvest acres by age class under Alternative 3

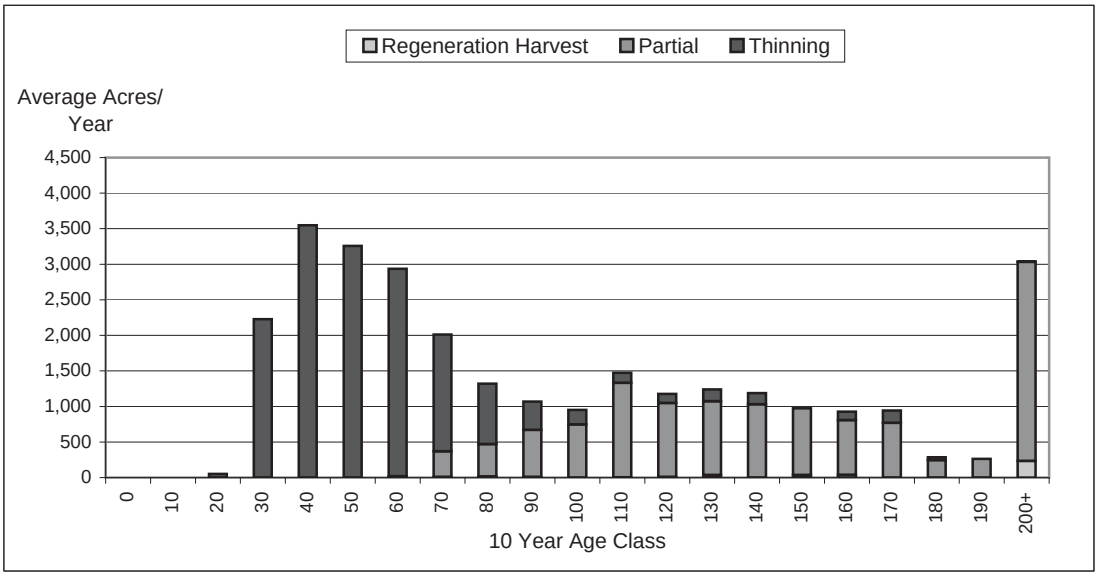


Table 173. Acres harvested by age group compared with the size of the total harvest land base under Alternative 3

Alternative 3		First Decade Harvest		
		Harvest Land Base		Nonharvest Land Base
Age Group (years)	Total Harvest Land Base (acres)	Regeneration Harvesting (acres)	Thinning (acres)	Thinning (acres)
0 to 30	377,100	0	22,800	0
40 to 70	445,700	100	117,500	0
80 to 110	201,400	300	47,800	0
120 to 150	160,100	800	44,900	0
160 to 190	83,200	400	23,800	0
200+	166,700	2,300	28,100	0
Totals	1,434,200	3,900	284,900	0

Under all four alternatives, the acres harvested would decline over time as the nonharvest land base thinning declines and as harvesting begins to shift to managed stands with higher expected yields. See *Figures 192* through *Figure 195* for the average annual harvested acres by harvest type over the next 100 years for each alternative.

Figure 192. No Action Alternative, average annual harvested acres by harvest type over the next 100 years

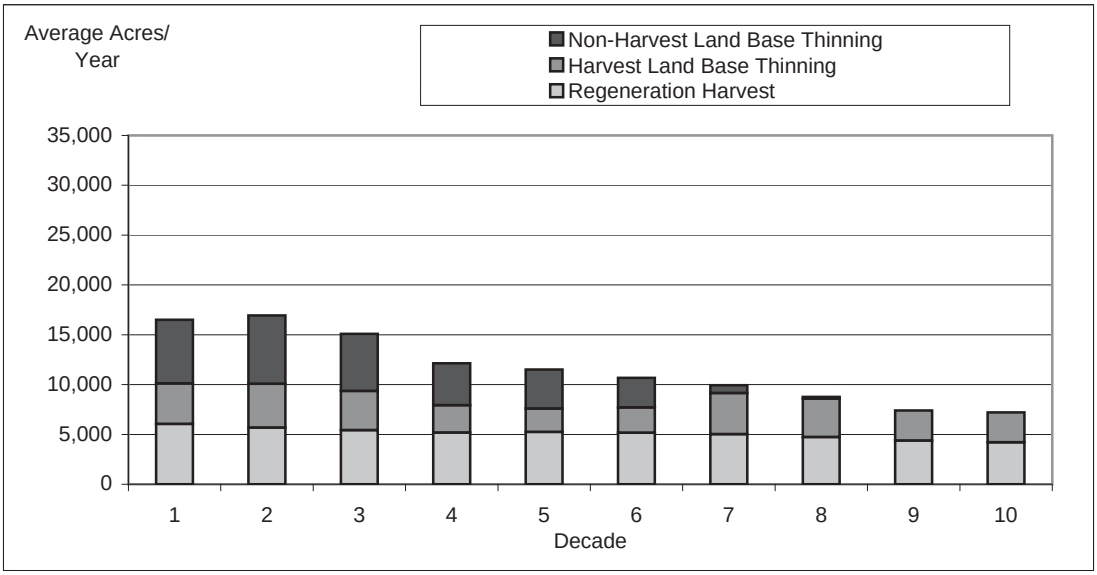


Figure 193. Alternative 1, annual average harvested acres by harvest type over the next 100 years

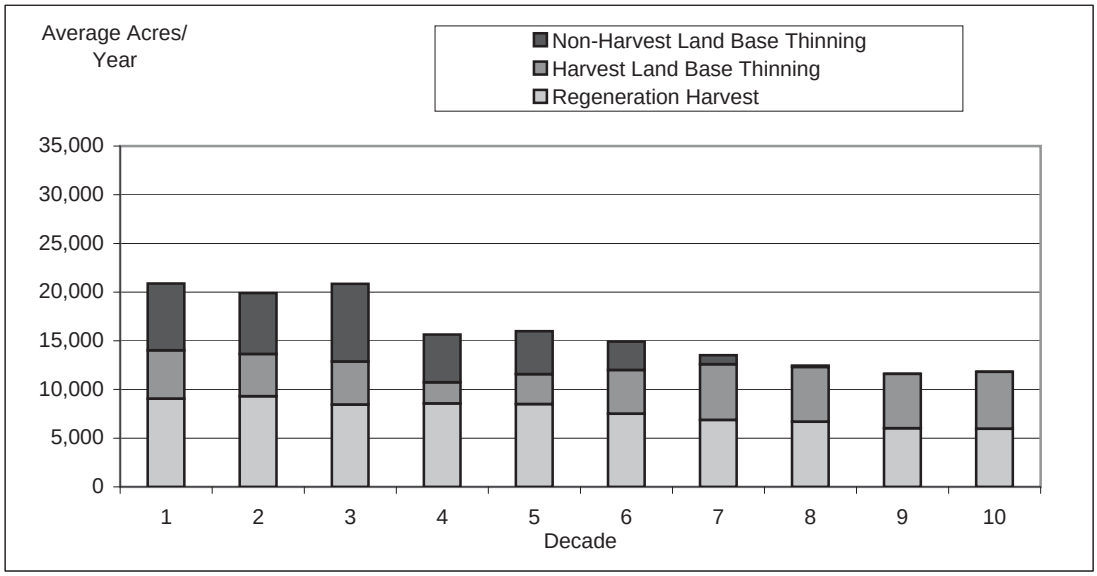


Figure 194. Alternative 2, average annual harvested acres by harvest type over the next 100 years

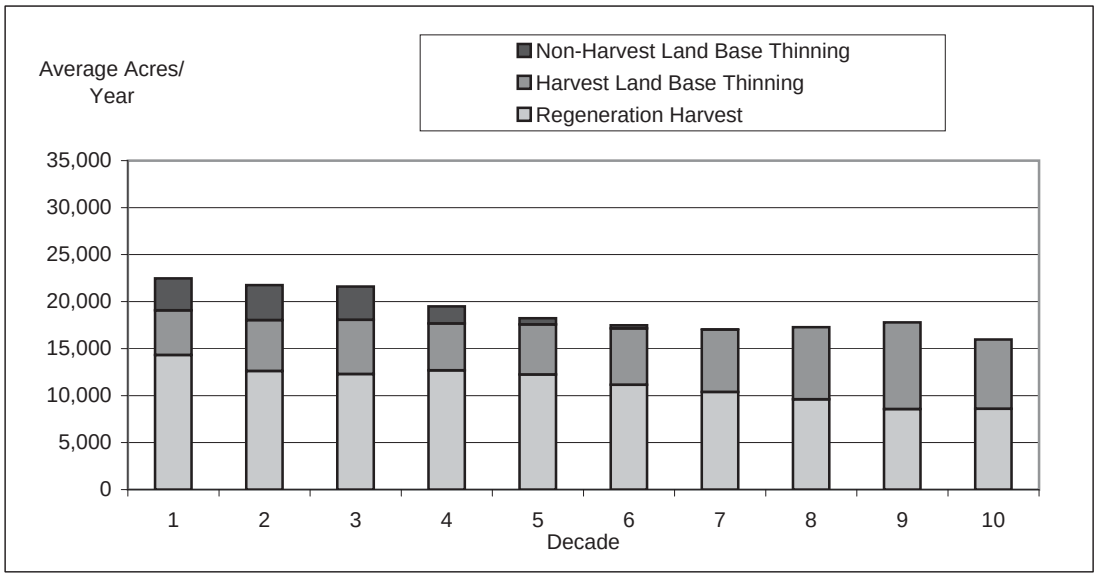
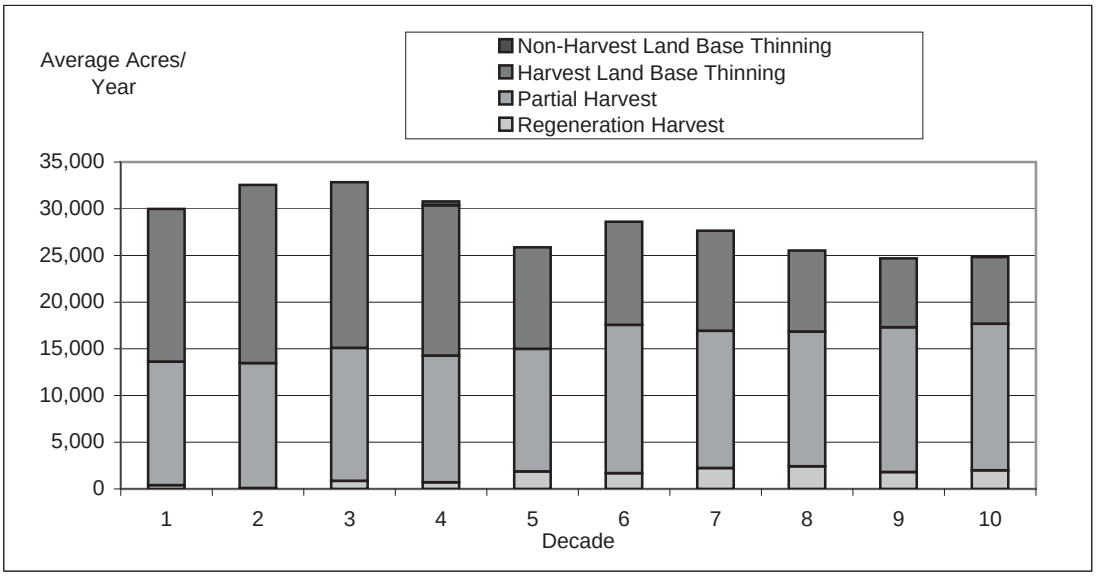


Figure 195. Alternative 3, average annual harvested acres by harvest type over the next 100 years



Under all four alternatives, some forest land would be converted to roads and landings in order to implement timber management activities. New permanent road construction under the alternatives over the next 10 years are shown in *Figures 196 (Miles of new permanent road construction under each alternative)* and *Figure 197 (Acres of new permanent road construction under each alternative).*

Figure 196. Miles of new permanent road construction under each alternative

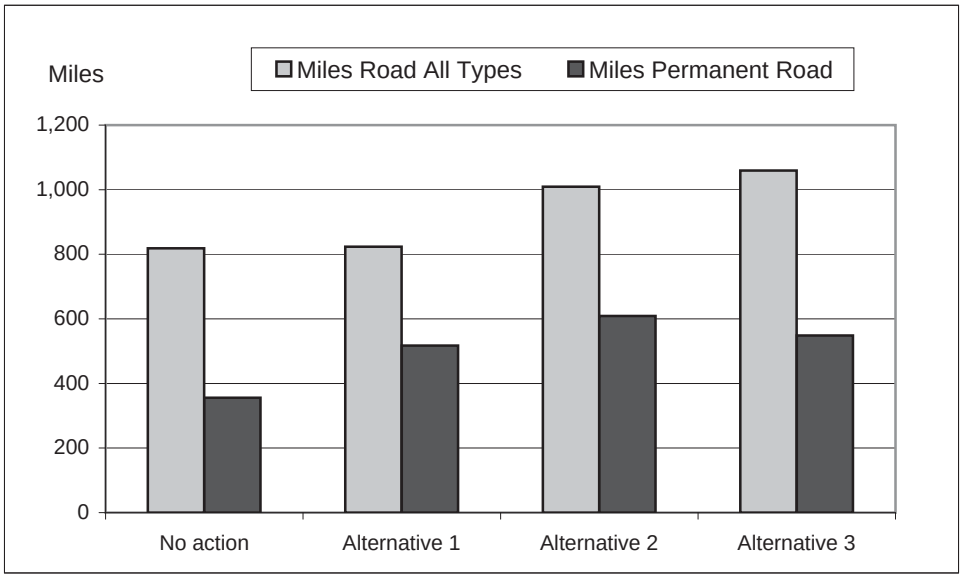
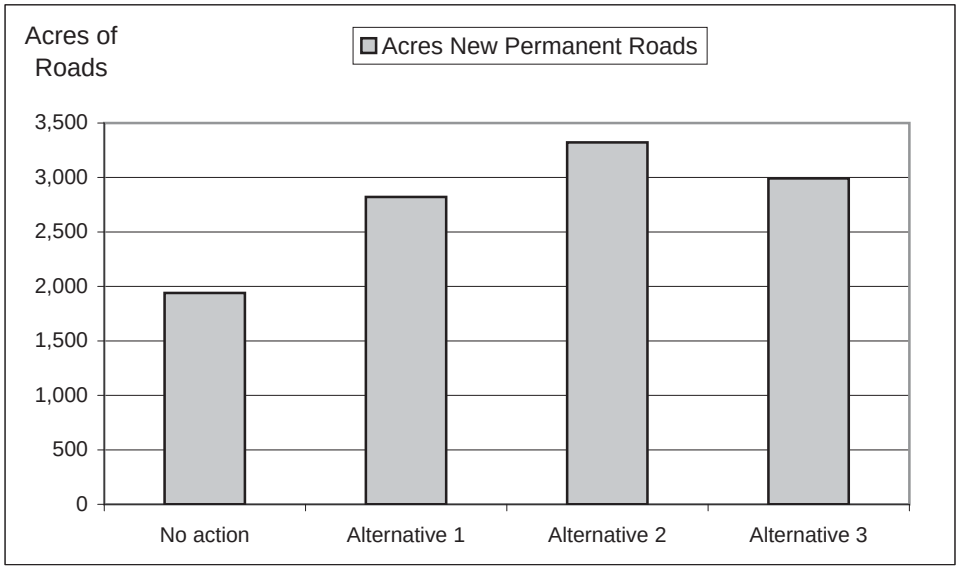


Figure 197. Acres of new permanent road construction under each alternative



Note: Acres are calculated using an average road construction and disturbance width of 45 feet.

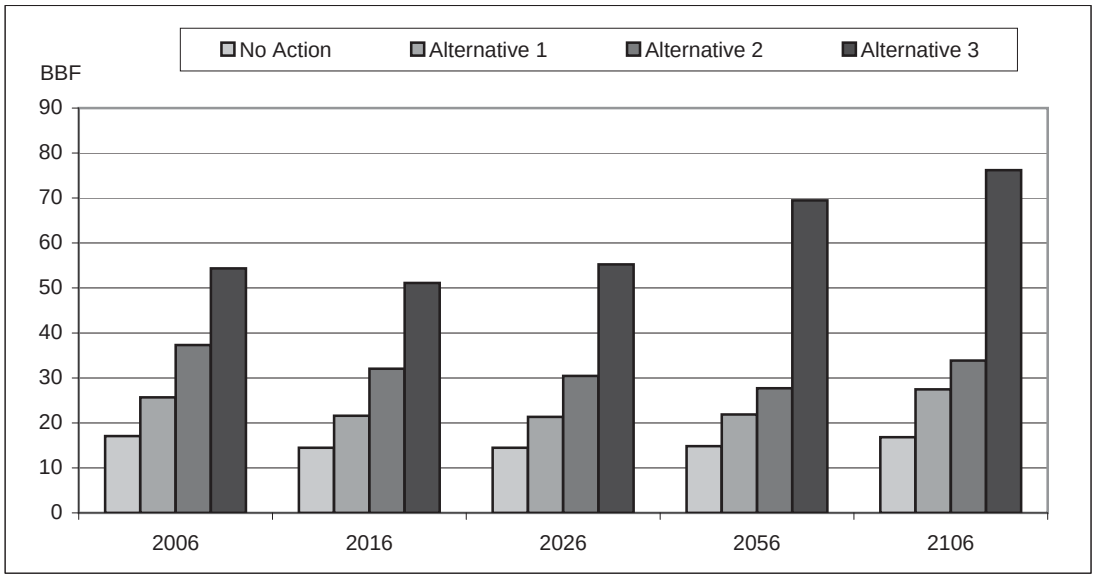
Forest Inventory and Forest stand Conditions

In the past 10 years, the amount of older forest on the BLM-administered lands within the planning area has been increasing. Under all four alternatives, this trend would continue (see the *Ecology* section in this chapter). Under all four alternatives, the aging of the nonharvest land base would cause the overall age class distribution on the BLM-administered lands to get older. Generally, the harvest land base would move towards a regulated condition.

To estimate the future growth and yield at the time of harvest, the initial volume for each forest operations inventory (FOI) unit is projected over time using the ORGANON and OPTIONS models. See *Appendix Q. Vegetation Modeling* for further explanation of this methodology.

For the entire planning area (all land use allocations), standing volume would increase under all four alternatives. This is primarily due to the stands within the nonharvest land base increasing in age. Under all four alternatives, the volume on the harvest land base would drop initially, then recover and increase as the harvest land base moves towards a regulated condition with approximately even levels of age classes below the anticipated harvest age. The trend of the standing volume for the planning area by alternative is shown in *Figure 198 (Inventory on the harvest land base by alternative over the next 100 years)*.

Figure 198. Inventory on the harvest land base by alternative over the next 100 years



The standing volume for the different alternatives varies due to the different sizes of harvest land base for the alternatives. Under all four alternatives, the standing volume in the harvest land base would dip and then recover as mature and structurally complex stands are harvested and replaced with rapidly growing stand establishment and young stands, while the standing volume in the nonharvest land base would increase. By 2106, Alternatives 1 and 3 would exceed the starting condition, the No Action Alternative will have nearly reached the starting standing volume, and Alternative 2 would not have yet recovered to the starting standing volume level.

The growth rates for stands would change in the harvest land base over time. mature and structurally complex stands would be harvested and replaced with more rapidly growing stand establishment and young stands. As young stands progress in age within the nonharvest land base, the growth on these stands would change as a result of increasing age and response to thinning.

The standing volume on the nonharvest land base indicates that the 100 year analytical period is not long enough to reach the time when the nonharvest land base growth rate would be expected to slow due to advancing age. Nonharvest land base areas, such as the late successional management areas, contain acres of stand establishment and young stands that have not yet reached culmination of mean annual increment. The growth rates on these stand establishment and young stands would remain high beyond 100 years.

Under all four alternatives, the harvest land base would move towards, but not reach, a regulated condition. The requirement to maintain a nondeclining even flow of harvest volume reduces the ability to rapidly achieve regulation. The age classes of the harvest land base in 2006 and by 2106 under the alternatives are shown in the next four figures (*Figure 199* through *Figure 202*).

Figure 199. Harvest land base distribution under the No Action Alternative over the next 100 years

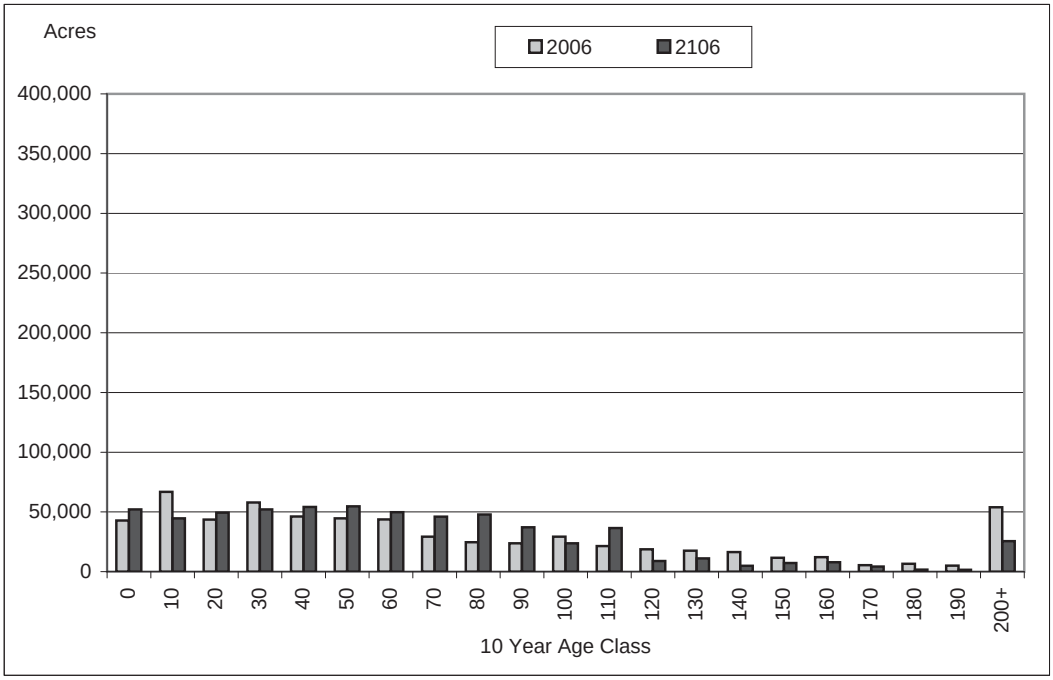


Figure 200. Harvest land base distribution under Alternative 1 over the next 100 years

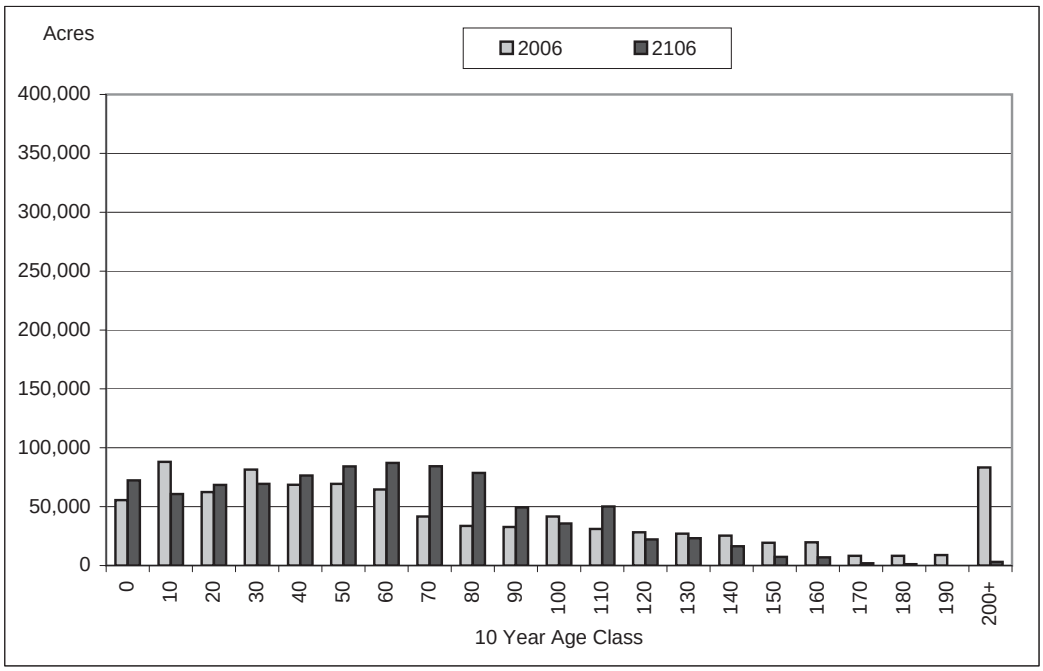


Figure 201. Harvest land base distribution under Alternative 2 over the next 100 years

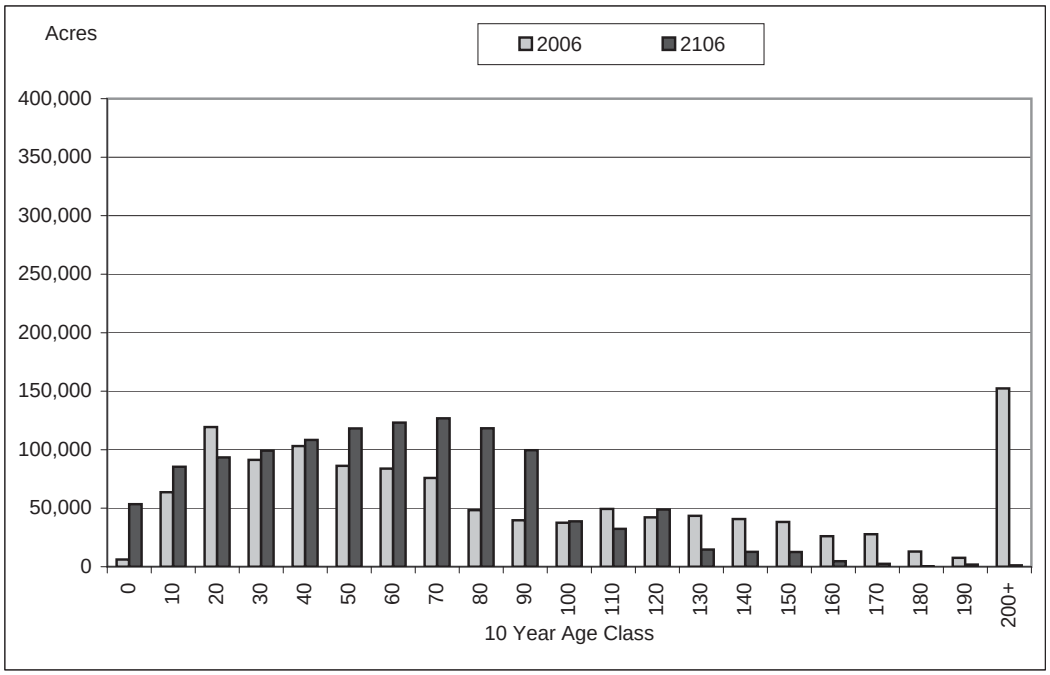
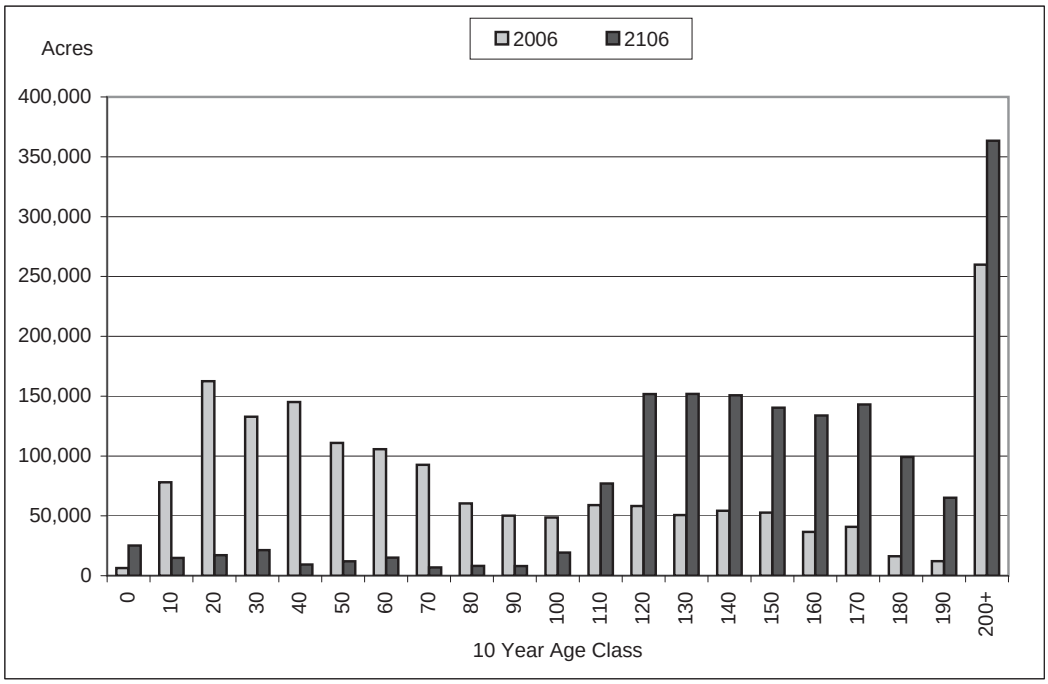


Figure 202. Harvest land base distribution under Alternative 3 over the next 100 years



Under the No Action Alternative, the age class distribution shows a substantial level of stands 200 years of age and older that would remain after 100 years in the harvest land base.

Alternative 1 would harvest more of the stands that are 200 years of age and older within the 100 year analytical period.

Alternative 2 would also harvest most of the 200+ year old stands in the harvest land base in the 100 year analytical period.

Under Alternative 3, age should be used with caution when describing stands that would develop. This is because the application of a silvicultural system consisting of partial harvests causes stand age to be a less applicable measurement of stand condition. As partial harvesting is applied to stands, they would increase in variability in age with different cohort ages included within the stands. They would develop into multistoried stands. Although stands harvested using partial harvesting have their ages adjusted to provide a blended age, age is a useful metric only for those stands that are regeneration harvested.

Under all four alternatives, the age class distribution in the districts would respond in two distinct manners. In the Salem, Eugene, and Coos Bay districts, and the Klamath Falls Resource Area of the Lakeview District, the harvest land base is currently approaching a regulated state, and the age class distribution of these districts would remain relatively stable. The Roseburg and Medford districts currently have proportionally more mature and structurally complex forests stands, which would be harvested over the next 100 years, and have variation in their acres by age class that would persist.

The alternatives would produce a variety of allowable sale quantities, a range of values for those timber products, and occur on a varying amount of acres, but all would move the harvest land base toward even amounts of acres in age classes that are less than the average harvest age.

Special Forest Products

This analysis examines the availability, quantity, and abundance of special forest products relative to their demand that would result from the alternatives.

Key Points

- All four alternatives would maintain similar levels of availability and quantity of special forest products.
- Under all four alternatives, special forest products would generally be abundant relative to demand over the long term.

Under all four alternatives, the harvest locations of specific special forest products would change over time as forest management activities occur in different locations. For example, the harvesting of firewood, fungi, floral, and greenery would shift either into or away from where regeneration timber harvesting occurs. Collectors focus harvesting efforts in locations where special forest products of commercial or personal value are abundant, easy, and economical to harvest. In general, it is expected that, similar to past activity, special forest products would be harvested from common and abundant plant or fungi species. Special forest products would be generally abundant under all four alternatives in relation to the overall demand. See the *Special Forest Products* section in *Chapter 3*.

All four alternatives would accommodate and respond to normal market fluctuations, conditions, and public demand, and provide reasonable opportunities for new special forest products. New road construction on the BLM-administered lands would occur under all four alternatives and would provide access to new harvest areas for special forest products. The additional access that results from new roads, however, would likely be offset by restrictions on public access that would be implemented for administrative purposes, and by the decommissioning of roads.

Timber harvesting would be distributed across the harvest land base over time and would result in an increase for some special forest products and a decrease for others. Regeneration and thinning harvests modify the condition of conifer forest stands and stand components (such as substrates and species that support mats of mosses), disturb the forest ground floor, and remove conifer host species that support mushrooms. See the *Special Forest Products* section in *Chapter 3*.

Silvicultural treatments (e.g., stand maintenance and precommercial thinning) retard the development of some special forest products (such as mushrooms and floral and greenery), while improving the quality and quantity of others (such as Christmas trees and boughs). The development of commercial mushroom products is delayed because silviculture treatments target host species and slash debris prevents access. The amount of precommercial thinning would be similar under all four alternatives.

Fuels reduction treatments, livestock grazing, recreation, watershed restoration, road construction and maintenance, and wildfire suppression activities would be similar under all four alternatives and would not affect the availability, quantity, and abundance of special forest products relative to their demand. Fuels reduction treatments normally target small diameter wood products and chip or cut unwanted fuels, but would not affect the overall availability and quantity of special forest wood products.

The availability and quantity of special forest products that are associated with the stand establishment structural stage would vary with the amount of regeneration harvesting and partial harvesting that would occur under the alternative.

The availability and quantity of special forest products that are associated with older forests would vary with the amount of forest in the mature and structurally complex structural stages that would exist under the alternatives.

Thinning would disturb the forest floor but would retain conifer host species and allow mushrooms to recover and fruit within approximately 5 to 10 years after harvesting (Pilz et al. 2006). Floral and greenery products would generally respond to the new growing conditions that would result from the increased light and decreased competition even though thinning activities would initially disturb the forest floor and the commercial floral and greenery special forest products.

Under all four alternatives, the relative availability and quantity of mushrooms, mosses, and floral and greenery are associated with the amount of stands that are in the mature and structurally complex structural stage.

The relative availability of Christmas trees is associated with the amount of regeneration harvesting. The relative availability and quantity of firewood and other wood products, which are byproducts of regeneration and thinning harvesting, would also coincide with the amount of regeneration harvesting.

Timber harvesting under all four alternatives would not alter the overall availability, quantity, and sustainability of special forest products, although availability would vary on individual harvest units in the short term. Although overall availability and quantity would be maintained because of the abundance of special forest products, a small variation in availability and quantity would occur as a result of varying amounts of regeneration harvesting and thinning of the structurally complex forests under all four alternatives. See *Table 174 (Acres of forest management activity and mature&structurally complex forest by alternative in the year 2016)*.

Table 174. Acres of forest management activity and mature&structurally complex forest by alternative in the year 2016

Forest Management Activity and Forest Type	Special Forest Product Response*	Response (as acres increase)	No Action (acres)	Alternative 1 (acres)	Alternative 2 (acres)	Alternative 3 (acres)
Regeneration harvesting or partial harvesting	Floral/ greenery	decreases	60,500	90,600	143,400	128,500
	Mosses	decreases				
	Mushrooms	decreases				
	Wood products	increases				
	Christmas trees	increases				
Thinning harvesting (includes both harvest land base and nonharvest land base)	Floral/ greenery	increases	100,000	113,400	76,700	160,300
	Mosses	decreases				
	Mushrooms	decreases				
	Wood products	increases				
Silvicultural treatments (stand maintenance/ protection)	Floral/ greenery	decreases	112,500	161,400	259,900	134,400
	Mushrooms	decreases				
	Christmas trees	increases				
mature&structurally complex forest	Floral/ greenery	increases	1,266,000	1,190,000	1,131,000	1,161,000
	Mosses	increases				
	Mushrooms	increases				

Under all four alternatives, the availability and quantity of five special forest product categories (transplants, seeds and seed cones, edibles and medicinals, burls and miscellaneous, and boughs-coniferous) would be similar to past levels. Differing levels of timber harvesting and silviculture activities, based on the amount of acres treated, would not increase or decrease the quantity or availability of these forest products from the current level. These forest products are generally abundant relative to their demand throughout the region or within the vegetative community where they occur. In general, an extensive amount of acres of forest habitat exists for these special forest products over the planning area, combined with relatively low commercial demand.

Natural disturbances, such as wildfires and wind storms, which shape the types and availability of special forest products, are unpredictable in time and location, but are expected to occur as in the past across the landscape. Natural disturbances change local conditions for special forest products. In general, most special forest products would be lost in wildfires, although the availability of firewood and mushrooms, which respond to fire, would increase. Windstorms that blow down large amounts of trees would reduce the quality of special forest products and would limit the access for harvesting. Natural disturbances would have a substantive effect on the availability and quantity of special forest products only at the local level. Availability, quantity, and abundance relative to the demand of special forest products would not be substantially affected at the planning area scale.

Botany

This analysis examines the effects of timber management, fuels treatments, road construction, grazing, and areas of critical environmental concern on plant populations including BLM sensitive and assessment species, and species listed under the Endangered Species Act.

Key Points

- Under all alternatives the populations and habitat of species listed under the Endangered Species Act and state listed species where the BLM has entered into a cooperative management agreement for a species would be maintained or increased and recovery activities implemented.
- Under all alternatives on BLM-administered lands, there would be little risk of loss of populations of BLM sensitive and assessments species in eight of nine habitat groups.
- Under the action alternatives, some populations of BLM sensitive and assessment species in the conifer habitat group on O&C lands in the harvest land base would be lost. There would be low to moderate risk of local extirpation for some species in the conifer forest habitat group, but little risk of extirpation from the planning area or extinction. The ranking of alternatives is as follows:

No Action	Alternative 1	Alternative 2	Alternative 3
Lower Risk ----------->.Moderate Risk			

Federally Listed Plant Species and those state listed species where the BLM has entered into a cooperative management agreement

The species shown in *Table 175* (*Federally listed and candidate plant species in the planning areas*) are listed as threatened or endangered or are candidates for listing under the Endangered Species Act.

Table 175. Federally listed and candidate plant species in the planning area

Status	Species	Common Name
FTO	Sidalcea nelsoniana	Nelson's Checker-mallow
FTO	Castilleja levisecta	Golden Paintbrush
FTO	Howellia aquatilis	Water Howellia
FTO	Lupinus sulphureus ssp. kincaidii	Kincaid's Lupine
FEO	Lilium occidentale	Western Lily
FEO	Astragalus applegatei	Applegate's Milk-Vetch
FEO	Lomatium cookii	Cook's Lomatium
FEO	Fritillaria gentneri	Gentner's Fritillary
FEO	Limnanthes floccosa ssp. grandiflora	Large-Flowered Wooly Meadowfoam
FEO	Arabis macdonaldiana	MacDonald's Rock-Cress
FEO	Plagiobothrys hirtus	Rough Popcorn Flower

FEO	Erigeron decumbens var. decumbens	Willamette Valley Daisy
FEO	Lomatium bradshawii	Bradshaw's Desert Parsley
FCO	Calochortus persistens	Siskiyou Mariposa lily

FTO = Federally Threatened Oregon FEO = Federally Endangered Oregon FTO = Federal Candidate Oregon

Under all four alternatives, no damage or loss of occupied habitat, individual plants, or populations would occur as a result of management activities on BLM-administered lands. This is because species recovery measures would be applied. These measures are required by recovery plans, biological opinions, or conservation agreements and would maintain or reduce the risk of extinction to species. Occasionally, emergency operations such as wildfire suppression would result in the damage or loss of occupied habitat or populations. When these occasional situations occur, conservation measures would be applied to the extent possible to minimize damage or loss of populations or habitat.

The number of populations of federally listed and candidate species on BLM-administered lands varies by species and the BLM's contribution to the recovery of the species also varies accordingly. The number of populations by species found on BLM-administered lands ranges from over 100 populations of Gentner's fritillary to only three known populations of Nelson's checker-mallow.

Populations of federally listed and candidate species also occur on private lands. For analysis purposes, it is assumed that these populations would not contribute to recovery of the species (USDI, USFWS 2006b; USDI, USFWS 2003b; USDI, USFWS). This is because no protection of plant species is provided by state or federal laws on private lands.

Recovery activities would be implemented consistent with plans and conservation agreements for each federally listed plant species. Recovery activities are described individually in each recovery plan (see *Appendix E, Botany*). Occupied habitat and populations of federally listed and candidate species would be maintained or increased on BLM-administered lands as a result of these conservation activities.

State Listed Species where the BLM has not entered into a conservation agreement and BLM Sensitive and Assessment Species

Most plant and fungi species are considered common and are of no conservation concern (see the *Botany* section of *Chapter 3*). This analysis focuses on the BLM's sensitive and assessment species which include State-listed species where the BLM has not entered into a conservation agreement. Species are grouped according to habitat associations (see the *Botany* section of *Chapter 3*) to facilitate the analysis of large number of species. *Table 176* shows the habitat groups and the physiographic provinces and land allocations in which they occur.

Table 176. Habitat groups, physiographic provinces, and land use allocations

Habitat Groups	Physiographic Provinces	Land Use Allocations
Upland Meadows/ Grasslands areas	Klamath and Willamette Valley	• Non timber management area • National Landscape Conservation System
Shrub Communities	Klamath	• Non timber management area • National Landscape Conservation System
Oak and Hardwood Woodlands	Klamath and Willamette Valley	• Timber management area • Non timber management area • National Landscape Conservation System
Conifer and Mixed Evergreen Forests	All	• Late-successional management area • Riparian management area • Timber management area • Areas of critical environmental concern and research natural areas • National Landscape Conservation System
Seasonal Wetlands Fens/Vernal Pools	All	• Riparian management area • Areas of critical environmental concern and research natural areas
Riparian and Aquatic	All	• Riparian management area
Serpentine Areas	Klamath	• Timber management area • Non timber management
Rocky Areas Outcrops/ Scree	All	• Non timber management
Maritime Zone	Coast and Klamath	• Late-successional management area • Riparian management area • Timber management area • Areas of critical environmental concern and research natural areas • National Landscape Conservation System

Introduction

Under the No Action Alternative, conservation measures would be applied to all habitat groups under the BLM Special Status Species Policy and Survey and Manage on all BLM-administered lands in the planning area. Habitat characteristics would be managed for the specific requirements of each species. Conservation measures provide protection from management activities that modify or degrade occupied habitat, compact or displace soil, or trample or damage individual plants or populations. The types of conservation measures are numerous and affect the area, extent, or timing of the activity, the type of operation, and the degree of disturbance to a population. Typically conservation measures are implemented as seasonal or operational restrictions and changes, treatment changes, or protection buffers.

Under the action alternatives, conservation measures from the BLM Special Status Species Policy would be applied on Public Domain lands and O&C lands that are not in the harvest land base. With the exception of the conifer habitat group, all other habitat groups occur primarily on Public Domain and O&C lands not in the harvest land base. Conservation measures would not be applied to populations of species in the conifer habitat group that occur within the O&C harvest land base unless 20 or fewer populations of a species are known to exist.

Timber harvest including silviculture treatments in young stands, hazardous fuels treatments, and road construction, are major activities that would affect populations in the conifer habitat group. The level of these activities that would occur under the alternatives is shown in *Table 177* (*Forest management activities that affect plant populations over the next 10 years).*

Table 177. Forest management activities that affect plant populations over the next 10 years

Activity	No Action (acres)	Alt 1 (acres)	Alt 2 (acres)	Alt 3 (acres)
Regeneration Harvest	60,500	90,600	143,400	3,900
Partial Harvest	0	0	0	124,600
Thinning (HLB and Non-HLB)	100,000	113,400	76,700	160,300
Hazardous Fuels Treatments	110,000	110,000	110,000	110,000
Road Construction	4,100	4,100	5,000	5,300

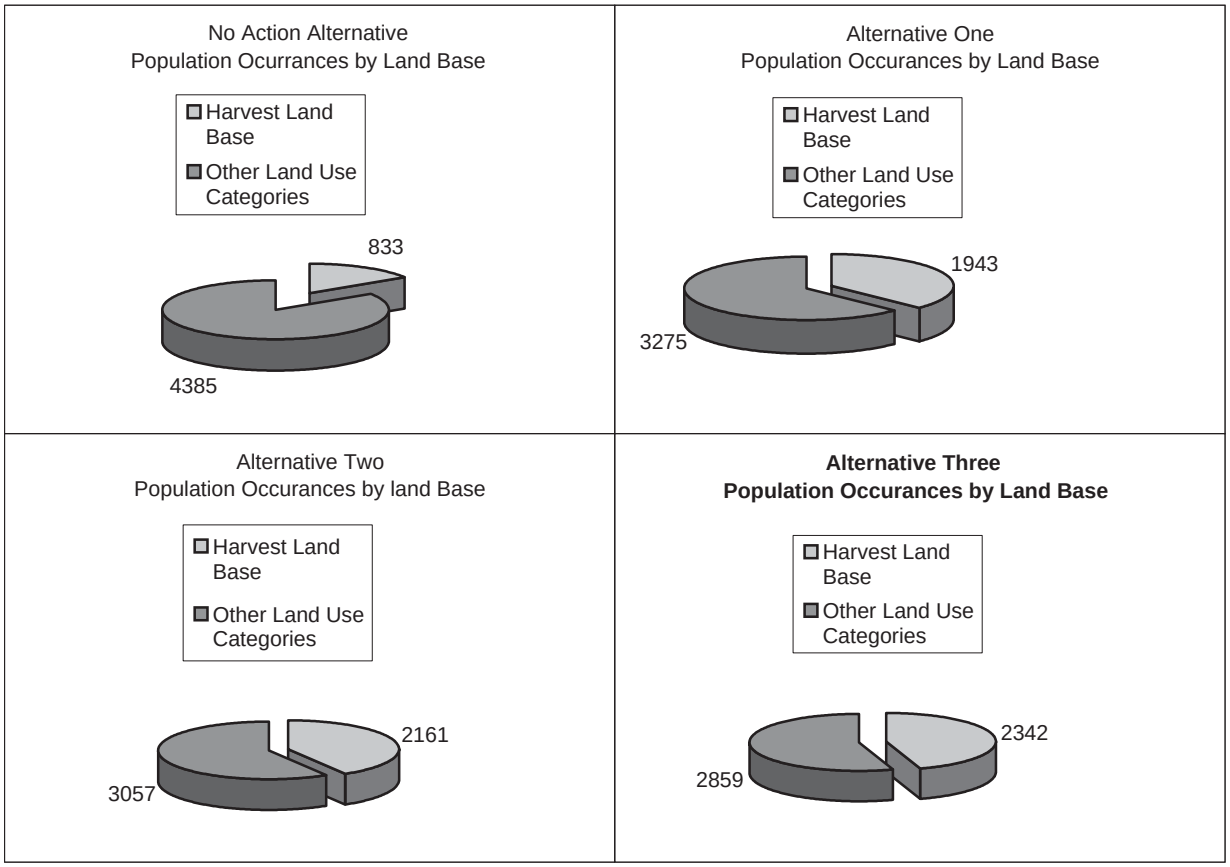
Timber Harvest

Under all action alternatives, the acres subject to timber harvest with known populations would increase. *Figure 203* (*Distribution of populations of BLM sensitive and assessment botany species subject to timber harvest)* shows that when all known populations of BLM sensitive and assessment species are aggregated and compared between alternatives, the most notable pattern is the

increase in the number of populations that occur in the harvest land base under the action alternatives compared to the No Action Alternative.

Approximately 5,000 known populations of BLM sensitive and assessment species occur on BLM-administered lands. The percentage of known populations in the conifer habitat group that would occur within the harvest land base is 16%, 37%, 41% and 45% under the No Action Alternative and Alternatives 1, 2, and 3, respectively. The known populations of species in the conifer habitat group located in the harvest land base would be subject to greater risk of population and habitat losses through management actions.

Figure 203. Distribution of populations of BLM sensitive and assessment botany species subject to timber harvest



Harvest methods include ground based, cable, and helicopter logging. Timber harvesting modifies forest stand vegetation, species composition, stand density and structure, canopy, snags, and large down wood which serve as substrate, hosts, and environmental conditions associated with species in the conifer habitat group. Thinning modifies forest stand structure and conditions less than regeneration harvests or partial harvests and stands recover quicker from disturbance. After harvest, slash disposal treatments reduce fuel loads.

Silvicultural treatments on new stands reduce vegetative competition to conifer species and would occur on the same areas where regeneration harvest and thinning would take place over a 3 to 20 year period of time after harvest.

Typically, more timber harvest units receive fuels and silviculture treatments in the Klamath province than the other provinces where more populations occur. Few populations that occur in these areas would survive the combination of treatments without the application of conservation measures. However, post treatment monitoring has shown that occasional populations have survived the combination of treatments, and populations of some species respond with increased vigor.

For some species and populations, the affects of the physical disturbance of the harvest method would have more consequence than the modification of the habitat itself. For example, the amount of physical disturbance of the site from regeneration harvest can vary widely depending upon factors such as terrain, access, type of equipment, and skills of the operator. These factors contribute to the total area disturbed and the survival of any population occurring in the area.

Under the alternatives, the amount of regeneration harvest acres as a portion of total harvest acres is 38% under the No Action Alternative and 44%, 65% and 44% under Alternatives 1, 2 and 3, respectively. Partial harvests under Alternative 3 would create forests in the stands establishment structural stage classification resulting in a change in forest habitat similar to that of regeneration harvest. Under the action alternatives, in regeneration harvests and partial harvests on O&C harvest base lands, few populations of species in the conifer forest habitat group would survive because of multiple fuels and silvicultural treatments associated with treating forests in the stand establishment structural stage classification within a 3 to 20 year period of time. This would also occur because no conservation measures under BLM special status species policy would be applied, except where populations of species are 20 or fewer. The amount of timber harvest, hazardous fuels treatments and road construction as a portion of the total amount of forested acres is estimated to be 12% under the No Action Alternative, and 14%, 15%, and 18% under Alternatives 1, 2, and 3 respectively over the next 10 years.

Under all alternatives, fuel reduction treatments would reduce slash from timber harvest and silviculture activities. The Medford District and Klamath Falls Resource Area would treat the slash on 90% of harvest units while the other districts would treat approximately 50% of harvest units.

These treatments include slash piling and burning or broadcast burning. Hand-piling and burning reduces slash and live vegetation. Approximately 10% to 25% of the treated area would be piled and burned. Excavator-piling crushes vegetation as well as displaces and compacts soil. Approximately 5,000 acres over the past 10 years has been treated and 2,500 acres would be projected to be treated for the next 10 years. Piling and burning occurs primarily in southern

Oregon. Broadcast burning occurs after harvest and consumes logging debris and other live vegetation on approximately 75% of the treated timber harvest areas.

Under all four alternatives, silvicultural treatments within the harvest land base would modify young stands through thinning, stand conversion, fertilization, cutting brush, and scalping vegetation. Treatments would result in young stands that are generally even-aged with reduced species diversity, reduced stand structures, and reduced amounts of small micro-habitat patches where less disturbance occurred during harvest and where species in the conifer habitat group are more like to persist. The amount of silviculture treatments within the harvest land base would be tied directly to the amount of regeneration and partial harvest acres as shown in *Table 177* (*Forest management activities that affect plant populations over the next 10 years).*

A few species in the conifer habitat group occur in forests in the stand establishment and young forest structural stage classification. As long as populations weren't completely lost during timber harvest, they would benefit from more frequent habitat disturbances. Post-harvest monitoring has shown that species such as Tall bugbane and Wayside aster respond positively by increasing growth, flowering, and fruiting from more open conditions (e.g., *Cimicifuga elata,* Kaye and Kirkland, 1994, *Eucephalus vialis,* Thorpe and Kaye, 2006*).* Other populations of species in the conifer habitat group have survived the combination of treatments in the past but do not appear to benefit with increased growth and reproduction *(Cypripedium fasciculatum,* Knorr and Martin, 2003). These are considered relic populations that have survived the activity and habitat disturbance in micro-habitat patches but do not appear to benefit with increased growth and reproduction.

Hazardous Fuels Treatments

Under all four alternatives, hazardous fuel reduction treatments (outside of timber harvest units) would occur on approximately 110,000 acres over the next 10 years in the Wildland Urban Interface. A majority of the acres that would be treated would occur in the Klamath province. The operational methods and habitat disturbance would be similar to fuel reduction treatments from timber harvest slash, except that these fuels reduction treatments would retain more of the original forest stand and vegetation conditions than treatments of slash from timber harvest.

These treatments would affect species in the conifer and mixed evergreen forests, shrub communities, and oak and hardwood woodlands habitat groups. Generally, the species in these habitat groups are shade intolerant and respond to increased light and reduction in plant competition with increased growth, flowering and fruiting (Kaye and Thorpe 2006; USDA,USDI 2004b;USDA and USDI, BLM and NPS 2004; USDI, USFWS 2005; USDI, USFWS 2006b). However, disturbance from fuel reduction treatments would create exposed soil and increased light that would result in the introduction and spread of invasive plants into occupied habitat. Invasive plant species would reduce population

vigor, expansion, and migration (See the *Invasive Plants* section of *Chapter 4*) of the BLM's sensitive and assessment species. Impacts would vary depending on several factors. Variations in site characteristics, the type and growth habit of the invasive species, and rare plant species vigor and growth would determine the growth or decline of a population. Actions to control invasive plants species would benefit the growth and survival of rare plant populations. Additionally, species with larger populations would be more likely to survive the disturbance than species with small populations.

The overall risk to species populations from these hazardous fuel treatments is low because the species in these habitat groups are generally shade intolerant and respond with increased growth to increased light and less competition.

Road Construction

Under all alternatives, road construction would occur in areas where all nine habitat groups are found. However, the majority of road construction activities would occur in the conifer habitat group. Roads built in the Klamath province are most likely to cross habitat types such as meadows or serpentine with rare plant populations. This is because such habitats and populations occur more commonly in the Klamath Province than other provinces. The estimated amount of new road construction over the next 10 years on the Medford District, primarily the Klamath province, would range from 158 miles under the No Action Alternative to 330 miles under Alternative 3. This would equate to 795 acres or 0.1% of BLM-administered lands in Medford District under the No Action to 1650 acres or about 0.2% of BLM-administered lands under Alternative 3. New road construction in the Klamath province has the potential to affect more BLM sensitive and assessment plant species relative to other provinces because of the higher density of such plant populations in this province.

New roads would increase the introduction and spread of invasive plants (See the *Invasive Plants* section of this chapter). Actions to control invasive plants would be applied in order to reduce competition to the BLM's sensitive and assessment plant populations and occupied habitat. Conservation measures would be applied to populations and occupied habitat in the path of road construction of all nine habitat groups in areas outside of the harvest land base. Populations in the conifer habitat group which occurred in the path of road construction would likely not survive in areas within the harvest land base management. However, it is assumed that conservation measures would be applied to species with 20 or fewer populations.

Other Management Activities

Under all alternatives, wildfire suppression activities would occur in all habitat groups. Plant species in the planning area evolved in ecosystems which included periodic natural fires but not wildfire suppression activities. The most wildfire suppression activity would occur in the Klamath province and in the

southern part of the Western Cascades province. Wildfire suppression activities that involve bull-dozing such as fireline access and construction, safety zone construction, and staging centers often make more fundamental and longer lasting changes to habitat than the wildfire itself, although on a much smaller area. On the recent Timber Rock wildfire, only 27 of 27,100 acres (0.1%) were disturbed by fire lines (USDI, BLM 2004). The acres of wildfire suppression activity are low relative to other management activities, but where they occur, populations of the BLM's sensitive and assessment species would likely be lost.

Under all alternatives, mining operations would occur primarily in areas occupied by the rocky areas/outcrops/scree, serpentine, conifer, and riparian and aquatic habitat groups. According to the BLM's records, mining operations occur primarily in the Klamath province where more rare plant populations occur. Approximately 230 mining notices would be issued over the next 10 years on approximately 280 acres. The number of acres is very low, but mining notices would require processing during a biological window when field reviews would not be suitable. Conservation measures would not be applied in most cases and some populations would be lost.

Approximately 17 mining plans that total 250 acres would be anticipated over the next 10 years. The total amount of acres is small and mining plans would provide for conservation measures associated with the application of the BLM's Special Status Species Policy in most cases. A mining plan currently occurs on portions of the French Flat area of critical environmental concern where seven of the BLM's sensitive and assessment species are found.

Quarry operations would also occur in areas occupied by the rocky areas/ outcrops/scree, serpentine, conifer, and riparian and aquatic habitat groups. The amount of quarry operation activity would be associated with the level of road construction under each alternative. There would be approximately 300 quarries located on 600 acres. This would affect a relatively small percentage of the planning area and would intersect with a small number of plant populations. The overall risk of population losses in these four habitat groups from quarry activities is low under all alternatives. This is because most quarries have been surveyed and few populations discovered. Additionally, populations and occupied habitat would receive conservation measures in most cases.

Under all alternatives invasive plants would increase and alter the existing plant community for all habitat groups (see the *Invasive Plants* section of this chapter). Invasive plants occur throughout the planning area, but are less prominent on serpentine soils in the Klamath province. Invasive plants are well documented on habitat occupied by the BLM's sensitive and assessment Species. Invasive plant species reduce vigor, flowering and fruiting and limit the expansion and migration of populations of the BLM's sensitive and assessment species. Under all action alternatives, rare plant populations forced to compete with invasive plants would decrease in vigor and the likelihood of survival would be reduced.

Under all alternatives, livestock grazing would occur in areas occupied by five habitat groups including upland meadows/grasslands, oak and hardwood woodlands, conifer, seasonal wetlands fens/vernal pools, and riparian and aquatic. Under the No Action Alternative, approximately 560,000 acres would be authorized for grazing. Under all action alternatives, the number of grazing allotment acres would be reduced by 141,000 acres to 420,000 acres. Since these 141,000 acres of allotments are currently vacant (no cattle grazing occurring), there would be no change in the effects to the 1,126 known populations of the BLM's sensitive and assessment species in this area. Allotments that would be authorized for grazing contain approximately 1,300 known populations.

Livestock graze and trample vegetation including the BLM's sensitive and assessment species. Species assessments and monitoring of rangeland conditions and trends indicate that few populations of species are lost due to grazing. However, livestock graze on vegetation and trample and damage plants (USDA, USDI 1996a; Oregon Department of Agriculture 2001; Kaye, 2002). Not all populations in grazing allotments are affected by grazing or trampling because they occur in inaccessible locations, areas of low forage, or where grazing and trampling is low. A few annual species such as bellinger's meadow-foam, disappearing monkeyflower, and sculptured allocarya tolerate light to moderate levels of trampling and grazing as long as they can produce seed and maintain stable germination and occupancy levels (Whiteaker, pers. com. 2007).

Generally, the areas of higher grazing utilization occur in close proximity to abundant forage, grassland meadows, water sources, and flat ground. Areas of higher disturbance from trampling occur around holding pens, watering areas and salt blocks. These high disturbance areas allow invasive plants to establish and increase occupancy. Populations of BLM sensitive and assessment species occur in areas of high utilization and high disturbance. While populations would normally withstand low to moderate amounts of grazing and trampling damage, high levels of disturbance repeated over multiple years would reduce plant vigor, prevent reproduction, and damage individual plants and populations. This would cause the loss of populations (Menke and Kaye 2006).

Populations and occupied habitat of most the BLM's sensitive and assessment species that occur in these five habitat groups would be protected from grazing and trampling through conservation measures associated with the application of the BLM's Special Status Species Policy under all alternatives.

Under the No Action Alternative, off-highway vehicle activities would occur on BLM-administered lands designated as open to off-highway vehicle use where species in all nine habitat groups are found. A total of 330,000 acres is currently designated as open in the Salem, Medford, and Klamath Falls districts. A majority of these open areas are located on steep, densely-forested terrain, which is not conducive to cross-country motor vehicle travel. However, where cross country travel would occur, vehicles would crush vegetation, displace soils

and create trails that degrade occupied habitat and damage populations scattered throughout the area.

High concentrations of off-highway vehicle activities occur around campgrounds, recreation areas, existing trails, and adjacent to private lands and fan outwards for hundreds of acres. Off-highway vehicle activities occur across a wide area including 140,000 acres in the Klamath province where the highest species' population densities are found.

Under all action alternatives, off-highway vehicle activity would be designated as limited to designated roads and trails on most of the 330,000 acres currently designated as open to off-highway vehicles under the No Action Alternative. A total of 77 acres are designated as open under the action alternatives. This would result in a reduction to the amount of damage to occupied habitat and populations for all habitat groups compared to the No Action Alternative.

Areas of critical environmental concern are designated where special management attention is required to maintain and protect relevant and important values. Under the No Action Alternative, 70 potential and existing areas of critical environmental concern would provide special management attention resulting in the conservation of approximately 700 known populations of the BLM's sensitive and assessment plant species. These species occur in a wide range of habitats throughout the planning area and over 540 populations occur in the Klamath province. More populations are likely to occur in existing areas of critical environmental concern because of the unique nature of the habitat.

Under the action alternatives, nine areas of critical environmental concern that contain special status species as a relevant and important value would not be designated under one or more alternatives. These areas contain 127 known populations. There are 14 additional areas of critical environmental concern with the BLM's sensitive and assessment species that would be reduced in size under one or more alternatives. Populations of species in the conifer habitat group would be subject to forest management activities. Since these species' populations would not receive special management attention (except for those species with 20 or fewer populations), populations would be lost. One of these species, *Cupressus bakeri*, is one of eight populations in Oregon and is found in the Baker Cypress area of critical environmental concern. It is the only population on BLM-administered lands and is the northern most population of cypress in North America.

Biological Factors and Risk to Species from Management

There is incomplete information available to determine the effects of the loss of one or more populations to a BLM sensitive and assessment plant or fungi species. The species in the habitat groups are diverse and respond differently to habitat change and disturbance. Each species' unique biological requirements and threats shape the number of individuals, patch size, and distribution. Biological

factors interact with environmental factors to determine population and species rarity and trends ((Gurevitch et al. 2006, Kaye et al, 1997). Several studies discuss specific factors that influence population trends and they include plant life-form and life history, breeding systems and effective breeding populations, seed dormancy, recruitment, clonal growth, colonization, genetic factors, and models of extinction risks and disturbance (Lennartsson 2002, Menges 2000, Ellestrand and Elam 1993, Schemske et. al, 1994). Any population losses from management activities to species with 20 or fewer populations would contribute to the trend toward local extirpation or extinction of the species within the planning area (Ellstrand and Elam, 1993; USF&WS, 2003; Kaye, pers.com., 2007, Freidman, 2007, pers. com). A minimum population threshold of 20 is selected to ensure survival of species and therefore no additional population losses would be allowed as a result of management actions. The threshold is based on biological and environmental factors and is consistent with species rankings in Oregon Natural Heritage Plan (2004) and NatureServe (2006).

Under all alternatives, there would be little risk of population losses of the BLM's sensitive and assessment species in the nine habitat groups on O&C lands in areas outside of the harvest land base and on Public Domain lands. This is because conservation measures associated with the BLM Special Status Species Policy would be applied.

Under all action alternatives, populations of species in the conifer habitat group on O&C lands in the harvest land base would be subject to forest management activities. This would include regeneration harvest, partial harvest, thinning harvest, slash treatment, silviculture treatments, and road construction. The following percentages of the area would be affected by management activities over the next 10 years:

- No Action Alternative: 12%
- Alternative 1: 14%
- Alternative 2: 15%
- Alternative 3: 18 %

The specific location of management activities that would take place under the alternatives is unknown in relation to the specific locations of populations of the BLM's sensitive and assessment species. Therefore, the specific number of populations in the conifer habitat group that would be lost is uncertain.

However, the risk of local extirpation to species in the conifer habitat group would increase under the action alternatives compared to the No Action Alternative. Populations would be lost under all action alternatives. Few populations would survive in areas of regeneration harvest that occur in the path of direct operational activities. However, conservation measures would be applied for species with from 20 or fewer known populations. The number of

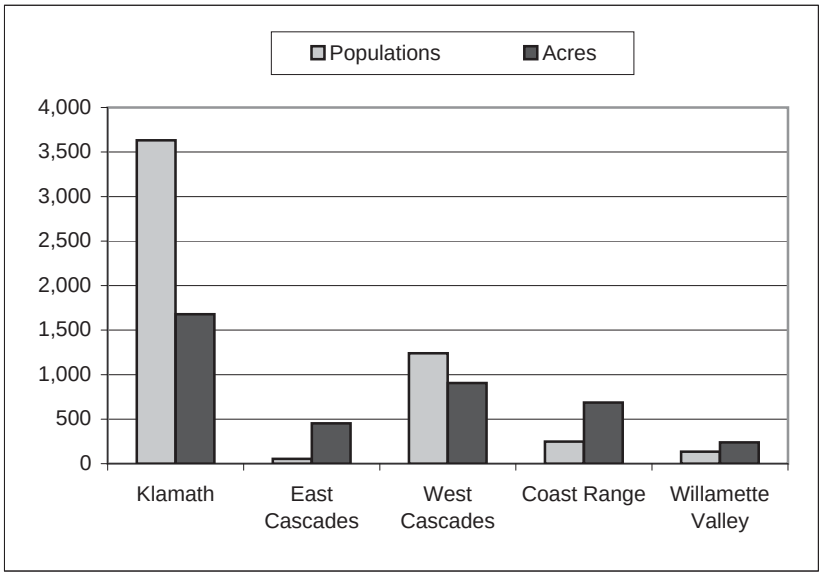
populations that would be lost would increase with the amount of acres of forest management activities. The combined amount of partial harvest and thinning under Alternative 3 would modify more conifer forest habitat than the other action alternatives even though partial harvest would leave small patches of habitat. The increase in the amount of thinning acres under Alternative 3 offsets any small habitat benefits to populations.

The factors used in determining these outcomes included:

- distribution and the number of known populations and occupied habitat on BLM-administered lands, particularly within the harvest land base, and
- the types and amount of activities anticipated over the next ten years.

As shown in *Figure 204* (*Number of populations and occupied habitat by province*), under all action alternatives, the Klamath province has the highest risk of losses of populations and the highest risk of local extirpation due to forest management activities. This is because the number of the BLM's sensitive and assessment species populations is the highest and the average patch size is the smallest compared to the other provinces. In the other provinces, there are fewer sites, but the patch size is larger.

Figure 204. Number of populations and occupied habitat acres by province



Under all alternatives, there would be 53 of the BLM's sensitive and assessment species with 20 or fewer known populations and containing at least one population on BLM-administered lands (excluding species in the Cascade Siskiyou National Monument and West Eugene Wetlands). There are 11 of these species that occur entirely on BLM-administered lands[5]. Specifically:

- There are 18 of the 53 species that have 1 to 5 known populations.
- There are 35 of the 53 species that have 6 to 20 known populations.

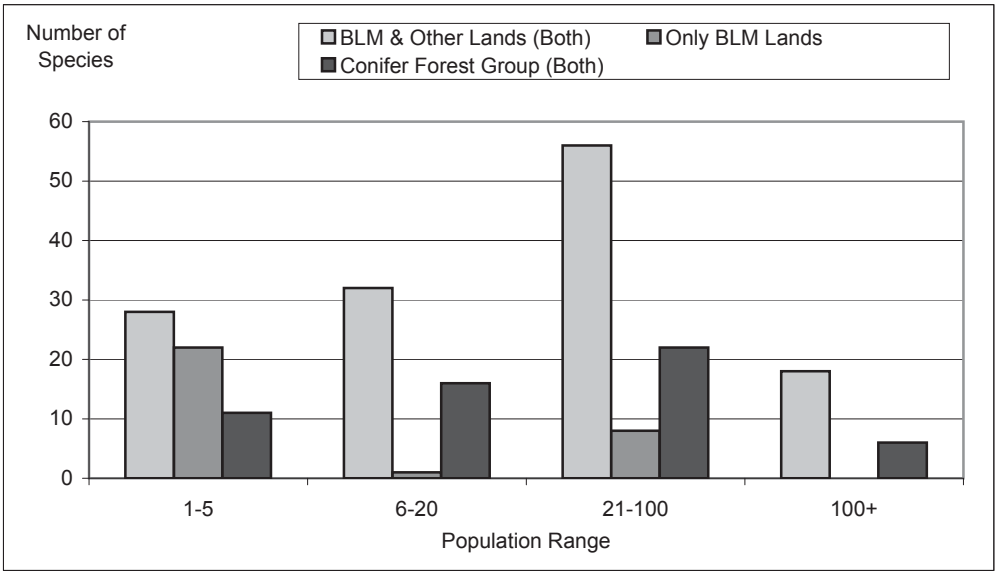
The conifer habitat group, where forest management activities would occur, includes 23 of the 53 species as shown in *Figure 205* (*Species in the conifer habitat group by ownership and number of currently known populations*). Of these:

- There are 5 species with 1 to 5 known populations.
- There are 18 species with 6 to 20 known populations.

Any population losses from management activities would be critical for species with fewer than 20 populations (Ellstrand and Elam, 1993; USDI, USFWS 2003c; Kaye, pers.com., 2007). Conservation measures would be applied to species with 20 or fewer populations to prevent extirpation in the planning area.

There are another 53 species that are known from between 21 to 100 populations. There are 5 of these that occur entirely on BLM-administered lands and 21 of these that occur in the conifer habitat group.

Figure 205. Species in the conifer habitat group by ownership and number of currently known populations



[5] There is some uncertainty when combining records from 2 data sets related to double counting and undercounting. Geobob was the primary data source for BLM and other Federal Lands and Heritage data was the source for state, private and other lands.

For species with 21 to 100 known populations in the conifer habitat group, risk of extirpation from population losses would increase. Any population losses would contribute to a trend toward extirpation within the planning area. However, if populations drop to 20 or fewer known sites, conservation measures would be applied to prevent extirpation.

It is assumed that no protection of the BLM's sensitive and assessment species would occur on private lands. These populations are at high risk of population loss. Populations of these species have been damaged and lost on private lands, including federally listed lands (USDI, USFWS 2003b; Brock and Callagan, 2006, USDI, USFWS 2006b) and the loss of habitat is documented in recovery plans for federally listed plant species (USDI, USFWS 1998c; USDI, USFWS 2000; UDDI, USFWS 2003a; USDI, USFWS 2003b). These sites would not be considered when determining which species have 20 or fewer known sites on federal lands.

Projected Populations

A quantitative analysis was conducted to calculate the number of populations of the BLM's sensitive and assessment species that would be expected to occur on unsurveyed BLM-administered lands. The analysis allows a comparison of the total number of populations and occupied habitat on BLM-administered lands under the alternatives. There is incomplete information on the distribution of the BLM's sensitive and assessment plant and fungi species in the planning area as well as the specific location of future management actions that could affect these populations. This information is useful in estimating the number of populations and occupied habitat expected to occur and the potential intersect of populations and management activities. The analysis derives estimated populations and occupied habitat based on a single linear projection using existing survey and population data for BLM-administered lands in the harvest land base (a subset of the total land base). The acres in the harvest land base ranges from 14%, 15% and 18% for Alternatives 1, 2, and 3, respectively. The number of known populations within the harvest land base ranges from 37%, 41% and 45 under Alternatives 1, 2, and 3, respectively.

The following information was used to determine outcomes:

- There have been 433,000 acres surveyed on BLM-administered lands in the planning area over the past 6 years. This is 17% of the total BLM land base (2,555,000 acres) in the planning area. Surveyed acres occur in the range of habitat types where future activities on BLM-administered lands would occur.
- There are 5000 total known populations of the BLM's special status species that occur on BLM-administered lands in the planning area.[6]

[6] These species and populations are based on the 2006 BLM special status species list and the records in GeoBob on 3-28-2006. It is anticipated that species on the BLM special status species list would change in the final EIS, as well as the number of populations which would change the results of this analysis.

- Acres of timber harvest and fuels reduction treatments were projected for each action alternative.
- Data sets of surveyed acres and known populations were analyzed for each BLM district.

A ratio of the total number of known populations to the total number of acres surveyed was calculated and applied across all BLM-administered lands. The following caveats apply to the projection of populations and occupied habitat:

- BLM sensitive and assessment species are not homogenously distributed throughout the planning area, and tend to have a clumpy or patchy distribution. They are often associated with poorly understood biotic, edaphic and climatic patterns.
- The pattern that results from the acres surveyed, populations found, and acres of occupied habitat cannot be used to predict the location of BLM sensitive and assessment species. The analysis is limited to broad-scale estimates of the aggregate of all populations and occupied habitat and is not applicable to any specific species.
- The pattern of distribution is based on the survey information and provides only a broad approximation of the number of populations and the pattern of occupied habitat at the planning area scale.

The results of the analysis, including the number and percentage of projected populations that would be affected by forest management activities under the alternatives is shown in *Table 178* (*Projected populations that would be affected by forest management over the next 10 Years)*. It is assumed for purposes of analysis that the percentage of projected populations that would be affected under the alternatives is directly proportional to the amount of acres subject to forest management. If forest management occurred on 12 percent of the planning area, then 12 percent of projected populations would be affected. There is no assumed propensity for management activities to occur where populations are scarce or dense.

The percentage of projected populations that would be affected by management activities under the alternatives ranges from 12 to 16 percent. The projected populations that occur in the harvest land base (not all populations), would intersect with forest management activities over many decades and be lost or harmed unless the species is known from 20 or fewer populations. In this case, populations would be protected by conservation measures under the BLM Special Status Species policy. The percentage of populations affected also does not equate to the percentage of risk that a specific population or species would be lost. Populations are not assumed to be affected under the No Action Alternative due to the application of conservation measures under the BLM Special Status Species policy.

Table 178. Projected Populations that would be affected by Forest Management over the next 10 Years

Alternative	Planning Area BLM acres	Number of Projected Populations	Acres of Timber Harvest & Fuels treatments	Number of Projected Populations Affected	Percent of Projected Populations Affected
Alt 1	2,557,800	31,400	314,000	3,850	12
Alt 2	2,557,800	31,400	330,100	4,050	13
Alt 3	2,557,800	31,400	398,800	4,950	16

The average occupied habitat size per population, or patch size, of BLM sensitive and assessment species varies widely between districts. Based on current survey data and known populations, the average patch size ranges from 0.5 acres per population in the Salem and Medford districts to approximately 5 acres in the Coos Bay District, and 10 acres in the Klamath Falls Resource Area. The Klamath Falls Resource Area has only 20 known populations. The differences in patch size are largely dependant on the species and characteristics of the population, including size, density, and the habitat type.

The ratio of known occupied habitat and known populations as a fraction of surveyed acres, when calculated for each BLM district and projected over each district's entire land base, provides a comparison of projected occupied habitat and populations between districts. The lowest percent of projected occupied habitat occurs in the Salem District (0.2%) and the Klamath Falls Resource Area (0.4%). The Medford, Roseburg, Coos Bay, and Eugene districts increase this ratio incrementally from 1.0 to 2.4 percent as shown in *Table 179* (*Projected BLM sensitive and assessment species populations and occupied habitat by district).*

The Medford District would have the most occupied habitat, and includes most of the Klamath province. The amount of projected populations in the Medford District is nearly 4 times greater than the next nearest district.

Under all action alternatives the risk of damage and loss of populations of the BLM's sensitive and assessment species changes by district relative to the number of populations and the patch size. In districts where few populations are found, the likelihood of activities occurring where populations occur is lower. In districts where more populations are found, the likelihood of activities occurring where populations occur is higher. Where the patch size per population is smaller, such as in the Medford and Salem districts, the risk of population loss would be higher when activities occur is areas where populations are found.

Table 179. Projected BLM sensitive and assessment species populations and occupied habitat by district

Total Area (acres)	Planning Area	Salem	Eugene	Roseburg	Coos Bay	Medford	Klamath Falls
	2,557,800	403,000	315,000	426,300	322,600	865,800	51,300
Projected Occupied (acres)	23,000	940	7,500	6,200	6,700	8,600	190
Land Base (%)	0.9	0.2	2.4	1.4	2.1	1.0	0.4
Projected Populations (#)	31,000	1,800	4,800	3,350	1,250	18,500	20

Mitigation Measures

Mitigation Measures could be applied to reduce the risks of extirpation to populations and species under the action alternatives. This would involve the application of conservation measures similar to the BLM special status species policy to species at risk of local extirpation in the conifer forest habitat group that have an Oregon Natural Heritage ranking of S1 and S2 in Oregon.

Invasive Plants

This analysis examines timber harvesting, road management activities, and off-highway vehicle use for the potential to introduce and spread invasive plant species that would result from the alternatives.

Key Points

- The risk of introducing invasive plant species would be greater under Alternative 2 than the No Action Alternative and Alternatives 1 and 3.
- Invasive plant species would have a greater risk of spreading more broadly under Alternative 3 than under the No Action Alternative and Alternatives 1 and 2.
- The BLM's influence on invasive plant species introduction and spread is limited by the relative amount of BLM-administered land within the planning area compared to other ownerships.

Timber harvesting, road management activities, and off-highway vehicle use create susceptibility for invasive plant species introduction and spread. Infestations are introduced and spread more readily in areas that have more human activity (e.g., high recreational use areas).

Introducing Invasive Plant Species

The factors that were considered in the analysis of the relative levels of risk for the inadvertent introduction of invasive plant species on the BLM-administered lands include:

- the distribution and abundance of species,
- the types and methods of timber harvesting,
- the proximity of harvesting activity to streams,
- the intensity and distribution of management activities, and
- the designations for off-highway vehicle use.

Species group distributions are categorized and displayed in maps as abundant, limited, or low by fifth-field watershed (see *the Invasive Plant* section in *Chapter 3)*. For analysis purposes, species groups are combined to represent invasive plant species.

Risk of Introduction

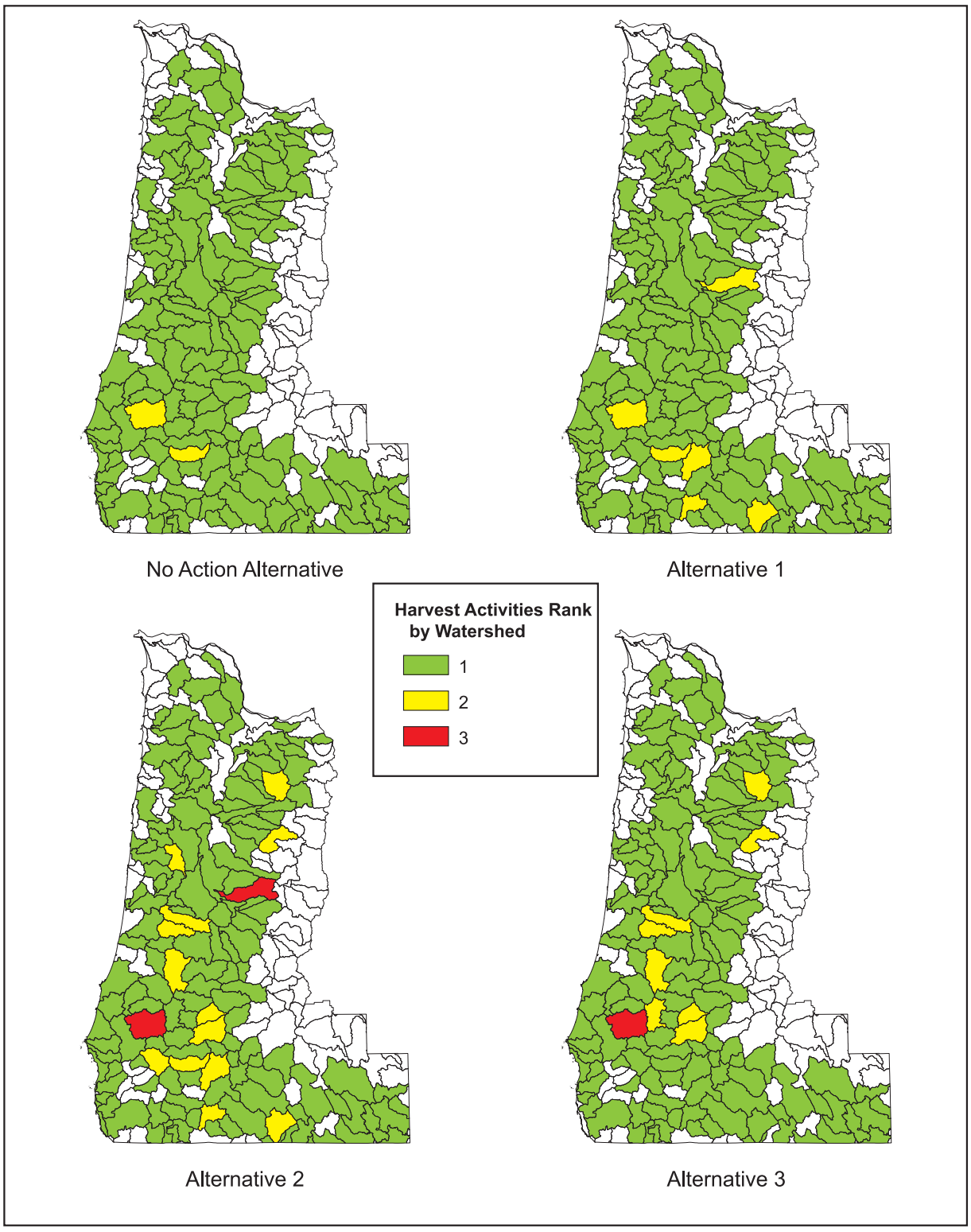
The relative risk of invasive plant species being introduced over the next 10 years as an inadvertent by-product of timber harvesting activities varies by alternative. The differences are based on the distribution of invasive plant species, the acres of the different timber harvesting types (thinning, partial harvesting, regeneration harvesting, and uneven-aged management), and the methods of logging used.

Timber harvesting types and logging methods alter the conditions that affect the introduction and spread of invasive weeds. For example:

- Regeneration harvests under all four alternatives and partial harvests under Alternative 3 create higher light levels than commercial thinning and uneven-aged management.
- Soil is disturbed more by ground-based logging methods, less by skyline cable systems, and least by aerial logging systems.

The watersheds that would generate the most and the least postharvest light and soil disturbance from timber harvesting activities are shown in *Figure 206 (Relative susceptibility of fifth-field watersheds to invasive plant species introduction as a result of timber harvesting activities over the next 10 years)*.

Figure 206. Relative susceptibility of fifth-field watersheds to invasive plant species introduction as a result of timber harvesting activities over the next 10 years



A comparison of the relative susceptibility between the alternatives can be seen in *Figure 207 and Table 180 (Susceptibility comparison for the introduction of invasive plant species that are associated with timber harvesting activities over the next 10 years)*. Watersheds with no potential for timber harvesting activities in the first 10 years after implementation, or which have no BLM-administered lands, have no assigned susceptibility category.

Figure 207. Susceptibility comparison for the introduction of invasive plant species that are associated with timber harvesting activities over the next 10 years

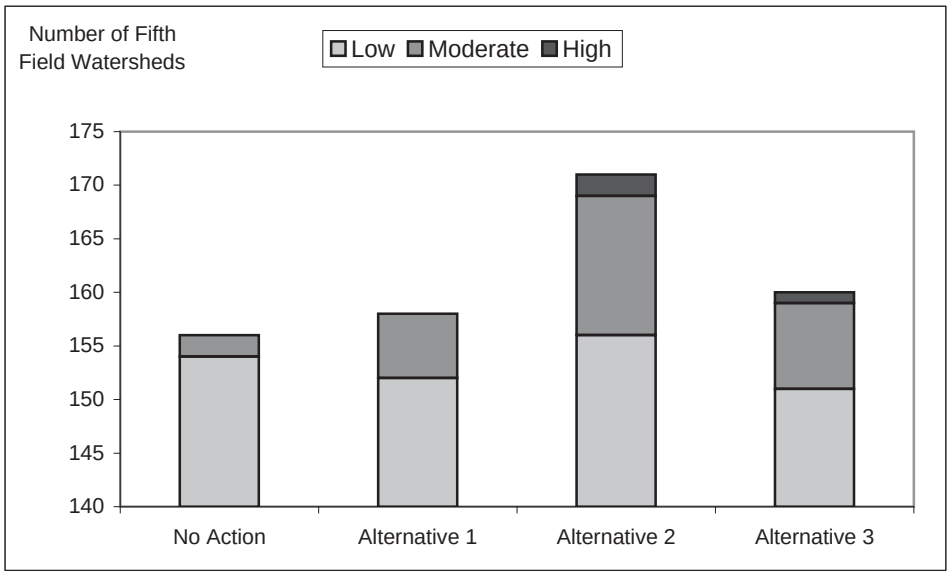


Table 180. Susceptibility comparison for the introduction of invasive plant species that are associated with timber harvesting in the fifth-field watersheds across the alternatives over the next 10 years

Susceptibility Ranking	No Action	Alternative 1	Alternative 2	Alternative 3
High	0	0	2	1
Moderate	2	6	13	8
Low	154	152	156	151
Total Susceptible	**156**	**158**	**171**	**160**
Total Not Susceptible	**104**	**102**	**89**	**100**
Total Watersheds	**260**	**260**	**260**	**260**

Susceptibility to the introduction of invasive plant species would be greatest under Alternative 2 with 171 watersheds having some level of susceptibility that is associated with timber harvesting activities over the next 10 years compared to the 156 watersheds under the No Action Alternative and 158 and 160 watersheds with susceptibility rankings under Alternatives 1 and 3.

Under Alternative 2, two fifth-field watersheds would be in the highest susceptibility category and 13 would be in the moderately susceptible category. Under Alternative 2, the highly susceptible watersheds would be in the Eugene,

Roseburg, and Coos Bay districts. Watersheds of moderate and low susceptibility would be in all of the districts within the planning area.

Alternative 3 would be the second most susceptible to invasion with one fifth-field watershed in the highest category and eight in the moderately susceptible category. Under Alternative 3, the highly susceptible watershed would in the Roseburg and Coos Bay districts. The moderately susceptible watersheds would be in the Salem, Eugene, and Roseburg districts.

Alternative 1 and the No Action Alternative would have the lowest overall susceptibility to the introduction of invasive plant species that are associated with timber harvesting activities over the next 10 years. For both of these alternatives, no fifth-field watersheds would be in the highest susceptibility category.

Under Alternative 1, six fifth-field watersheds would be in the moderately susceptible category. The moderately susceptible watersheds would be in all of the districts within the planning area, except the Salem District.

The No Action Alternative would have two fifth-field watersheds in the moderately susceptible category and they would be in the Roseburg, Coos Bay, and Medford districts. All of the other watersheds would be in the lowest susceptibility category.

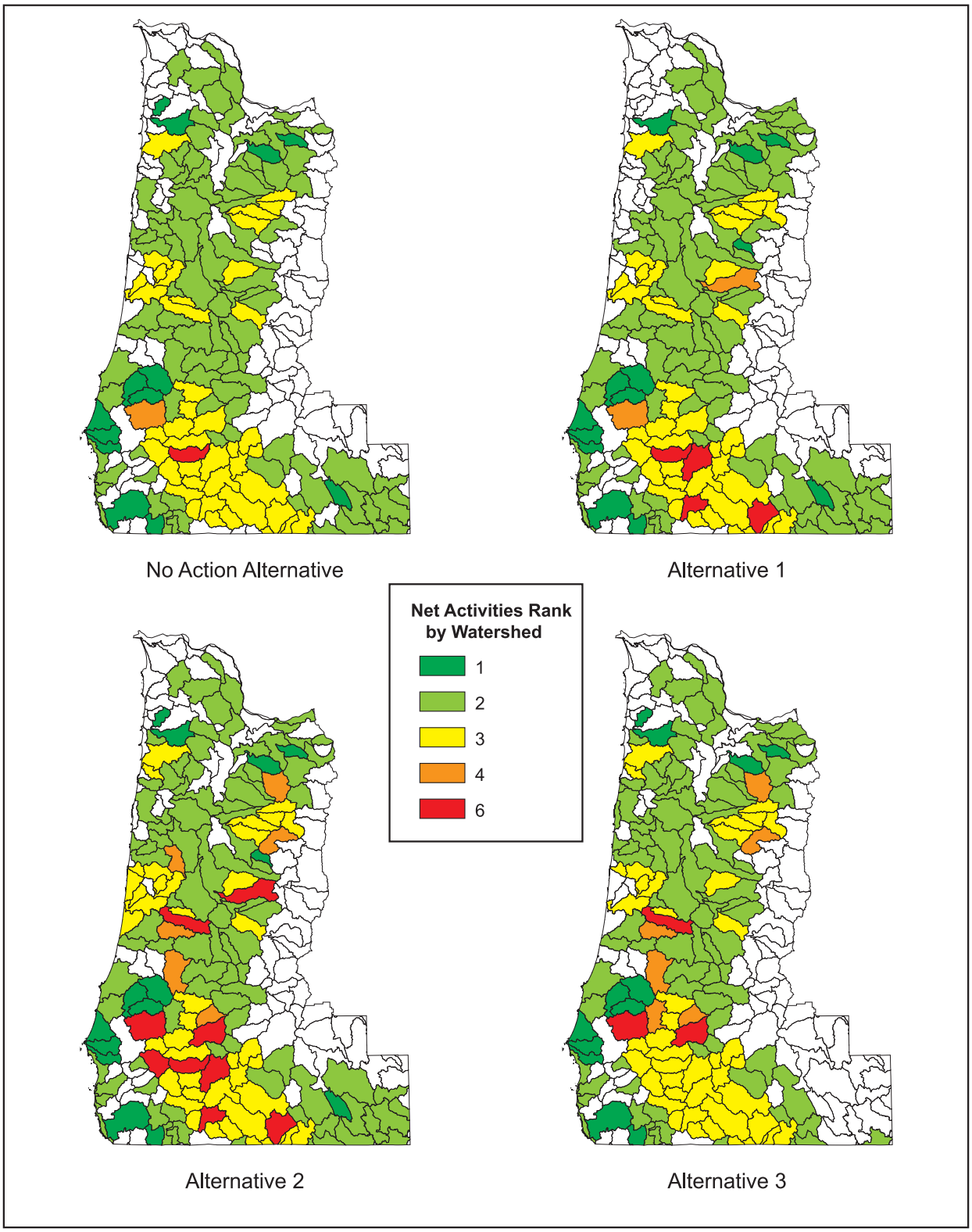
The risk of invasion is determined by both the susceptibility of a watershed to invasion from timber harvesting activities in the first 10 years of implementation and the presence of invasive plant species.

The process used to determine the risk of invasive plant species introduction by fifth-field watershed is shown in *Table 181 (Matrix to determine the relative risk for the introduction of invasive plant species that are associated with timber harvesting activities over the next 10 years)* and displayed in *Figure 208 (Comparison of the risk by mapped watershed for the introduction of invasive plant species that are associated with timber harvesting activities over the next 10 years)*. Within this table, categories for the distribution of invasive plant species distribution categories and the categories for the susceptibility of introduction from timber harvesting activities are used to determine the relative risk categories for the inadvertent introduction of invasive plant species.

Table 181. Matrix to determine the relative risk for the introduction of invasive plant species that are associated with timber harvesting activities over the next 10 years

Species distribution categories	Susceptibility categories for the introduction of invasive plant species from timber harvesting activities		
	Low	Moderate	High
Low	Low	Moderately Low	Moderate
Limited	Moderately Low	Moderately High	High
Abundant	Moderate	High	Highest

Figure 208. Comparison of the risk by mapped watershed for the introduction of invasive plant species that are associated with timber harvesting activities over the next 10 years



Watersheds with a low distribution of invasive plant species and a low or moderate susceptibility for the introduction of invasive plant species would have the lowest risk of invasion. The greatest risk of invasion would be in fifth-field watershed where both invasive plant species are abundant and susceptibility would be high. Watersheds with either no reported sites for the sample set of invasive plant species in the analysis or with no BLM ownership have no assigned risk category.

See *Figure 209 (Comparison of the risk by watersheds for the introduction of invasive plant species associated with timber harvesting activities over the next 10 years)* and *Table 182 (Risk comparison for the introduction of invasive plant species associated with timber harvesting in the fifth-field watersheds across the alternatives over the next 10 years)* for the relative risk for the introduction of invasive plant species that are associated with timber harvesting activities over the next 10 years across the alternatives.

Figure 209. Comparison of the risk by watersheds for the introduction of invasive plant species associated with timber harvesting activities over the next 10 years

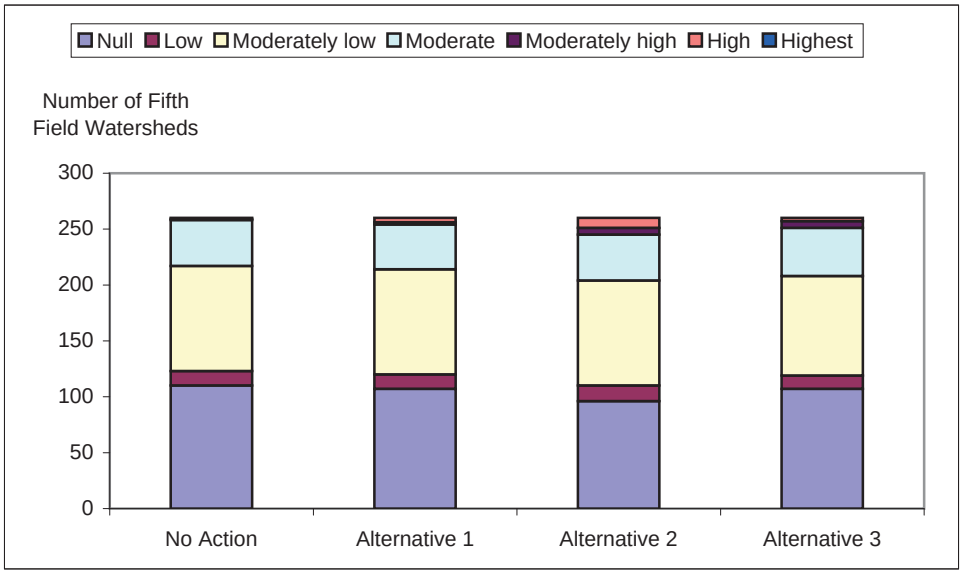


Table 182. Risk comparison for the introduction of invasive plant species associated with timber harvesting in the fifth-field watersheds across the alternatives over the next 10 years

Risk Ranking	No Action	Alternative 1	Alternative 2	Alternative 3
High	1	4	9	3
Moderately high	1	2	6	6
Low	148	147	149	144
Total Susceptible	**150**	**153**	**164**	**153**
Total Not Susceptible	**110**	**107**	**96**	**107**
Total Watersheds	**260**	**260**	**260**	**260**

The relative levels of risk of invasive plant species introduction associated with timber harvesting activities over the next 10 years under the alternatives follow the same pattern as the relative levels of susceptibility. Alternative 2 would have 164 watersheds with some level of risk compared to 150 watersheds under the No Action Alternative and 153 watersheds under both Alternatives 1 and 3.

Alternative 2 would have the most watersheds in the high and moderately high risk categories for invasive plant species introduction associated with timber harvesting activities over the next 10 years. Under Alternative 2, nine of the fifth-field watersheds would have a high risk of invasion and another six watersheds would have a moderately high risk of invasion. High risk watersheds are from all of the districts within the planning area, except the Salem District. Moderately high risk watersheds would be in the Salem, Roseburg, and Coos Bay districts.

Under the No Action Alternative, one of the fifth-field watersheds would be in both the high risk and moderately high risk categories. The high risk watershed would be in the Medford District. The moderately high risk watershed would be shared between the Roseburg and Coos Bay districts.

Alternative 1 would have four fifth-field watersheds in the high risk category and two watersheds in the moderately high risk category. The high risk watersheds would be all in the Medford District and one would be shared between the Medford District and the Klamath Falls Resource Area in the Lakeview District. The moderately high risk watersheds would be in the Eugene and Coos Bay districts.

Alternative 3 would have three fifth-field watersheds in the high risk category and six watersheds would be in the moderately high risk category. The high risk watersheds would be in the Eugene, Roseburg, and Coos Bay districts. The moderately high risk watersheds would be in the Salem, Roseburg, Coos Bay, and Medford districts.

Invasive Plant Species Introduction into Riparian Areas

The introduction of invasive plant species into riparian habitats provides a corridor for introduction (see the *Invasive Plants* section in *Chapter 3*). The risk of invasive plant species being introduced into riparian habitats as an inadvertent by-product of timber harvesting activities and associated new road construction varies with the widths, prescriptions, and levels of timber harvesting activities within riparian reserves and riparian management areas. The lower the shade levels, the higher the risk for the introduction of invasive plant species (see the *Invasive Plants* section in *Chapter 3*).

Under the No Action Alternative and Alternative 1, the post-thinning shade levels are the highest because of the broader widths of the riparian reserves or riparian management areas for all streams (perennial and intermittent).

- Post-thinning shade levels in the riparian management areas for perennial streams under Alternatives 2 and 3 would be lower than those under

Alternative 1 and the No Action Alternative since the widths of the riparian management areas are narrower.

- The widths of the riparian management areas are 25 feet for all intermittent streams under Alternative 2, except for debris-flow prone intermittent streams, and for all intermittent streams under Alternative 3. This would result in the lowest post-harvest shade levels along these streams.

The analytical assumption for the risk for the introduction of invasive plant species in intermittent streams under Alternative 2 and 3 is that the shade levels for the riparian habitats that are associated with these streams would mimic the levels in the surrounding timber harvest units. The intermittent riparian habitat post-harvest shade levels would be lower under Alternatives 2 and 3 than under the No Action Alternative and Alternative 1.

See *Figure 210 (Susceptibility comparison for the introduction of invasive plants species into riparian habitats associated with timber harvesting activities over the next 10 years)* and *Table 183 (Susceptibility comparison for the introduction of invasive plant species into riparian habitats that are associated with timber harvesting activities in the fifth-field watersheds over the next 10 years)* for a comparison of the relative susceptibility between the alternatives.

Figure 210. Susceptibility comparison for the introduction of invasive plant species into riparian habitats associated with timber harvesting activities over the next 10 years

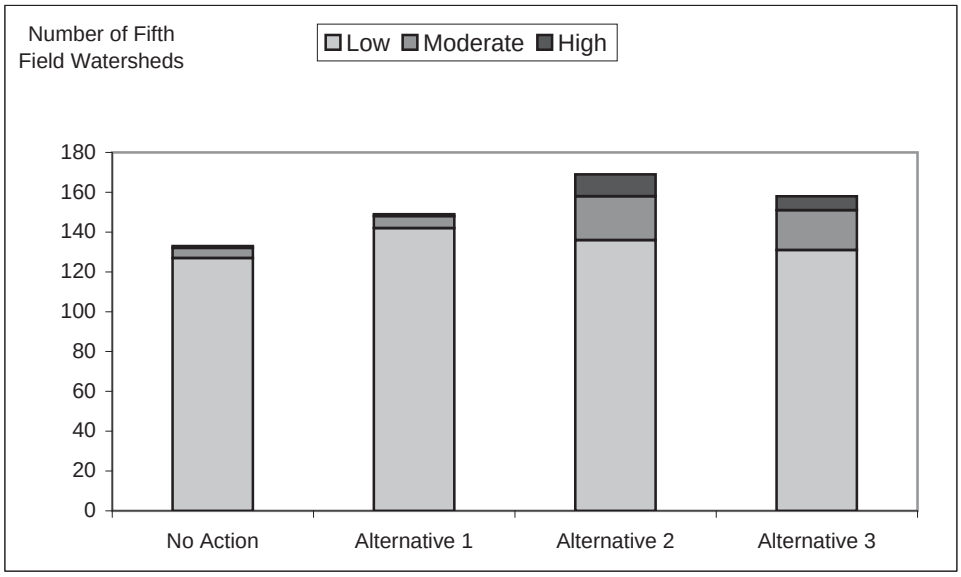


Table 183. Susceptibility comparison for the introduction of invasive plant species into riparian habitats that are associated with timber harvesting in the fifth-field watersheds over the next 10 years

Susceptibility	No Action	Alternative 1	Alternative 2	Alternative 3
Post-thinning shade levels	highest	highest	lower	lower
Widths of riparian reserves or riparian management areas	broader	broader	narrower	narrower
Overall susceptibility	moderate	moderate	highest	next highest
High	1	1	11	7
Moderate	5	6	22	20
Low	127	142	136	131
Total Susceptible	**133**	**149**	**169**	**158**
Total Not Susceptible	**127**	**111**	**91**	**102**
Total Watersheds	**260**	**260**	**260**	**260**

Alternative 2 would have 169 fifth-field watersheds with assigned susceptibility categories. Alternative 3 would have 158 with assigned susceptibility categories. The No Action Alternative and Alternative 1 would have 133 and 149 fifth-field watersheds, respectively, with assigned susceptibility categories.

The relative distribution of the fifth-field watersheds that were assigned susceptibility categories for invasive plant species introduction into riparian habitats for each alternative can be seen in *Appendix F, Invasive Plants*.

Over the next 10 years, Alternative 2 would have the most fifth-field watersheds in the highest susceptibility category for the introduction of invasive plant species into riparian habitats that are associated with timber harvesting activities. There are 11 watersheds that would be the most susceptible to introductions and they would be in the Salem, Eugene, Roseburg, and Medford districts. Another 22 watersheds would be in the moderately susceptible category and they would be in all of the districts within the planning area, except for the Klamath Falls Resource Area of the Lakeview District.

Over the next 10 years, Alternative 3 would have the second highest overall susceptibility for the introduction of invasive plant species into riparian habitats that are associated with timber harvesting activities. There are seven watersheds that would be the most susceptible to introductions and they would be in the Klamath Falls Resource Area of the Lakeview District and the Medford District. There are 20 fifth-field watersheds that would be moderately susceptible to invasive plant species introductions and they would be in all of the districts within the planning area.

Over the next 10 years, Alternative 1 and the No Action Alternative would be similar in their relative level of susceptibility for the introduction of invasive plant species into riparian habitats that are associated with timber harvesting activities. Both alternatives would have a single fifth-field watershed in the

highest susceptibility category and it would be shared between the Roseburg and Coos Bay districts. There are five and six fifth-field watersheds under the No Action Alternative and Alternative 1, respectively, which would be in the moderately susceptible category. Under the No Action Alternative, the moderately susceptible fifth-field watersheds would be in the Eugene, Roseburg, and Coos Bay districts. Under Alternative 1, all of the districts within the planning area, except the Klamath Falls Resource Area of the Lakeview District, would have moderately susceptible fifth-field watersheds.

The risk of introducing invasive plant species into riparian habitats is shown in *Figure 211 (Relative risk of introducing invasive plant species in riparian habitats over the next 10 years)* and based on riparian susceptibility values and invasive plant species distribution. The risk comparison for invasion into riparian habitats between the alternatives is presented in *Figure 212 (Riparian risk category comparison for the introduction of invasive plant species over the next 10 years)* and *Table 184 (Risk comparison for the introduction of invasive plant species into riparian habitats associated with timber harvesting in the fifth-field watersheds over the next 10 years).*

Figure 211. Relative risk of introducing invasive plant species in riparian habitats over the next 10 years

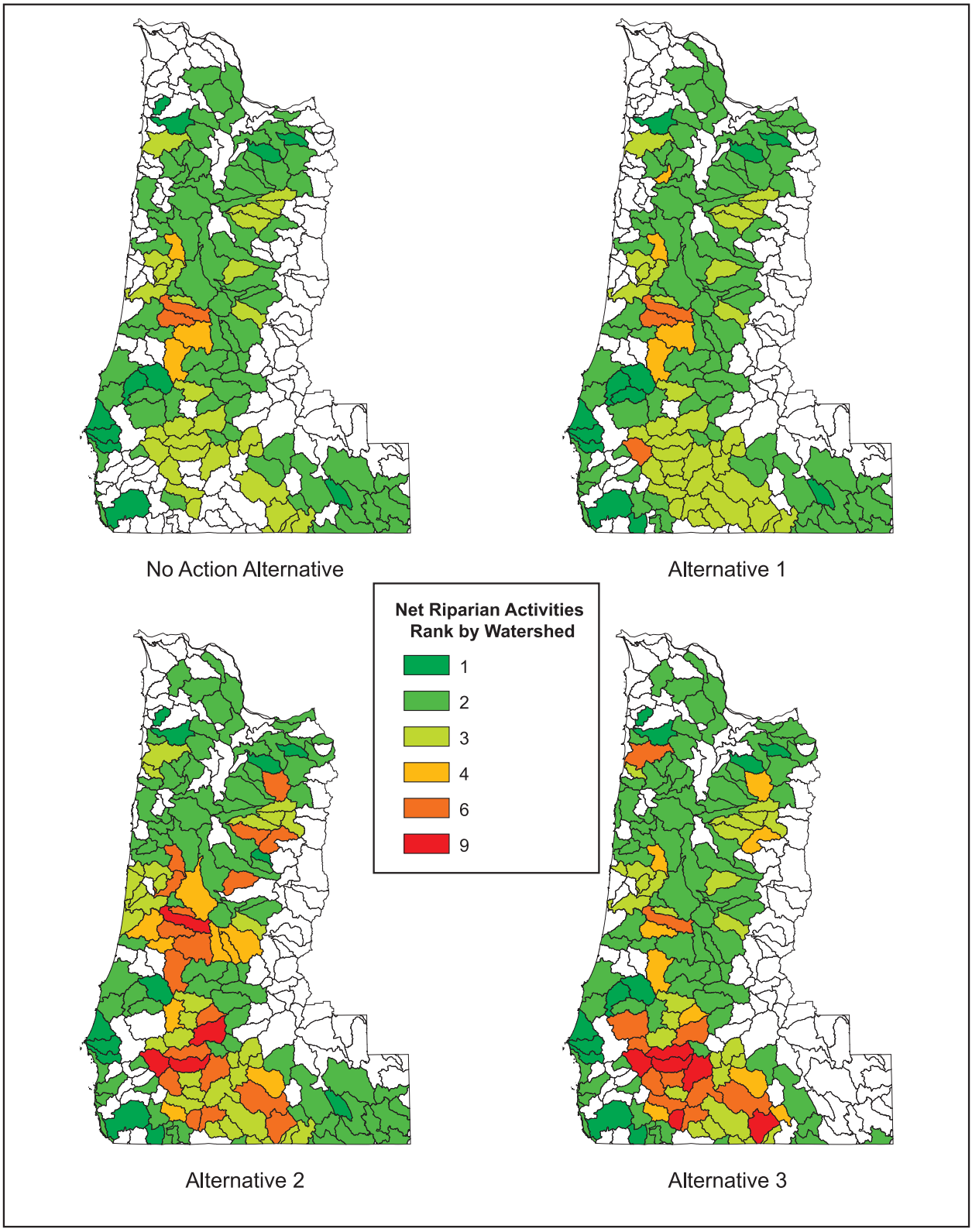


Figure 212. Riparian risk category comparison for the introduction of invasive plant species over the next 10 years

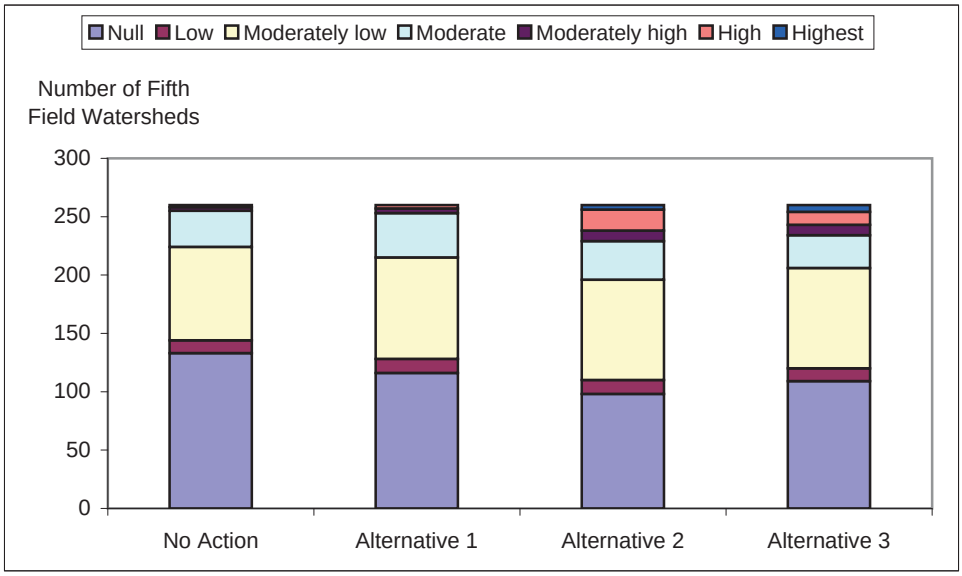


Table 184. Risk comparison for the introduction of invasive plant species into riparian habitats associated with timber harvesting in the fifth-field watersheds across the alternatives over the next 10 years

Risk Ranking	No Action	Alternative 1	Alternative 2	Alternative 3
Highest	0	0	4	6
High	2	3	18	11
Moderately high or lower	125	141	140	134
Total Susceptible	**127**	**144**	**162**	**151**
Total Not Susceptible	**133**	**116**	**98**	**109**
Total Watersheds	**260**	**260**	**260**	**260**

Alternative 2 would create the greatest risk of introducing invasive plant species into riparian habitats. The least amount of risk would occur under the No Action Alternative with its broader riparian management areas on both perennial and intermittent streams. Alternative 2 would have 162 fifth-field watersheds with risk for the introduction of invasive plant species into riparian habitats that are associated with timber harvesting activities. Alternative 3 would have 151 fifth-field watersheds with a risk for introduction. The No Action Alternative and Alternative 1 would have 127 and 144 fifth-field watersheds, respectively, with a risk for introduction. Over the next 10 years, watersheds with either no harvesting activities or no documented invasive plant species were determined to have no risk of introduction into riparian habitats that are associated with timber harvesting activities. These watersheds are represented in the null category in *Figure 212*.

Alternative 3 would have the most fifth-field watersheds in the highest risk category for the introduction of invasive plant species into riparian habitats that are associated with timber harvesting activities over the next 10 years. There are

six watersheds that would be in the highest risk category and they would be in the Klamath Falls Resource Area of the Lakeview District and the Medford District. Another 11 watersheds would be in the high risk category and they would be in all of the districts within the planning area.

Over the next 10 years, Alternative 2 would have the second highest amount of fifth-field watersheds in the highest risk category for the introduction of invasive plant species into riparian habitats that are associated with timber harvesting activities. There are four fifth-field watersheds that would be in the highest risk category and they would be in the Eugene, Roseburg, and Medford districts. There are 18 fifth-field watersheds that would be in the high risk category and they would be in all of the districts within the planning area, except the Coos Bay District.

Over the next 10 years, Alternative 1 and the No Action Alternative would be similar in their relative level of risk for the introduction of invasive plant species into riparian habitats that are associated with timber harvesting activities. Alternative 1 and the No Action Alternative would have a relatively low risk of invasive plant species introduction into riparian areas compared to the risk levels under Alternatives 2 and 3.

Alternative 1 and the No Action Alternative would have no fifth-field watersheds in the highest risk category. Under the No Action Alternative there would be two fifth-field watersheds in the high risk category and they would be in the Eugene, Roseburg, and Coos Bay districts. Under Alternative 1, the three fifth-field watersheds in the high risk category would be in the Eugene, Roseburg, Coos Bay, and Medford districts.

An increase in timber harvesting activities indirectly increases the amount of road construction and maintenance that is needed to support the preparation, harvesting, and reforestation of the timber harvesting. Typical road management activities involve some level of soil disturbance and reduction in shade. For the relationship of timber harvesting and roads to the runoff into streams, see the *Water* section in this chapter.

See *Figure 213 and Table 185 (Risk comparison for the introduction of invasive plant species associated with new road construction over the next 10 years)* for the risk comparison for the introduction of invasive plant species into fifth-field watersheds as a result of new road construction activities between the alternatives.

Figure 213. Risk comparison for the introduction of invasive plant species associated with new road construction over the next 10 years

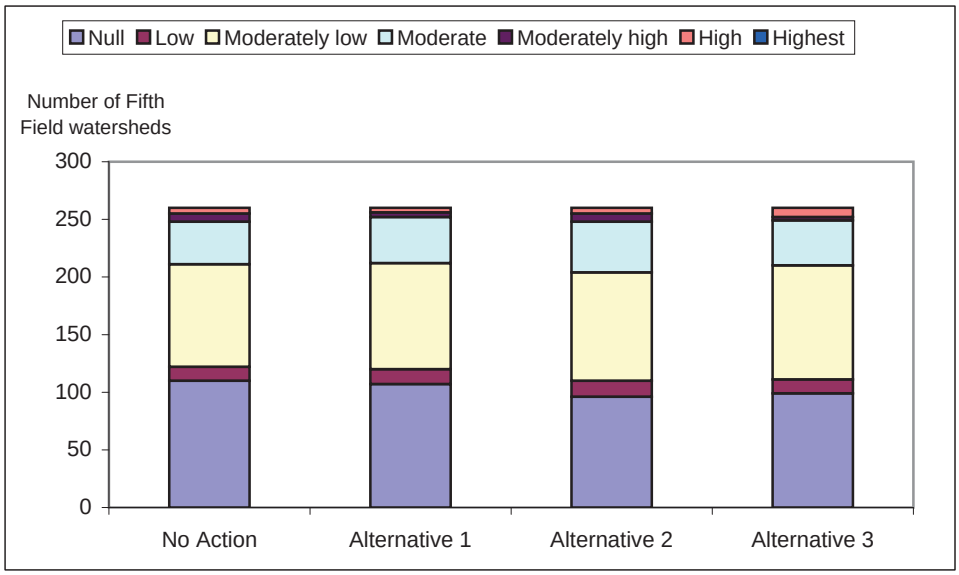


Table 185. Risk comparison for the introduction of invasive plant species associated with new road construction by fifth-field watershed over the next 10 years

Risk Ranking	No Action	Alternative 1	Alternative 2	Alternative 3
High	5	4	5	8
Moderately high	7	4	7	3
Moderate or lower	138	145	152	150
Total Susceptible	**150**	**153**	**164**	**161**
Total Not Susceptible	**110**	**107**	**96**	**99**
Total Watersheds	**260**	**260**	**260**	**260**

The greatest relative risk of inadvertent invasive plant species introduction that is associated with new road construction activities would occur under Alternative 2 and would be the lowest under the No Action Alternative. Alternative 2 would have 164 fifth-field watersheds with assigned risk categories. Alternative 3 would have 161 fifth-field watersheds with assigned risk categories. The No Action Alternative and Alternative 1 would have 150 and 153 fifth-field watersheds, respectively, with assigned risk categories.

Over the next 10 years, Alternative 3 would have the most fifth-field watersheds in the high risk category for the introduction of invasive plant species that are associated with new road construction activities. There are eight fifth-field watersheds from the Eugene, Coos Bay, and Medford districts that would be in the high risk category. Another three fifth-field watersheds from the Salem, Roseburg, and Coos Bay districts would be in the moderately high risk category.

Alternative 2 and the No Action Alternative would have the same amount of fifth-field watersheds in the high and moderately high risk categories, but the high risk watersheds would come from four of the districts within the planning area under Alternative 2 compared to two districts under the No Action Alternative.

Over the next 10 years, Alternative 2 would have five fifth-field watersheds in the high risk category for the introduction of invasive plant species that are associated with new road construction activities and they would be in the Eugene, Roseburg, Coos Bay, and Medford districts. Another seven fifth-field watersheds from the Salem, Eugene, Roseburg, and Coos Bay districts would be in the moderately high risk category.

Over the next 10 years, the No Action Alternative would have five fifth-field watersheds in the high risk category for the introduction of invasive plant species that are associated with new road construction activities and they would be in the Eugene and Medford districts. Another seven fifth-field watersheds from the Salem, Eugene, Roseburg, and Coos Bay districts would be in the moderately high risk category.

Over the next 10 years, Alternative 1 would have four fifth-field watersheds in the high risk category for the introduction of invasive plant species that are associated with new road construction activities and they would be in the Medford District. Another four fifth-field watersheds from the Roseburg and Coos Bay districts would be in the moderately high risk category.

Areas that are designated as open to off-highway vehicle use would not be substantially more susceptible to having new introductions of invasive plant species and more spread than areas that are designated as limited or closed because a majority of the open areas are located on steep, densely-forested terrain, which is not conducive to cross-country motor vehicle travel. Areas that are designated closed to off-highway vehicle use would not be susceptible to having new introductions and spread of invasive plant species due to off-highway vehicle activity.

Emphasis areas for off-highway vehicle use would be more susceptible to having new introductions than other areas under the limited designation. This higher level of susceptibility is due primarily to the use of larger numbers of off-highway vehicles in the emphasis areas. The analytical assumption is that with additional off-highway vehicle use there is a corresponding chance of introducing infestations.

Under the No Action Alternative, 330,000 acres are designated as open and 84,600 acres are designated as closed, and the remaining acres are designated as limited. In contrast, under the three action alternatives, 77 acres are designated as open in the three action alternatives and 98,800 acres are designated as closed. Most of the acres that were designated as open under the No Action Alternative would be designated as limited under the three action alternatives. Therefore, the BLM-administered lands would be somewhat less susceptible to the introduction of invasive plant species by off-highway vehicle use under the three action alternatives than under the No Action Alternative. The designation of off-highway vehicle emphasis areas under Alternative 2 would raise the relative risk

of invasive plant species introduction from off-highway vehicle use (in affected watersheds) above the risk levels under Alternatives 1 and 3.

A relative risk comparison between the alternatives for the introduction of invasive plant species into fifth-field watersheds that are associated with the off-highway vehicle designations is shown in Figure 214 (R*elative risk for the introduction of invasive plant species that are associated with off-highway vehicle designations)* and Figure 215 (*Risk comparison for introduction of invasive plant species that are associated with off-highway vehicle use).*

Figure 214. Relative risk for the introduction of invasive plant species that are associated with off-highway vehicle designations

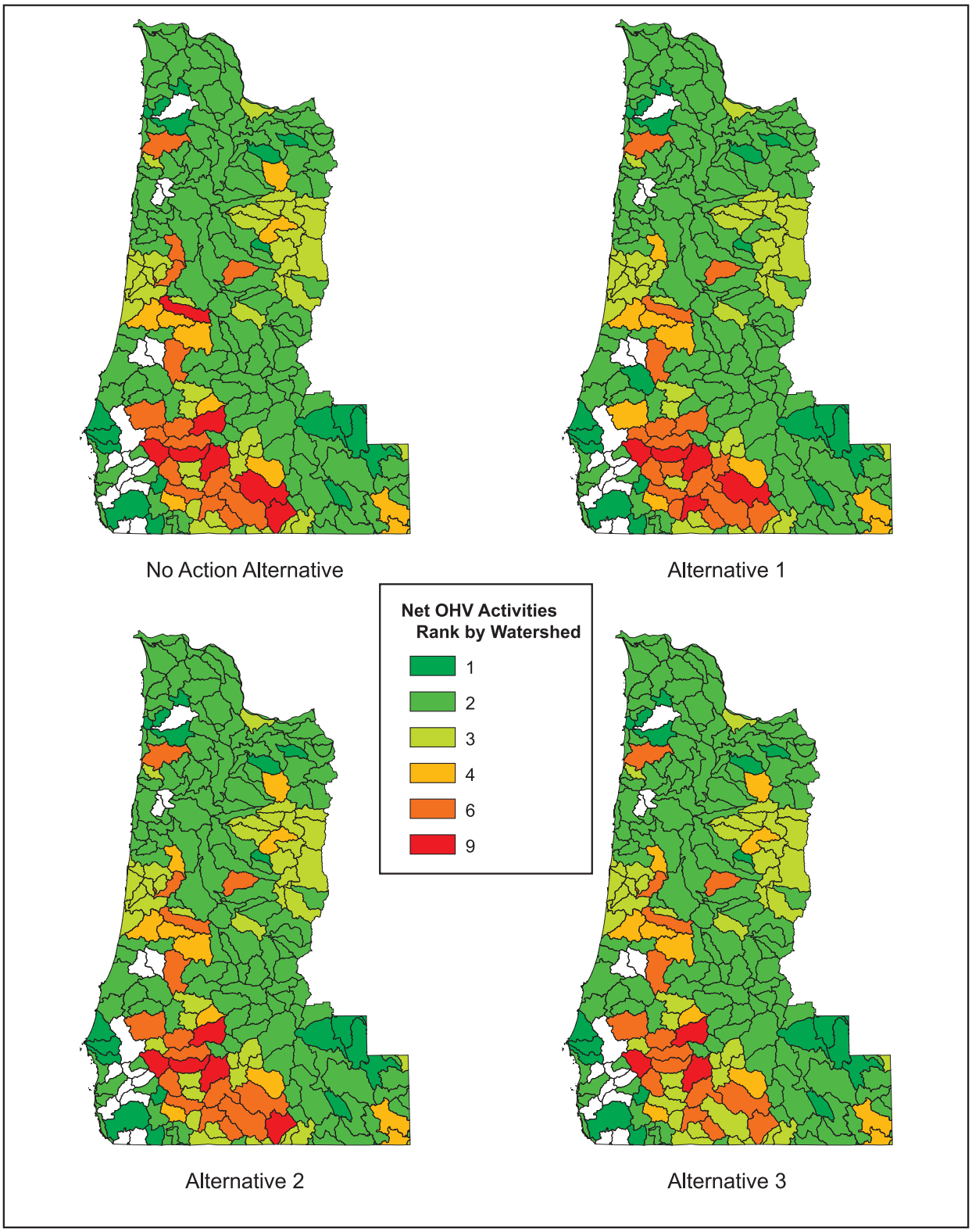
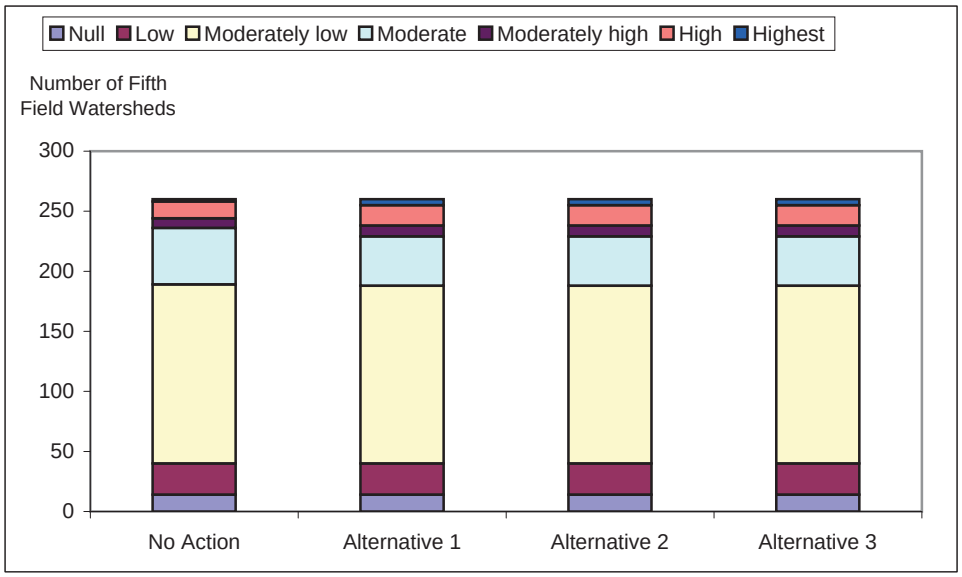


Figure 215. Risk comparison for introduction of invasive plant species that are associated with off-highway vehicle use



The No Action Alternative would have the most fifth-field watersheds in the highest risk category for the introduction of invasive plant species that are associated with off-highway vehicle use. There are seven fifth-field watersheds that would be in the highest risk category and they would be in the Eugene, Roseburg, and Medford districts and the Klamath Falls Resource Area of the Lakeview District. Another 15 fifth-field watersheds would be in the high risk category and they would be in all of the districts within the planning area, except the Klamath Falls Resource Area of the Lakeview District.

Alternative 2 would have the second highest overall risk for the introduction of invasive plant species from off-highway vehicle use. There are five fifth-field watersheds that would be in the highest risk category and they would be in the Roseburg and Medford districts and the Klamath Falls Resource Area of the Lakeview District. There are 15 fifth-field watersheds that would be in the high risk category and they would be in all of the districts within the planning area, except the Klamath Falls Resource Area of the Lakeview District. There would be more emphasis areas designated under Alternative 2 than under Alternatives 1 and 3 in the Medford District. The addition of these emphasis areas under Alternative 2 creates a relative increase in the risk for the introduction of invasive plant species from off-highway vehicle use in those watersheds compared to the level of risk for the same watersheds under Alternatives 1 and 3.

Alternatives 1 and 3 would have the same relative level of risk for the introduction of invasive plant species from off-highway vehicle use and it would be less than the levels under Alternative 2 and the No Action Alternative. There are three fifth-field watersheds that would be in the highest risk category and they would be in the Roseburg and Medford districts. There are 15 fifth-field watersheds that would be in the high risk category and they would be in all of the

districts within the planning area, except the Klamath Falls Resource Area of the Lakeview District.

Spreading Invasive Plant Species

Management activities that create susceptibility for the spread of invasive plant species are timber harvesting, associated road management activities, and off-highway vehicle use.

Infestations are introduced and spread more readily in areas that have more human activity (such as high recreational use area). The distribution of high-use recreational use areas does not vary by alternative, except for off-highway vehicle designations.

Over the long term, the potential for the introduction and spread of invasive plant species is higher in the following areas that are associated with timber harvesting activities:

- the matrix areas under the No Action Alternative,
- the timber management areas under Alternatives 1 and 2, and
- the general landscape areas under Alternative 3.

See *Chapter 2* for maps that show the relative amounts and distribution of the land use allocations under each alternative.

The No Action Alternative and Alternatives 1 and 2 would concentrate timber harvesting and the associated road management activities in the matrix, adaptive management area, and timber management area land use allocations, which would consist of 33%, 37%, and 48% of the BLM-administered lands, respectively. Under Alternative 3, timber management activities would occur throughout the general landscape area, which includes 66 % of the BLM-administered lands.

The potential for the spread of invasive plant species from existing weed infestations and as a result of infestations that are associated with timber harvesting activities would be the lowest under the No Action Alternative. Alternative 1 would have the second lowest amount of area in a land use allocation with an emphasis on timber harvesting activities. Alternative 3 would contribute more to invasive plant species spread from timber harvesting activities than the other alternatives because timber harvesting and road construction would be most dispersed across the BLM-administered lands and would occur on a larger proportion of the BLM-administered lands.

There is less potential for the introduction and spread of invasive plant species with larger late-successional reserves or late-successional management areas. Within the planning area, Alternative 1 would have 28% of the BLM-administered lands in late-successional management areas, Alternative 2 would have 19%, and the No Action Alternative would have 36% in late-successional

reserves. There would be larger blocks of land in late-successional management areas or late-successional reserves under Alternative 1 and the No Action Alternative compared to Alternative 2. Therefore, less introduction and spread of invasive plant species would be expected under Alternative 1 and the No Action Alternative than under Alternative 2.

Under Alternative 2, the BLM-administered lands in the Western Cascades physiographic province within the Salem District would predominately be in the timber management area land use allocation. There would be larger blocks of late-successional reserves under the No Action Alternative and late-successional management areas under Alternative 1. Therefore, in the Western Cascades province within the Salem District, the spread potential for invasive plant species would be higher under Alternative 2 than it would be under the No Action Alternative and Alternative 1.

Invasive plant species infestations in riparian areas spread as seeds and vegetative propagules that are carried downstream. The risk of the spread of invasive plant species along riparian habitats would be higher under Alternatives 2 and 3 than under the No Action Alternative and Alternative 1 because more infestations that are associated with timber harvesting would be introduced along intermittent streams under Alternatives 2 and 3 with their relatively narrow riparian management areas widths along most of the intermittent streams.

Compared to the other alternatives, Alternative 2 would have the greatest risk of introducing invasive plant species infestations and Alternative 3 would have the greatest potential of spreading invasive plant species based the following factors:

- current invasive plant species distribution
- timber harvesting activity levels
- proximity of harvesting to streams
- off-highway vehicle designations
- land use allocation arrangement

For the introduction and spread of invasive plant species, Alternative 2 would have the greatest number of high risk and moderate risk fifth-field watersheds that are associated with timber harvesting activities over the next 10 years. The No Action Alternative, closely followed by Alternative 1, would have the fewest.

Alternative 3 would create the greatest risk of introducing and spreading invasive plant species in riparian habitats. The No Action Alternative, closely followed by Alternative 1, would create the lowest risk of introducing and spreading invasive plant species in riparian habitats.

Under Alternative 3, invasive plant species would spread most readily. Under the No Action Alternative, invasive plant species would spread the least over the long term. Of the action alternatives, Alternative 1 would have the lowest risk of invasive plant species spread.

Although off-highway designations favor invasive plant species introduction and spread under the No Action Alternative relative to the action alternatives, when considered in combination with timber harvesting activities and associated road management activities, the No Action Alternative would have the lowest overall potential to introduce and spread invasive plant species and Alternative 3 would have the greatest overall potential for introduction and spread.

Management activities on other land ownerships would also contribute to the amount of lands made susceptible to the introduction and spread of invasive plant species that are associated with timber harvesting activities, road construction, off-highway vehicle use, and other recreational activities. Because the BLM is rarely the predominate landowner within the fifth-field watersheds within the planning area (see the *Introduction* to this chapter), the overall influence that the BLM management activities would have on the introduction and spread of invasive plant species across all lands is limited.

Mitigation Measures

Applying the following mitigation measures would reduce the risk of the introduction and spread of invasive plant species that are associated with shade-reducing and soil-disturbing management activities:

- Use cable or aerial logging methods in fifth-field watersheds that are at high risk for the introduction of invasive plant species.
- Use clean heavy equipment on actions that would operate off of roads.
- In infested areas, where the transport of invasive plant species seeds or propagules on heavy equipment is likely, clean the heavy equipment before leaving the project site, except in emergency situations.
- Use weed-free straw and mulch.
- Consistent with project objectives, retain native vegetation in and around project locations and minimize soil disturbance.

Wildlife

This analysis examines how the alternatives would affect wildlife habitat. The requirements for habitat and the responses to habitat changes vary by species. The northern spotted owl is examined first, the marbled murrelet next, followed by deer, elk, the bald eagle, the fisher, landbirds in general, the western snowy plover, the sage grouse, and special status species specifically.

Key Points

Northern spotted owl:

- The No Action Alternative and Alternative 1 would steadily increase the total amount of suitable habitat. Alternative 2 would maintain approximately the current amount of suitable habitat over time. Alternative 3 would maintain approximately the current amount of suitable habitat for the first 20 years, and then increase the amount of habitat to more than Alternative 1 in 2106.
- The No Action Alternative, Alternative 1, and Alternative 2 would contribute to large blocks of suitable habitat to support clusters of reproducing owls, distributed among the physiographic provinces, and spaced so as to facilitate owl movement between the blocks. However, the BLM contribution to large blocks would require 50 to 100 years to develop into almost all suitable habitat.
- Alternative 3 would not contribute to large blocks of suitable habitat that support clusters of reproducing owls, because it would fragment suitable habitat from current conditions.
- During the next 50 years, while large blocks are developing into suitable habitat, the No Action Alternative would increase the amount of suitable habitat outside of large blocks. Alternative 1 would approximately maintain the amount of suitable habitat outside of large blocks. Alternative 2 would decrease the amount of suitable habitat outside of large blocks.
- No Action and Alternative 1 would maintain the current total quantity of dispersal habitat, and would increase the quality of dispersal habitat from current conditions. Alternative 2 would decrease the total quantity of dispersal habitat, and would not increase the quality of dispersal habitat. Alternative 3 would decrease the total quantity of dispersal habitat, but would increase the quality of dispersal habitat over time.
- In the Rogue-Umpqua area of concern, No Action and Alternative 1 would steadily increase the amount of suitable habitat over time, but Alternative 2 and Alternative 3 would decrease the amount of suitable habitat for the next 50 years. In the South Willamette-North Umpqua and Ashland areas of concern, all alternatives would steadily increase the amount of suitable habitat.

Marbled Murrelet:

- By 2106, the quantity of marbled murrelet nesting habitat would increase under all alternatives.
- In the short term (50 years) there would be a decrease in the quantity of marbled murrelet nesting habitat of 16% under Alternative 2 and 14% under Alternative 3 compared to the current condition.
- Under No Action and Alternative 1 in the Coast Range province, and No Action in the Klamath province, there would be an increase in the mean patch and core area size and an increase in edge density compared to current condition. Under Alternatives 2 and 3 there would be decreasing patch size and core area and increasing edge density.

Northern Spotted Owl

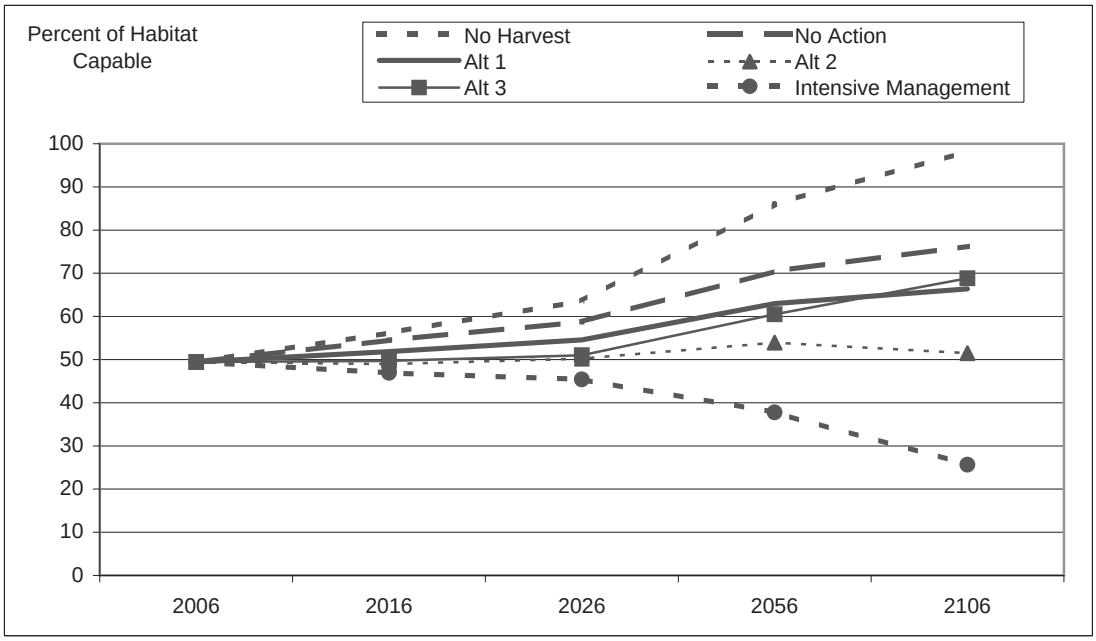
This analysis examines the effects of the alternatives on the quantity and quality of northern spotted owl suitable habitat and dispersal habitat. The analysis further examines the development, distribution and spacing of large blocks of suitable habitat and areas of concern.

Effects to populations were not analyzed because population size is affected by numerous factors other than habitat. As described in the *2007 Draft Recovery Plan for the Northern Spotted Owl*, the most important threat to the northern spotted owl is competition from the barred owl. The interaction of barred owl competition and habitat changes is currently unknown.

Development of Suitable Habitat

The reference analysis for no harvest on BLM-administered lands would steadily increase the amount of suitable habitat to 98% of the habitat-capable acres in 2106. The reference analysis of intensive management on most commercial timber lands would steadily decrease the amount of suitable habitat to 26% of habitat-capable acres in 2106. As shown in *Figure 216* (*Northern spotted owl suitable habitat on BLM-administered lands by alternative and reference analysis),* all of the alternative would result in amounts of suitable habitat between these two reference analyses. Note that while this analysis acknowledges that natural disturbances will occur and affect habitat under all four alternatives, the specific location, timing, severity, and extent of such disturbances are speculative (see the *Introduction* to this chapter). Some management actions may affect the likelihood of impact from natural disturbances (see the *Fire and Fuels* section of this chapter). For example, management actions may make the landscape more or less vulnerable to catastrophic wildfire. However, it is impossible to predict where or when wildfires would occur in specific areas.

Figure 216. Northern spotted owl suitable habitat on BLM-administered lands by alternative and reference analysis



No Action and Alternative 1 would steadily increase suitable habitat over the next 100 years:

- No Action would result in the greatest increase in suitable habitat of all alternatives with 76% of habitat-capable acres in suitable habitat by 2106.
- Alternative 1 would result in suitable habitat on 66% of habitat-capable acres in 2106.

The subalternatives of Alternative 1 would increase the amount of suitable habitat compared to Alternative 1. See *Table 186* (*Northern spotted owl suitable habitat on BLM-administered lands by alternative, reference analysis, and sub-alternatives*).

- The subalternative of no harvesting of stands that are older than 80 years would increase the amount of suitable habitat almost as much as No Harvest: 94% of habitat-capable acres in 2106.
- The subalternative of no harvesting of stands that are older than 200 years would result in suitable habitat on 72% of habitat-capable acres in 2106.
- The subalternative of including all currently designated northern spotted owl critical habitat units with the late-successional management area would result in suitable habitat on 74% of habitat-capable acres in 2106

Alternative 2 and Alternative 3 would each result in a nearly stable amount of suitable habitat until 2026. Alternative 2 would result in a slight increase in suitable habitat between 2026 and 2056, followed by a slight decrease to 51% of

habitat-capable lands in 2106 - an amount almost equal to the current condition. Alternative 3 would increase the amount of suitable habitat after 2026 to 69% of habitat-capable lands in 2106 – an amount slightly more than Alternative 1, but less than No Action.[7]

Table 186. Northern spotted owl suitable habitat on BLM-administered lands by alternative, reference analysis, and subalternative

	Habitat-Capable Acres	Percent of Habitat Capable (Acres)				
		2006	2016	2026	2056	2106
No Harvest	2,196,700	49 (1,085,800)	56 (1,234,600)	64 (1,396,100)	86 (1,889,200)	98 (2,158,000)
No Action	2,196,700	49 (1,085,800)	54 (1,196,500)	59 (1,290,300)	70 (1,547,700)	76 (1,674,800)
Alternative 1	2,196,700	49 (1,085,800)	52 (1,138,800)	55 (1,198,400)	63 (1,383,700)	66 (1,457,900)
Alt 1 No Harvest >80	2,196,700	49 (1,085,800)	56 (1,225,400)	62 (1,365,400)	81 (1,783,200)	94 (2,066,900)
Alt 1 No Harvest >200	2,196,700	49 (1,085,800)	52 (1,151,700)	56 (1,229,200)	66 (1,460,100)	72 (1,578,000)
Alt 1 + CHU	2,196,700	49 (1,085,800)	53 (1,159,800)	57 (1,241,700)	68 (1,487,800)	74 (1,635,400)
Alternative 2	2,196,700	49 (1,085,800)	49 (1,075,400)	50 (1,102,900)	54 (1,184,400)	51 (1,131,100)
Alternative 3	2,196,700	49 (1,085,800)	50 (1,092,000)	51 (1,119,200)	60 (1,329,000)	69 (1,512,000)
Intensive Management	2,196,700	49 (1,085,800)	47 (1,030,800)	45 (997,000)	38 (829,700)	26 (563,100)

The changes in suitable habitat by alternative would differ among the provinces. See *Figure 217* (*Northern spotted owl suitable habitat on BLM-administered lands by province by alternative*). In the Coast Range province, all alternatives would result in an increase in suitable habitat from current conditions. In the other provinces, the changes in suitable habitat are not consistent among alternatives.

The No Action Alternative would:

- Steadily increase the amount of suitable habitat over time in the Coast Range, Western Cascades, and Klamath provinces.

[7] Suitable habitat in Alternative 3 is classified by a combination of the habitat classification and the forest structural stage classification. This is because partial harvesting in Alternative 3 would create multi-cohort stands that are not accurately classified by the habitat classification alone. For Alternative 3, stands are classified as suitable habitat if they either are classified as such by the habitat classification, or if they are classified as dispersal habitat and are also classified as mature – multiple canopy or structurally complex forest by the structural stage classification. For other alternatives, the classification of suitable habitat is generally parallel with the structural stage classification of mature - multiple canopy and structurally complex forest, even though the habitat classification and structural stage classification used a different set of stand parameters. This combined classification is only used for results from the years 2056 and 2106; in the earlier years the results of the two different classification approaches are similar because the difference in classification is not apparent for several decades after the partial harvesting applied in Alternative 3. For further information, see *Appendix G - Wildlife*.

- Result in a fluctuating amount of suitable habitat in Eastern Cascades province, increasing until 2026, decreasing to 2056, and then increasing to an amount almost equal to current conditions in 2106.

Alternative 1 would:

- Steadily increase the amount of suitable habitat over time in the Coast Range, Western Cascades, and Klamath provinces, but less so than the No Action alternative.
- Decrease the amount of suitable habitat in Eastern Cascades province.

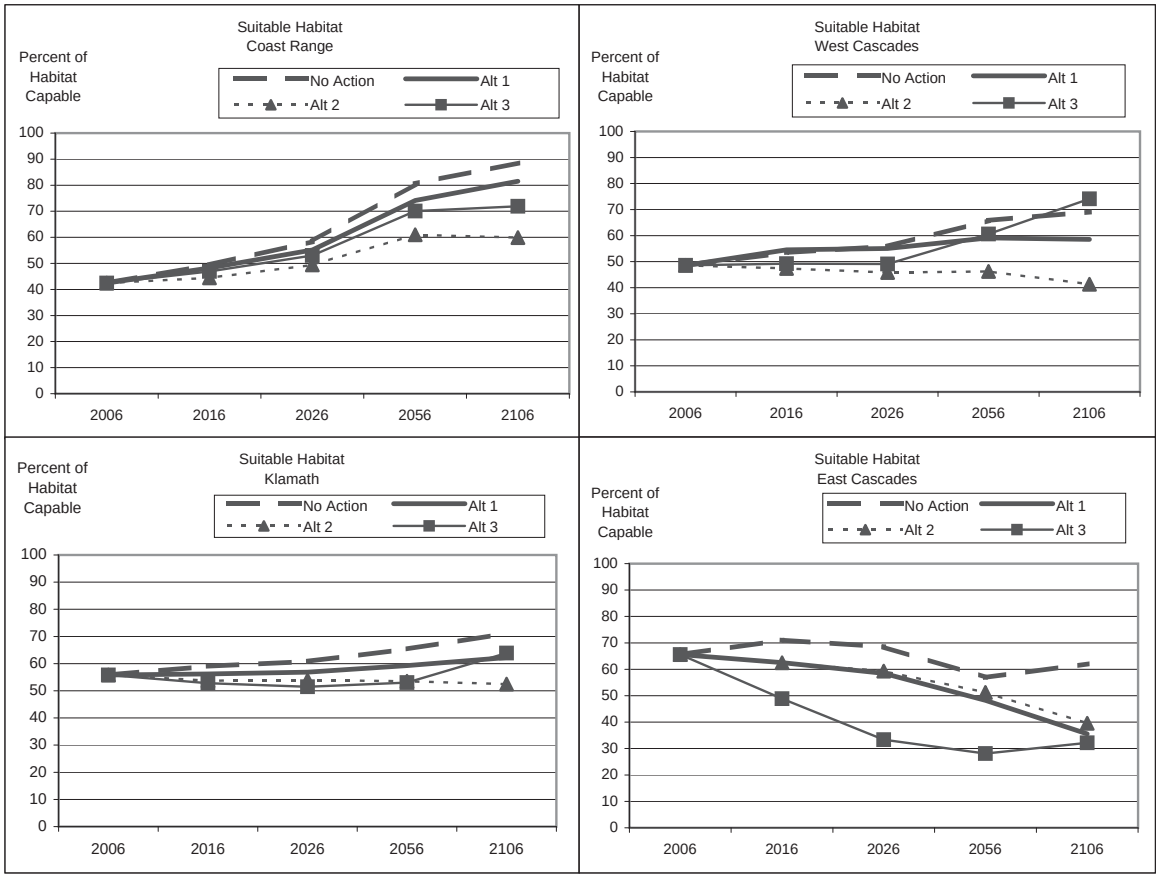
Alternative 2 would:

- Increase the amount of suitable habitat over the next 50 years in the Coast Range and Klamath provinces.
- Increase the amount of suitable habitat in the Western Cascades province over the next 50 years and then decrease from 50 to 100 years, resulting in an overall decrease from current conditions.
- Decrease the amount of suitable habitat in Eastern Cascades province, similar to Alternative 1.

Alternative 3 would

- Steadily increase the amount of suitable habitat over the next 50 years in the Coast Range province, but less so than No Action and Alternative 1.
- Maintain the current amount of suitable habitat in the Western Cascades province over the next 20 years, and then increase the amount of habitat to more than any other alternative by 100 years.
- Decrease the amount of suitable habitat in the Klamath province over the next 20 years, and then increase habitat to more than Alternative 2.
- Decrease the amount of suitable habitat in Eastern Cascades province more than any other alternative.

Figure 217. Northern spotted owl suitable habitat on BLM-administered lands by province by alternative



The amount of suitable habitat by designated critical habitat units is presented in *Appendix G - Wildlife.*

Large Blocks of Suitable Habitat

This section compares the development of blocks of suitable habitat on BLM-administered lands under each alternative. The distribution and spacing of those blocks are examined in subsequent sections.

Northern spotted owl conservation is predicated on providing blocks of suitable habitat that support clusters of owls. A cluster is at least 20 breeding pairs of owls that support each other demographically and thereby maintain a stable population (Thomas et al. 1990 p. 24). The Interagency Scientific Committee strategy (Thomas, et al. 1990), 1994 draft northern spotted owl recovery plan (USDI, USFWS 1992), northern spotted owl critical habitat designation (Federal Register 1992a), and the Northwest Forest Plan (USDA, USDI 1994) utilized this principle in developing systems of large blocks of habitat. Using assumptions from Thomas et al. (1990), the minimum size of a block of suitable habitat varies among the provinces in the planning area. See *Table 187* (*Minimum acreage of large blocks of suitable habitat*).

The land ownership pattern in most of the planning area limits the ability of BLM-administered lands to satisfy the minimum acreage for 20-pair blocks without the contribution of suitable habitat from other ownerships. In some parts of the planning area, suitable habitat on U.S. Forest Service lands could contribute along with BLM-administered lands to make a large block of suitable habitat. But in most of the planning area, BLM-administered lands could only form large blocks of suitable habitat together with nonfederal lands. Because of their different management objectives and different responsibilities under the Endangered Species Act, most nonfederal lands are unlikely to provide suitable habitat (Raphael et al. 2006; USDA, USDI 1994b pp. 3&4-244 – 2&4-245). Therefore, most potential large blocks would require that all or nearly all BLM-administered lands in the block be suitable habitat before the block would support clusters of the intended number of reproducing northern spotted owls. For the purpose of this analysis, the large blocks would not be considered functional until at least 90% of the BLM-administered lands are suitable habitat.

Table 187. Minimum acreage of large blocks of suitable habitat

Province	Acres	
	20-pair Block	10-19-pair Block
Coast Range	70,000	35,000 – 66,500
Western Cascades	45,000	22,500 – 42,750
Klamath	55,000	25,000 – 52,250

The analysis of the Northwest Forest Plan in the Northwest Forest Plan final supplemental environmental impact statement and the U.S. Fish and Wildlife Service biological opinion concluded that the mapped late-successional reserves on BLM-administered lands together with the mapped late-successional reserves on U.S. Forest Service lands would provide large blocks of habitat capable of supporting self-sustaining, breeding clusters of northern spotted owls (USDA, USDI 199b pp. 3&4-238 - 3&4-239; Appendix G-18; G-11). That analysis is incorporated by reference.

The No Action alternative would allocate 809,400 acres to large blocks in late-successional reserves. This number underestimates the actual amount of such reserves since it does not exclude occupied marbled murrelet sites and other unmapped late-successional reserves.[8] Alternative 1 would allocate 807,400 acres to late-successional management areas (excluding occupied marbled murrelet sites) that would be almost exactly coincident with the late-successional reserves in the No Action Alternative. Alternative 2 would allocate 521,500 acres to late-successional management areas (excluding occupied marbled murrelet sites) - 36% less than under the No Action Alternative and Alternative 1. Alternative 3 would allocate no late-successional management areas.

[8] Late-successional reserves in the Northwest Forest Plan were allocated for a variety of objectives, in addition to providing large blocks of suitable habitat for northern spotted owls: "[t]he objective of Late-successional reserves is to protect and enhance conditions of late-successional and old-growth forest ecosystems, which serve as habitat for late-successional and old-growth related species including the northern spotted owl…They are designed to incorporate key watersheds to the extent possible, while remaining consistent with other objectives. They also incorporate some or parts of…ecologically significant late-successional and old-growth forests (Northwest Forest Plan ROD, C-9).

Because the mapped late-successional reserves in the No Action Alternative would be almost coincident with the late-successional management areas in Alternative 1, the No Action Alternative and Alternative 1 would provide essentially the same large blocks of suitable habitat.

Late-successional reserves in the No Action Alternative and late-successional management areas in Alternative 1 would be 300,000 acres larger than the late-successional management areas in Alternative 2, and would largely overlap the late-successional management areas in Alternative 2 (see *Map 32, Overlap between Alternative 2 and Alternative 1 late-successional management areas*). The overlap would not be exact: 83% of the late-successional management areas acres in Alternative 2 would also be allocated to late-successional reserves in the No Action Alternative and late-successional management areas in Alternative 1.

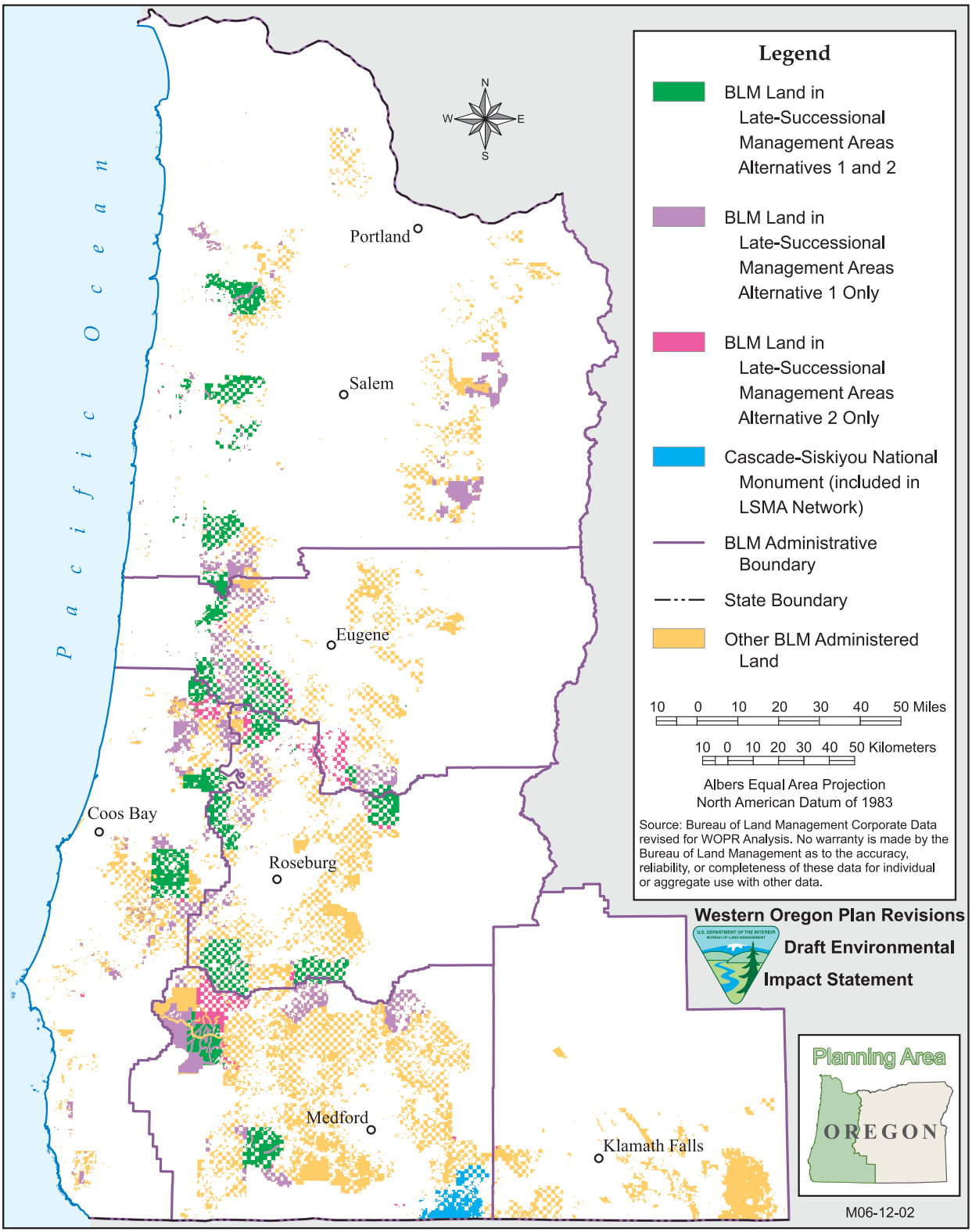
Because of this considerable overlap, the No Action Alternative and Alternative 1 would be at least as effective as Alternative 2 in developing large blocks of suitable habitat simply by the design of the land use allocations. The most notable exceptions to the overlap between the late-successional reserves in the No Action Alternative and late-successional management areas in Alternative 1 and the late-successional management areas in Alternative 2 would be the two areas (contained in Alternative 2 only) that are northeast and southwest of Roseburg as shown in *Map 32* (*Overlap between Alternative 2 and Alternative 1 late-successional management areas).* These two areas would be allocated mostly to Matrix in the No Action Alternative and Timber Management Area in Alternative 1. The area northeast of Roseburg would be located within the South Willamette-North Umpqua area of concern, which is specifically addressed below under "Areas of Concern."

Alternative 3 would allocate no late-successional management areas, and therefore this analysis cannot directly compare the creation of large blocks under Alternative 3 to the other alternatives. However, examination of the total abundance of suitable habitat and the spatial pattern analysis of mature & structurally complex forest (see *Ecology* section of this chapter) reveals that Alternative 3 would not create large blocks of suitable habitat. Alternative 3 would not increase the total acreage of suitable habitat from current conditions on BLM-administered lands for the first twenty years and would progressively fragment suitable habitat compared to current conditions over the next 100 years.

Spatial pattern analysis (see *Ecology* section of this chapter) analyzed fragmentation of mature & structurally complex forest by measuring mean patch size and connectance of patches. Although mature & structurally complex forest does not directly equate to suitable habitat, there is sufficient overlap between the two classifications that changes in spatial patterns would be similar (USDA, USDI 1994b p. G-33). [9]

[9] Using mature and structurally complex forest structural stage classification as a surrogate for suitable habitat likely overestimates the amount of suitable habitat by approximately 5 to 10% in most years, based on evaluation of the two classifications on BLM-administered lands. Nevertheless, the trends in the amount of mature and structurally complex forest and the relative results for the alternatives are consistent with the results for suitable habitat. Therefore, using mature and structurally complex forest as a surrogate for suitable habitat in the evaluation of spatial pattern is sufficient for comparative analysis of the effects of the alternatives.

Map 32. Overlap between Alternative 2 and Alternative 1 late-successional management areas



Alternative 3 would decrease the mean patch size and connectance of mature & structurally complex forest from the current condition in all provinces and more than any other alternative (see *Ecology* section of this chapter). The current condition does not yet provide large blocks with the amounts of suitable habitat considered necessary to provide for the intended level of self-sustaining, breeding clusters of northern spotted owls in the future (USDA, USDI 1994b pp. 3&4-229 through 242; *Appendix G*) and Alternative 3 would fragment suitable habitat into patches smaller than the current condition. Therefore, Alternative 3 would not provide the large blocks of suitable habitat that are necessary to provide for self-sustaining, breeding clusters of northern spotted owls.

Development of Suitable Habitat Within Large Blocks

The development of suitable habitat within large blocks can be directly compared among The No Action Alternative, Alternative 1, and Alternative 2 by summarizing the development of suitable habitat within the late-successional reserves or late-successional management areas at the scale of the planning area and the District/Province divisions (e.g. Salem/Coast Range, Salem/West Cascades, etc.). Although both of these scales of analysis group together several blocks, it allows direct comparison of the alternatives within the large blocks allocations.[10]

As is the case with the nonharvest land base as a whole, the rate of development of suitable habitat within late-successional reserve/late-successional management areas is similar under The No Action Alternative, Alternative 1, and Alternative 2. See *Table 188* (*Suitable habitat within late-successional reserves/late-successional management areas*).

Table 188. Suitable habitat within late-successional reserves/late-successional management areas[11]

Alternatives	Habitat-capable acres	Percent of Habitat Capable (acres)				
		2006	2016	2026	2056	2106
No Action	809,400	57 (458,900)	61 (490,400)	66 (535,300)	86 (693,100)	99 (797,300)
Alternative 1	807,400	57 (456,800)	60 (485,600)	65 (528,000)	84 (682,000)	99 (796,500)
Alternative 2	521,500	54 (281,300)	58 (300,400)	64 (334,800)	87 (452,400)	99 (515,000)

The No Action Alternative, Alternative 1, and Alternative 2, when supported by the late-successional reserves on U.S. Forest Service lands, eventually would

[10] This analysis includes only the mapped late-successional reserves in the No Action Alternative and the portions of the Adaptive Management Areas in the North Coast and Applegate Adaptive Management Areas which are managed with objectives similar to late-successional reserves. It does not include occupied marbled murrelet sites or other unmapped late-successional reserves.

[11] Alternative 3 is not included, because it would not allocate late-successional management areas.

provide large blocks of habitat capable of supporting self-sustaining, breeding clusters of northern spotted owls. However, late-successional reserves/late-successional management areas would require about 50 years before the blocks will be close to the goal of having 90% of the BLM-administered lands providing suitable habitat in all District/Province divisions (see *Table 189, Suitable within late-successional reserves/late-successional management areas by district/ province divisions as percent of habitat-capable acres*). Note that this analysis does not include the effects of natural disturbances (see the *Introduction* section of this chapter).

Alternative 2 would explicitly allocate late-successional management areas in discrete and individually numbered blocks. Therefore, it is possible to examine the development of suitable habitat over time in individual blocks in Alternative 2. This analysis of individual blocks is not possible for the No Action Alternative or Alternative 1, because the blocks in those alternatives are not discrete (that is, the boundaries between "individual" late-successional reserves or late-successional management area are not explicitly delineated). Furthermore, because the late-successional reserves in the No Action Alternative and late-successional management areas in Alternative 1 would largely overlap the late-successional management areas in Alternative 2, the effects of the No Action Alternative, Alternative 1 and Alternative 2 would be approximately similar within the areas allocated to late-successional management areas in Alternative 2.

Of the late-successional management area blocks created in Alternative 2, only one (LSMA-24-27) would be able to satisfy the minimum acreage for a 20-pair block with BLM-administered lands alone (see *Table 190, Development of suitable habitat within Alternative 2 large blocks of late-successional management).* All other blocks would rely in part on suitable habitat on other ownerships within the block to meet the minimum acreage required for 20-pair or 10-19-pair blocks. Although the blocks in the No Action Alternative and Alternative 1 are not explicitly delineated, the land ownership pattern similarly limits the ability to satisfy the minimum acreage for 20-pair blocks with BLM-administered lands alone.

Table 189. Suitable Habitat within Late-successional reserves/Late-successional management areas by District/Province Divisions, as percent of habitat-capable acres[12]

District/ Province	Alternative	Habitat-capable acres	2006	2016	2026	2056	2106
Salem/ Coast Range	No Action	148,700	47	54	64	90	100
	Alt 1	148,700	47	52	61	89	100
	Alt 2	105,400	43	49	60	91	100
Salem/ West Cascades	No Action	53,600	61	62	63	85	100
	Alt 1	53,600	61	62	63	83	100
	Alt 2	-[13]	-	-	-	-	-
Eugene/ Coast Range	No Action	103,200	42	51	61	86	100
	Alt 1	102,900	42	50	59	85	100
	Alt 2	61,700	46	53	62	87	100
Eugene/ West Cascades	No Action	22,500	56	57	59	87	100
	Alt 1	22,500	56	57	59	86	100
	Alt 2	23,900	35	41	54	94	100
Roseburg/ Coast Range	No Action	79,500	61	63	65	81	92
	Alt 1	78,200	61	63	66	78	91
	Alt 2	48,900	59	61	64	80	94
Roseburg/ West Cascades	No Action	25,700	69	69	70	76	99
	Alt 1	25,700	69	69	70	75	99
	Alt 2	29,900	63	63	66	76	98
Roseburg/ Klamath	No Action	60,000	59	61	63	76	99
	Alt 1	59,900	59	62	65	76	100
	Alt 2	58,400	58	61	64	75	100
Coos Bay/ Coast Range	No Action	126,000	50	53	61	89	99
	Alt 1	125,800	50	53	60	89	99
	Alt 2	88,700	45	47	55	91	99
Coos Bay/ Klamath	No Action	9,000	68	69	82	97	100
	Alt 1	9,000	67	69	82	97	100
	Alt 2	-	-	-	-	-	-
Medford/ West Cascades	No Action	21,000	57	60	61	69	96
	Alt 1	21,000	57	60	60	68	96
	Alt 2	-	-	-	-	-	-
Medford/ Klamath	No Action	160,300	74	76	79	88	98
	Alt 1	160,300	73	75	78	87	99
	Alt 2	103,500	75	76	80	90	98

[12] Alternative 3 is not included, because it would not allocate late-successional management areas.

[13] Results are not reported where late-successional reserves or late-successional management areas total <500 acres: Salem/West Cascades, Coos Bay/Klamath, and Medford/West Cascades in Alternative 2, and Klamath Falls/East Cascades in all alternatives.

Table 190. Development of suitable habitat within Alternative 2 large blocks of late-successional management areas[14]

Late-Successional Management Areas	Total acres (all ownerships)	Total LSMA acres	Habitat-Capable acres	Suitable Habitat (acres)				
				2006	2016	2026	2056	2106
LSMA-10	70,800	100	100	-	-	-	100	100
LSMA-11a	75,300	26,400	25,100	7,500	9,000	12,800	22,400	24,400
LSMA-11b	46,900	30,100	28,700	19,600	19,600	19,800	22,600	28,700
LSMA-17	91,700	800	800	200	200	200	300	800
LSMA-19	55,600	400	400	300	200	300	400	400
LSMA-21a	55,000	36,200	35,100	27,200	27,600	28,500	31,000	33,900
LSMA-24-27	201,800	104,600	99,800	68,400	70,900	74,300	85,500	99,000
LSMA-26	55,200	400	400	400	400	400	400	400
LSMA-28	55,100	27,900	26,700	15,200	16,000	16,900	20,000	26,600
LSMA-29	71,400	46,300	43,900	24,000	25,300	29,700	39,900	43,400
LSMA-30	78,200	48,700	46,700	25,100	26,300	28,300	40,900	45,500
LSMA-32-34	70,300	39,400	37,100	13,500	14,400	16,500	33,000	37,000
LSMA-33	127,000	60,200	57,200	25,900	28,000	32,200	46,600	55,500
LSMA-36	58,700	26,400	25,500	12,700	16,000	19,000	23,600	25,500
LSMA-38	46,900	900	800	700	700	700	800	800
LSMA-39	70,100	25,500	24,100	14,200	15,200	17,300	21,900	24,100
LSMA-40	20,300	7,300	6,700	2,700	3,100	3,800	6,400	6,700
LSMA-41	48,200	26,400	25,000	5,400	7,900	13,700	22,800	24,700
LSMA-42	68,500	4,300	3,800	1,600	2,100	2,200	3,300	3,800
LSMA-43	72,600	37,000	33,600	16,500	17,200	18,100	30,500	33,600
Total	1,439,700	549,200	521,500	281,300	300,400	334,800	452,400	515,000

Figure 218 (*Suitable habitat within Alternative 2 large blocks of late-successional management areas by province*) also shows the development of suitable habitat as a percent of the habitat-capable acres on BLM-administered lands within the individual blocks of late-successional management area. Only those 9 blocks for which BLM-administered lands constitute at least 10% of the total acres in the block are shown. Data for the amount of suitable habitat in the remaining 11 blocks is shown in *Table 190* above.

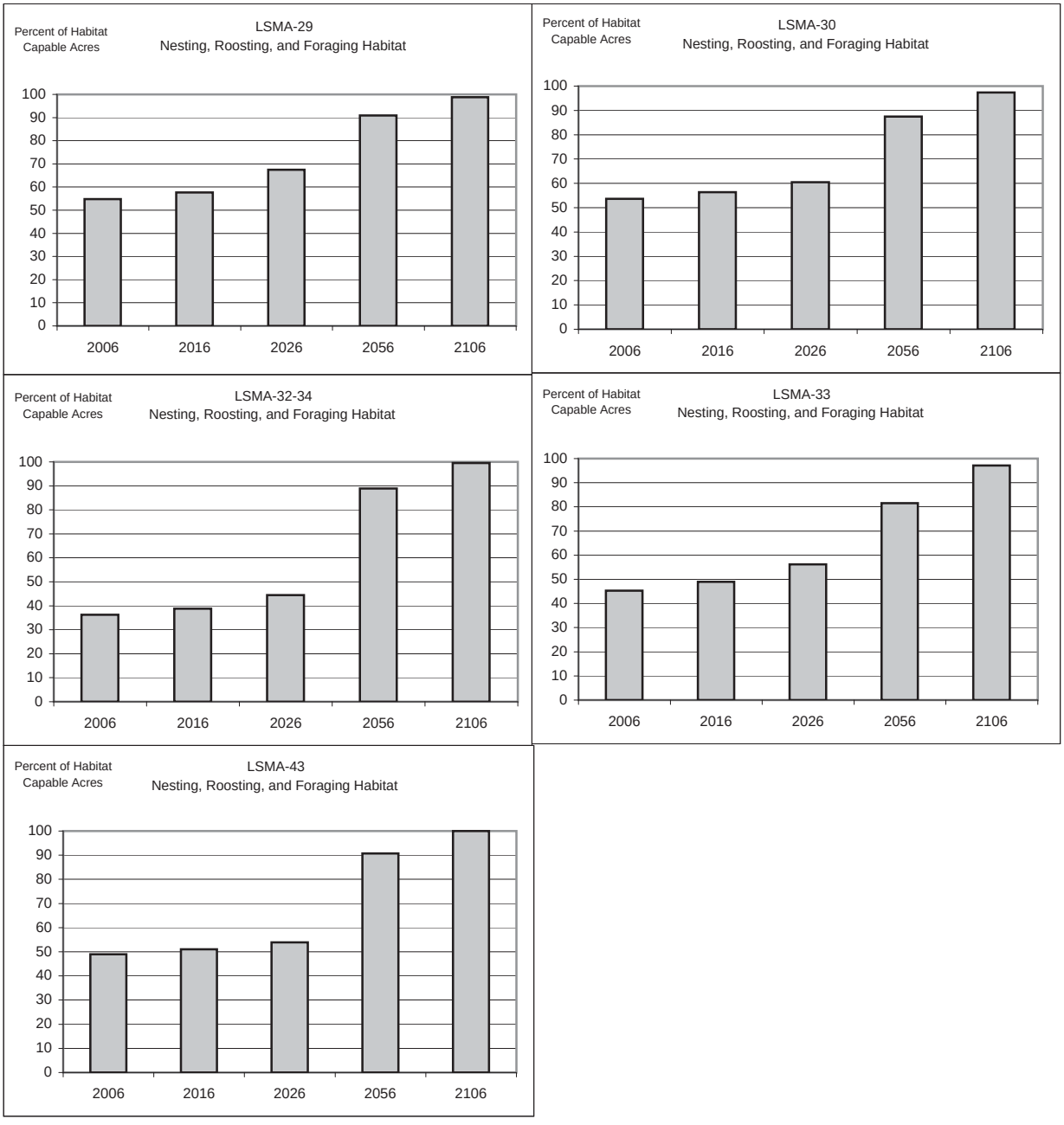
Under the current condition, suitable habitat averages 54% of habitat-capable acres in the Alternative 2 late-successional management areas. By 2026, the average amount of suitable habitat would increase to 64%, ranging from 44% to 81% on blocks with at least 10% BLM-administered lands. By 2056, average amount of suitable habitat would increase to 87%, ranging from 75% to 95% on blocks with at least 10% BLM-administered lands. All blocks would develop suitable habitat on 97% to 100% of habitat-capable acres by 2106.

[14] For most acreage numbers in this analysis, descriptions of conditions are rounded to the nearest 1,000 acres. However, these results are rounded to the nearest 100 acres because several individual blocks have less than 1,000 acres of late-successional management area.

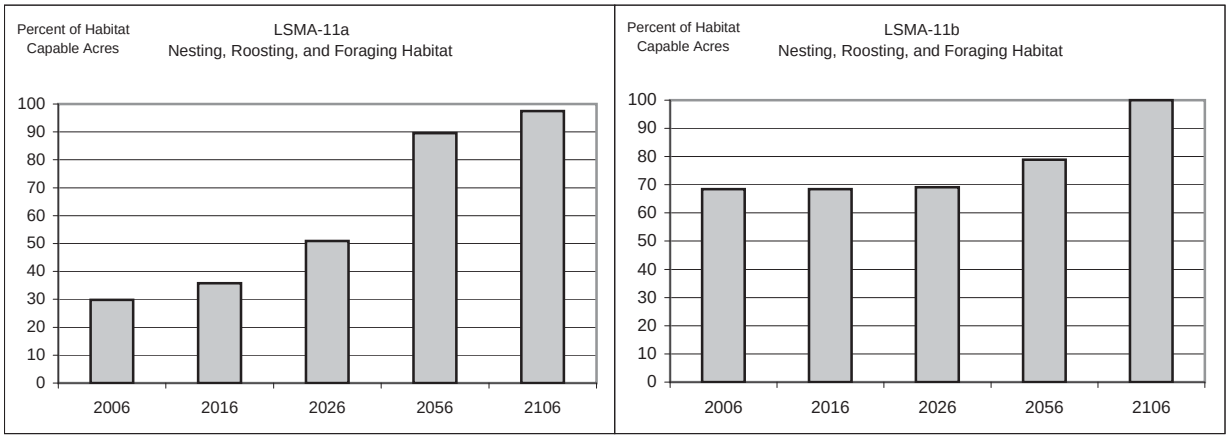
All of the individual blocks under Alternative 2 eventually would provide large blocks of habitat capable of supporting self-sustaining, breeding clusters of northern spotted owls. However, all blocks would require 50 years before reaching the threshold of 90% of BLM-administered lands providing suitable habitat.

Figure 218. Suitable Habitat within Alternative 2 large blocks of late-successional management areas by province

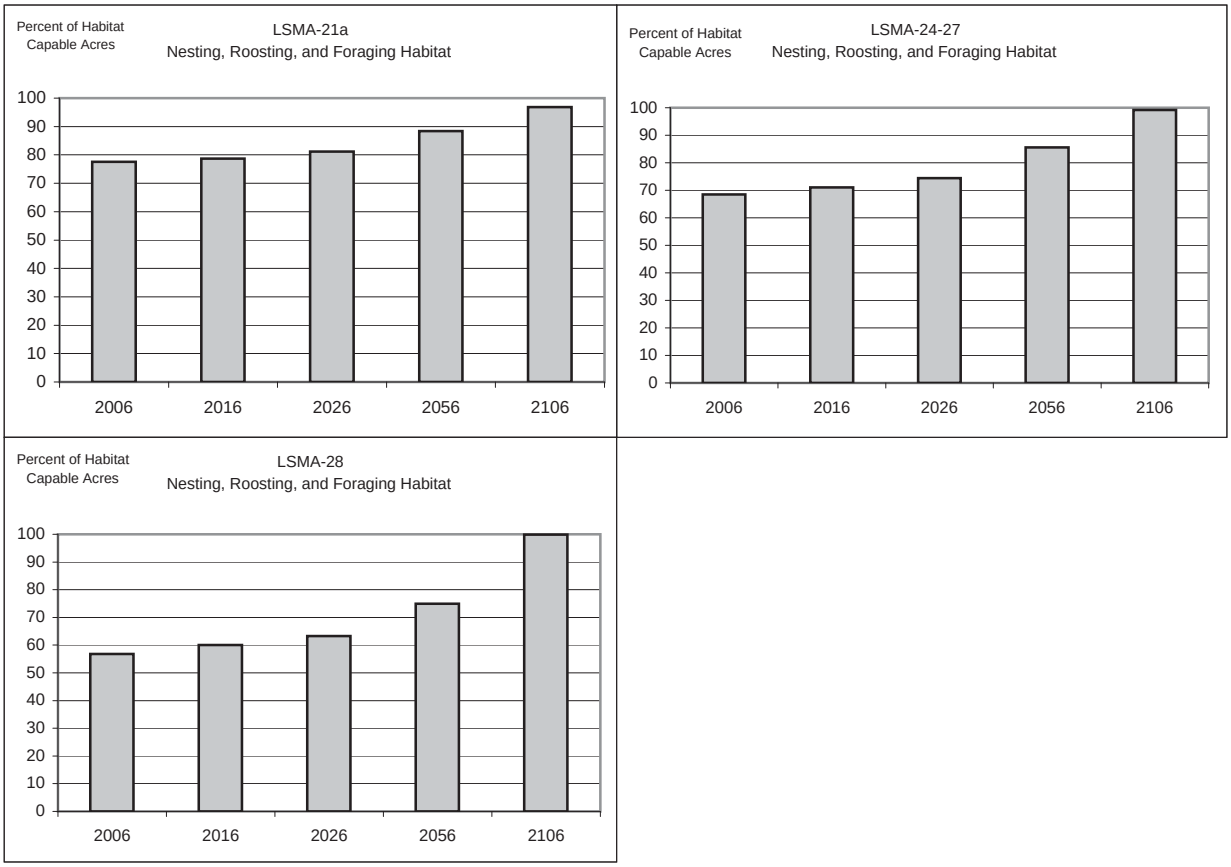
Coast Range Province:



Western Cascades province:



Klamath Province:



Examining the development of large blocks of suitable habitat from the two perspectives shows the same result: the No Action Alternative, Alternative 1, and Alternative 2 would all eventually contribute to blocks suitable habitat capable of supporting self-sustaining, breeding clusters of northern spotted owls.

- The late-successional management areas under Alternative 2 would generally be limited to those needed to provide for large blocks of suitable habitat, and therefore would allocate fewer acres to late-successional management areas than the No Action Alternative or Alternative 1.
- In all three alternatives, the development of suitable habitat would proceed at the same pace and would take 50 years before the BLM contribution to large blocks would be almost entirely (90%) in suitable habitat.
- The No Action Alternative and Alternative 1 would allocate 300,000 additional acres beyond the large blocks to late-successional reserve/ late-successional management areas, but these additional acres would not make large blocks of suitable habitat develop more quickly than under Alternative 2.

The land ownership pattern of BLM-administered lands and the current forest condition restrict the capability to speed the development of large blocks of suitable habitat by allocating additional acres to late-successional management areas. The additional acres of late-successional reserves in the No Action Alternative and late-successional management areas in Alternative 1 would result in more total acres of suitable habitat than Alternative 2, but would not result in faster development or a higher proportion of suitable habitat within large blocks.

Because it would take 50-100 years before the BLM contribution to large blocks would be almost entirely suitable habitat, habitat outside of large blocks would be important to owl populations until habitat within the blocks is capable of supporting clusters of reproducing owls (see “Suitable Habitat Outside of Large Blocks” later in this section).

Large Block Distribution

This section evaluates how blocks of suitable habitat would be distributed across a variety of ecological conditions under each alternative. Thomas et al. (1990) noted that species that are well distributed across their range are less prone to extinction than species confined to small portions of their range. Therefore, conservation planning for northern spotted owls includes distribution of large blocks of suitable habitat among the provinces.

The No Action Alternative would allocate to late successional reserves:

- 478,200 acres (60% of BLM-administered lands) in the Coast Range province,
- 131,400 acres (19% of BLM-administered lands) in the Western Cascades province,
- 239,300 acres (29% of BLM-administered lands) in the Klamath province.

Alternative 1 would allocate Late-successional management areas:

- 476,200 acres (60% of BLM-administered lands) in the Coast Range province,
- 131,300 acres (19% of BLM-administered lands) in the Western Cascades province,
- 239,200 acres (29% of BLM-administered lands) in the Klamath province.

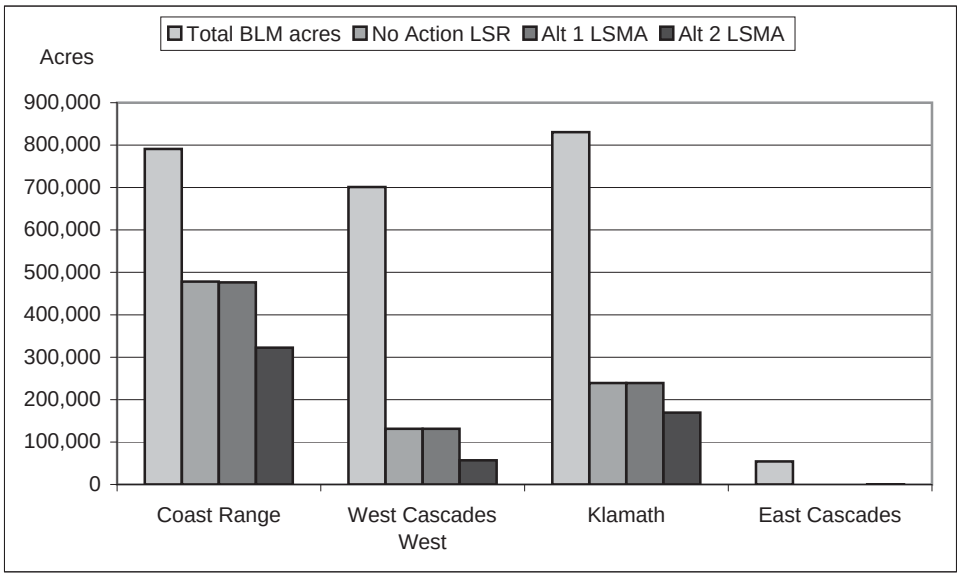
Alternative 2 would allocate Late-successional management areas:

- 322,400 acres (41% of BLM-administered lands) in the Coast Range province,
- 57,100 acres (8% of BLM-administered lands) in the Western Cascades province,
- 169,500 acres (20% of BLM-administered lands) in the Klamath province.

None of the alternatives would allocate large blocks in the Eastern Cascades province. The BLM-administered lands in the East Cascades make up only 2% of the habitat-capable acres within the planning area. The Northwest Forest Plan allocated late-successional reserves on U.S. Forest Service lands in the Eastern Cascades province and it is assumed that they will remain in place.

The No Action Alternative, Alternative 1, and Alternative 2 would all distribute large blocks among the Coast Range, Western Cascades, and Klamath provinces and therefore would provide habitat across a variety of ecological conditions (see *Figure 219, Acres of late-successional reserve/late-successional management area allocated by province*). This is consistent with the analysis of the No Action Alternative in the Northwest Forest Plan FSEIS, which concluded that the late-successional reserves would provide large blocks of habitat distributed among the provinces (USDA, USDI 1994b pp. 3&4-231 – 3&4-232). That analysis is incorporated by reference.

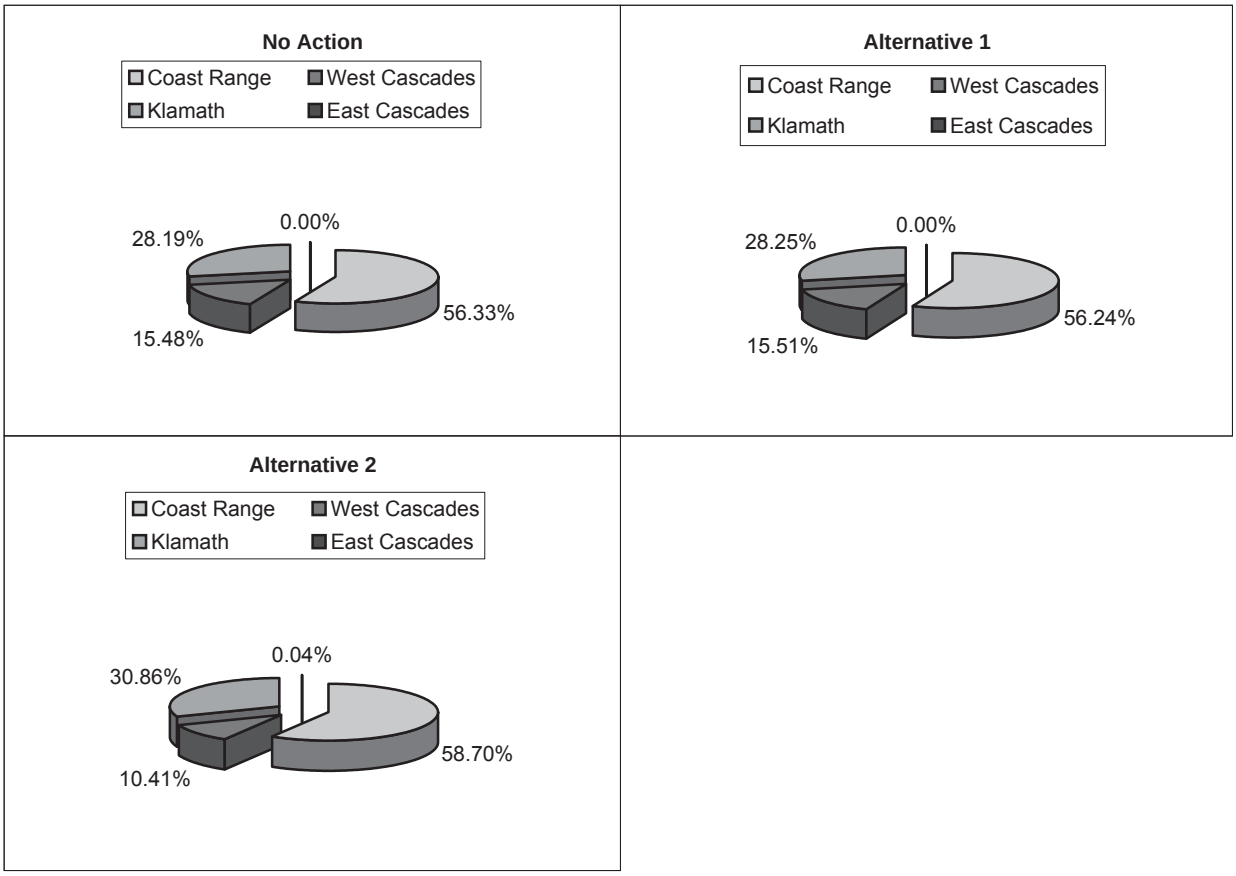
Figure 219. Acres of late-successional reserve/late-successional management area allocated by province



As shown in *Figure 220* (*Percentage of late-successional reserve/late-successional management area acres allocated by province)*, Alternative 2 would allocate a smaller acreage of BLM-administered lands to late-successional management areas in the Coast Range, Western Cascades, and Klamath provinces than the No Action Alternative and Alternative 1. However, the percent of the total late-successional management area allocated to each province would be similar to the No Action Alternative and Alternative 1, with a slight increase in the Coast Range and Klamath provinces and a slight decrease in the Western Cascades province.

Alternative 3 would not provide large blocks of suitable habitat necessary to provide for self-sustaining, breeding clusters of northern spotted owls, and therefore the distribution of large blocks is not relevant to Alternative 3. Suitable habitat would develop as a consequence of long-rotation timber management, but it would be in a dispersed pattern rather than consolidated into large blocks.

Figure 220. Percentage of late-successional reserve/late-successional management area acres allocated by province



Large Block Spacing

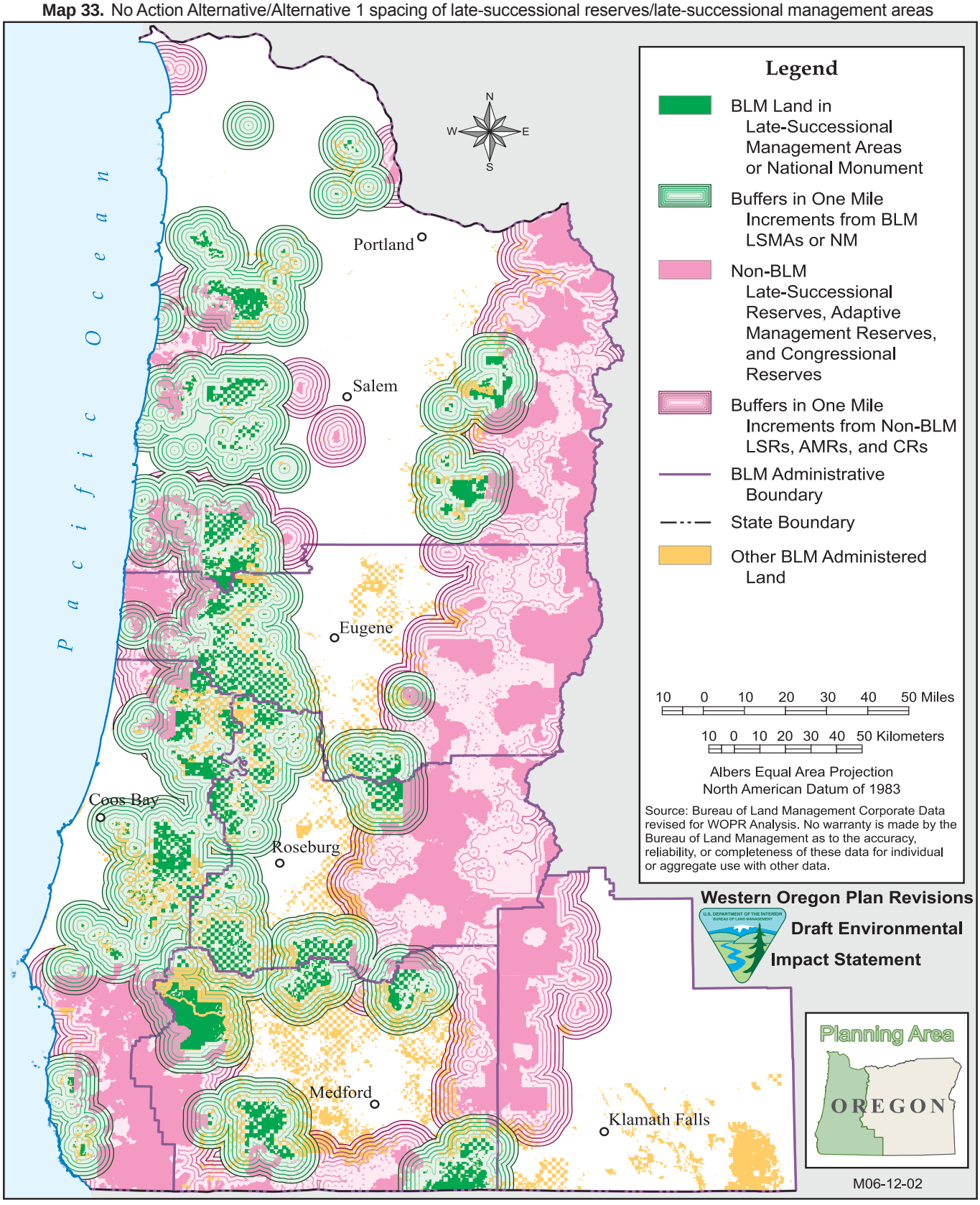
This section evaluates how blocks of suitable habitat would be spaced under each alternative. Thomas et al. (1990) and the Northwest Forest Plan determined that blocks of habitat should be of sufficient size to support 20 breeding pairs of northern spotted owl, should be spaced no more than 12 miles apart, and that smaller blocks should be spaced no more than 7 miles apart (USDA, USDI 1994b p. G-28).

The large blocks of suitable habitat that would be created under the No Action Alternative and Alternative 1 would be virtually identical. When supported by the large blocks of suitable habitat on U.S. Forest Service lands, the large blocks created under these two alternatives would be spaced so as to facilitate owl movement between the blocks. See *Map 33* (*No Action Alternative/Alternative 1 spacing of late-successional reserves/late-successional management areas*). This is consistent with the analysis of the No Action Alternative in the Northwest Forest Plan FSEIS, which concluded that the late-successional reserves would provide large blocks of habitat distributed among the provinces (USDA, USDI 1994b pp. 3&4-231 – 3&4-232). That analysis is incorporated by reference.

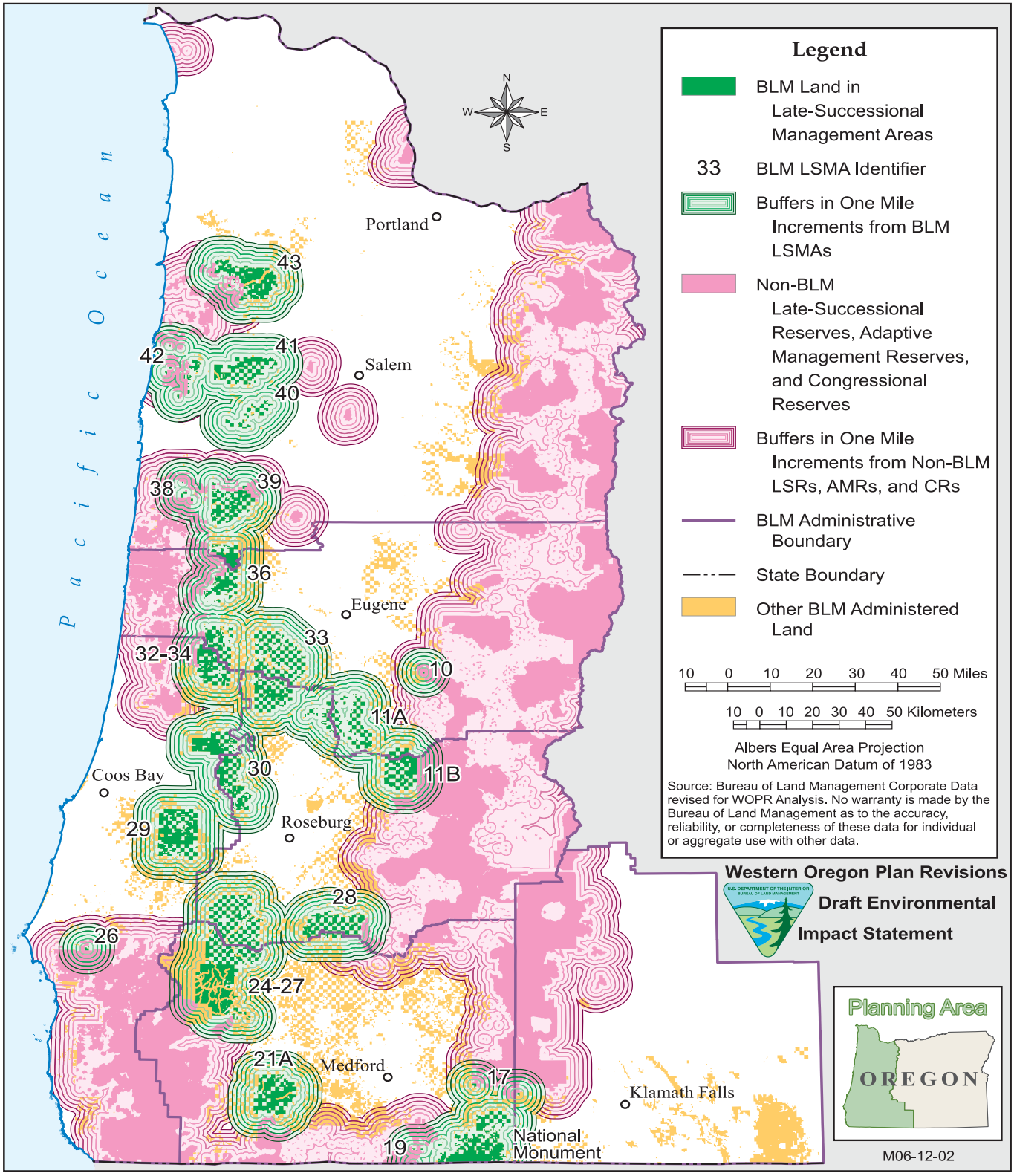
Late-successional management areas in Alternative 2 were allocated explicitly to create spacing of no more than 12 miles between blocks large enough to support 20 pairs, and to create spacing of no more than 7 miles between blocks large enough to support 10-19 pairs with the support of large blocks of suitable habitat on U.S. Forest Service lands. See *Map 34* (*Alternative 2 spacing of late-successional management areas*).

Alternative 3 would not provide large blocks of suitable habitat, even when supported by the large blocks of suitable habitat on U.S. Forest Service lands. Therefore the analysis of spacing of large blocks is not relevant to Alternative 3.

Map 33. No Action Alternative/Alternative 1 spacing of late-successional reserves/late-successional management areas



Map 34. Alternative 2 spacing of late-successional management areas



Suitable Habitat Outside of Large Blocks

The availability of suitable habitat outside of the large blocks is important because owl populations would need to rely on suitable habitat outside of the large blocks until habitat within the blocks is capable of supporting clusters of reproducing owls (Lint 2005, p. 75).

The amount of suitable habitat outside of the large blocks would differ widely among the alternatives as a result of differing amounts of riparian management area acres and differing management direction within the harvest land base. The late-successional reserves/late-successional management areas have a higher proportion of suitable habitat than the other land use allocations in each alternative. However, there are currently more total acres of suitable habitat outside of late-successional reserves/late-successional management areas than within late-successional reserves/late-successional management areas in the No Action Alternative, Alternative 1, and Alternative 2.

Although the development of suitable habitat within large blocks is similar among the No Action Alternative, Alternative 1, and Alternative 2, the development and maintenance of suitable habitat outside of large blocks would differ among the alternatives. See *Table 191* (*Acres of suitable habitat outside of late-successional reserves/late-successional management areas)* and *Figure 221 (Suitable habitat outside of late-successional reserves/late-successional management areas, as percentage of habitat-capable acres*).

- Under the No Action Alternative the percentage of suitable habitat outside of large blocks would increase.
- Under Alternative 1 the percentage of suitable habitat outside of large blocks would be maintained at the current level.
- Under Alternative 2 the percentage of suitable habitat outside of large blocks would decrease.

Table 191. Acres of suitable habitat outside of late-successional reserves/late-successional management areas[15]

Alternative	Habitat-Capable acres	Percent of Habitat Capable (acres)				
		2006	2016	2026	2056	2106
No Action	1,404,000	47 (661,300)	50 (706,100)	54 (755,000)	61 (854,700)	62 (877,500)
Alt 1	1,406,000	45 (637,900)	46 (653,200)	48 (670,400)	50 (701,700)	47 (661,400)
Alt 2	1,675,000	48 (808,100)	46 (774,900)	46 (767,900)	44 (731,800)	37 (615,900)
Alt 3	2,196,700	49 (1,085,800)	50 (1,092,000)	51 (1,119,200)	60 (1,329,000)	69 (1,512,000)

[15] For Alternative 3, this figure presents the amount of suitable habitat on all BLM-administered lands, because Alternative 3 does not allocate late-successional management areas.

Under the No Action Alternative the percentage of suitable habitat outside of the large blocks over the next 100 years would increase because:

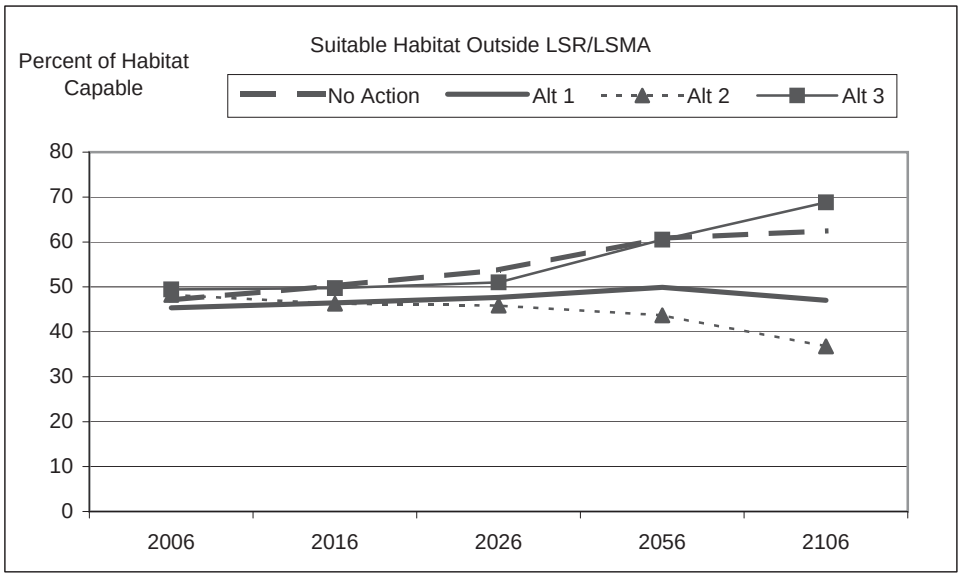
- more acres would be allocated to riparian reserves than the riparian management areas in any of the action alternatives;
- green trees would be retained within the harvest land base, which would speed the redevelopment of suitable habitat after timber harvest compared to Alternative 1 and Alternative 2; and
- the harvest of suitable habitat within the harvest land base would be more constrained than in Alternative 1 and Alternative 2 (see the *Ecology* section of this chapter).

Under Alternative 1 the percentage of suitable habitat outside of the large blocks would increase over the next 50 years (though less than the No Action Alternative), and then would decrease to an amount only slightly above the current condition in 2106.

Under Alternative 2, the percentage of suitable habitat outside of large blocks would steadily decrease over the next 100 years. Alternative 2 would result in a lower percentage of suitable habitat outside of large blocks than Alternative 1, because Alternative 2 would allocate fewer acres to riparian management areas.

Under Alternative 3, the percentage of suitable habitat within the harvest land base would be the highest of all alternatives after 2056 because of green tree retention and the long-rotation constraint on harvest. Since Alternative 3 would allocate no late-successional management areas, it would create and maintain less total suitable habitat than the No Action Alternative and Alternative 1 until 2106.

Figure 221. Suitable habitat outside of late-successional reserves/late-successional management areas, as percentage of habitat-capable acres[16]

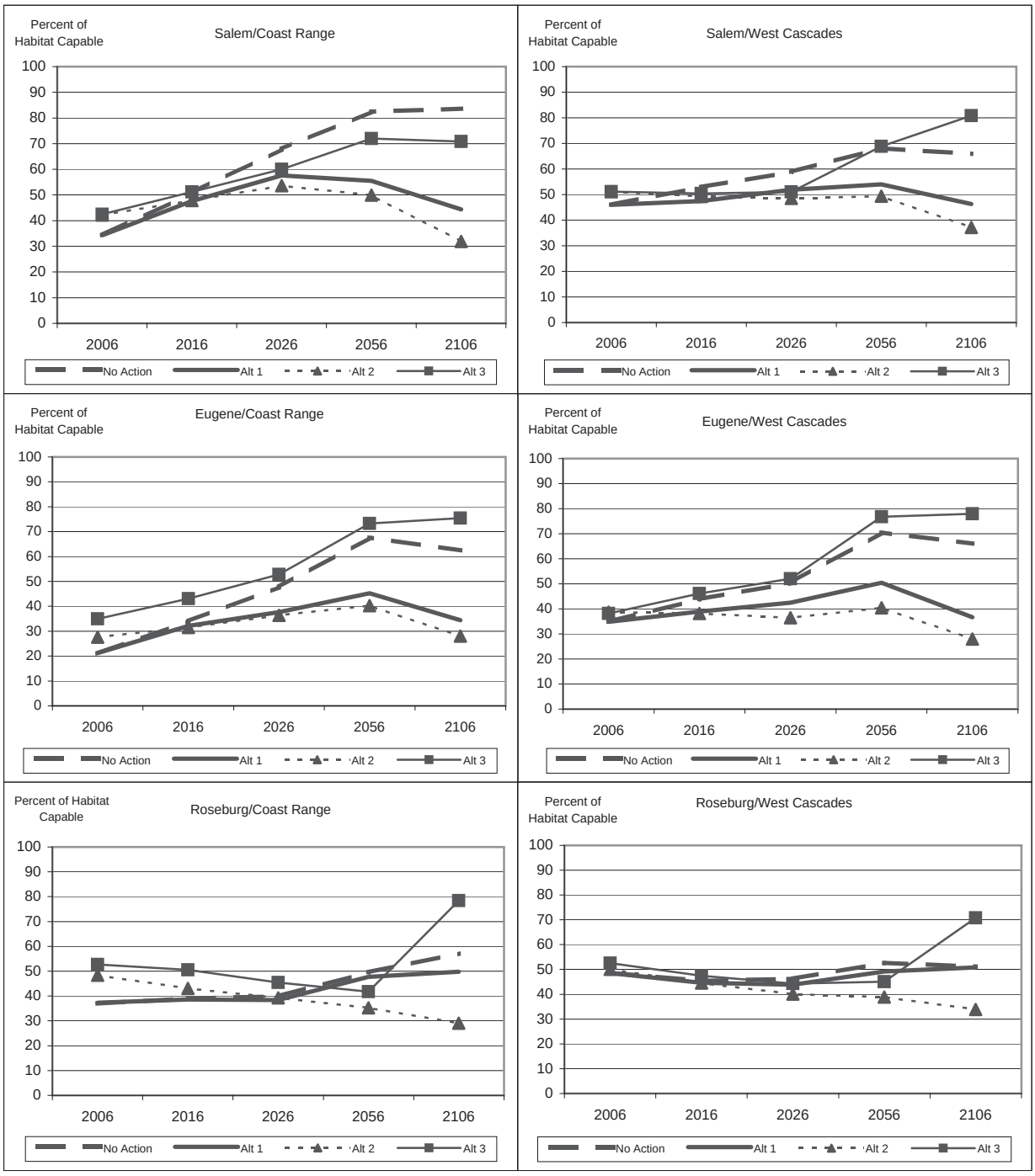


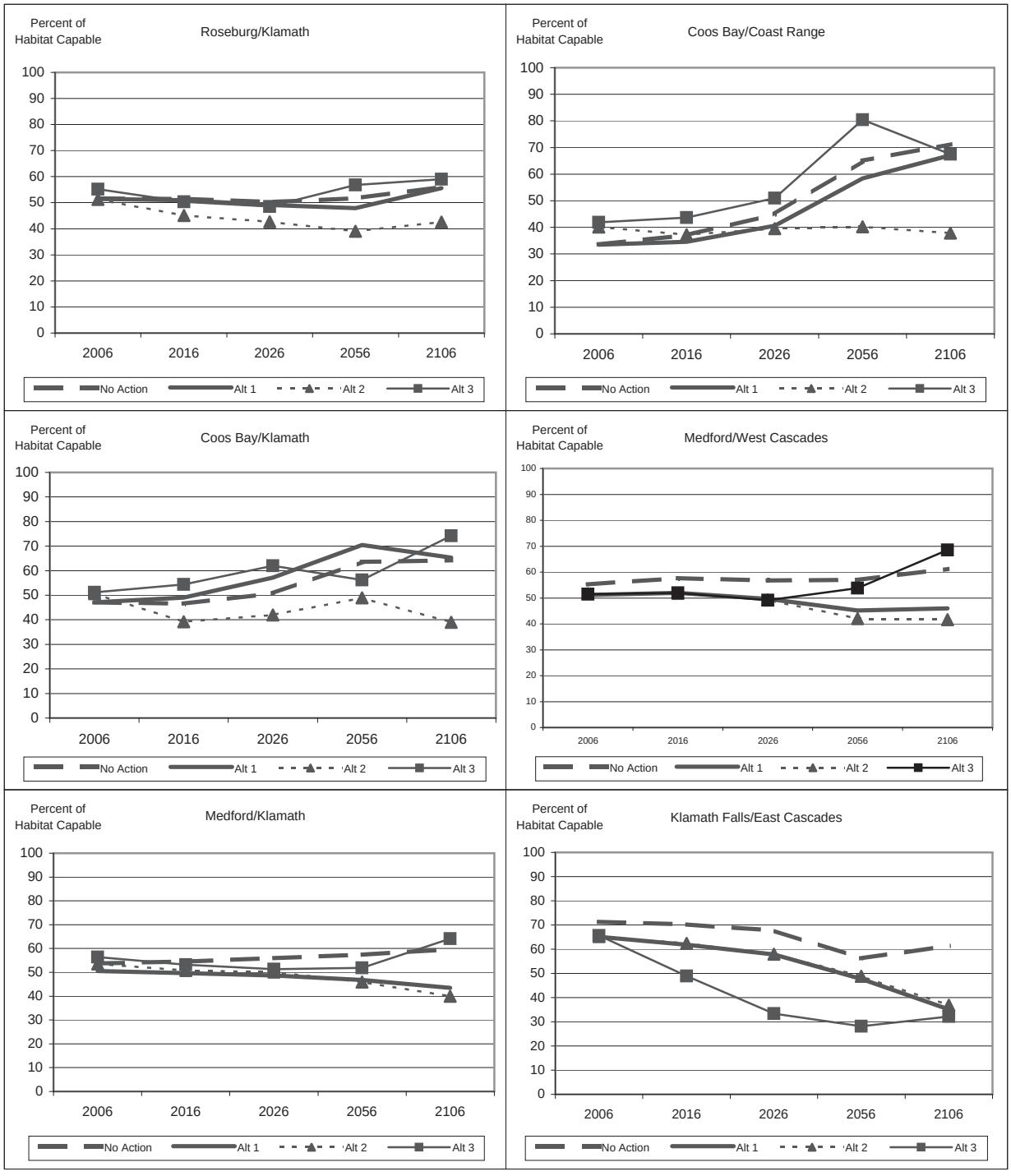
The amount of suitable habitat outside of late-successional reserves/late-successional management areas at the scale of the District/Province divisions is shown in *Figure 222* (*Suitable habitat outside of late-successional reserves/late-successional management areas, by district/province divisions, as percentage of habitat-capable acres).* The amount is generally consistent with the overall pattern at the planning area scale. As *Figure 222* shows:

- In almost all District/Province divisions, the No Action Alternative and Alternative 3 would increase the amount of suitable habitat, and Alternative 2 would decrease the amount of suitable habitat.
- In all District/Province divisions except Klamath Falls/Eastern Cascades, Alternative 2 would result in the least suitable habitat outside of late-successional management areas.
- In Roseburg/Coast Range, Roseburg/West Cascades, Roseburg/Klamath, Coos Bay/Coast Range, and Coos Bay/Klamath, Alternative 1 would show a pattern similar to the No Action Alternative, but elsewhere would show a pattern similar to Alternative 2.

[16] For Alternative 3, this table presents the amount of suitable habitat on all BLM-administered lands, because Alternative 3 does not allocate Late-successional management areas.

Figure 222. Suitable habitat outside of late-successional reserves/late-successional management areas, by district/province divisions, as percentage of habitat-capable acres




Percent of Habitat Capable
Roseburg/Klamath
100
90
80
70
60
50
40
30
20
10
0
2006
2016
2026
2056
2106
No Action
Alt 1
Alt 2
Alt 3
Percent of Habitat Capable
Coos Bay/Coast Range
Percent of Habitat Capable
Coos Bay/Klamath
Percent of Habitat Capable
Medford/West Cascades
Percent of Habitat Capable
Medford/Klamath
Percent of Habitat Capable
Klamath Falls/East Cascades

Dispersal Habitat

This section evaluates whether dispersal habitat conditions within and between large blocks of suitable habitat would facilitate owl movement between the blocks. Dispersal habitat is comprised of both suitable habitat and additional habitat that supports only owl dispersal. The quality of dispersal quality increases with the portion of that habitat that is comprised of suitable habitat (see the *Wildlife* section of Chapter 3).

This analysis describes dispersal habitat at three scales:

- the quantity and quality of dispersal habitat on BLM-administered lands for the entire planning area;
- the quantity and quality of dispersal habitat on BLM-administered lands by the District/Province divisions; and
- the quantity of dispersal habitat across all ownerships by sixth-field watersheds.

The analysis by sixth-field watersheds is at a scale similar to the quarter-township scale (approximately 5,760 acres) of the original 50-11-40 rule (see Chapter 3 – Wildlife). The analysis by sixth-field watershed includes all land ownerships.

While the total quantity of dispersal habitat (dispersal habitat only and suitable habitat) on BLM-administered lands across the entire planning area would remain high under all alternatives, the quality of the dispersal habitat would differ among the alternatives. See *Figure 223* (*Dispersal habitat conditions on BLM-administered lands across the planning area by alternative*).

Under the No Action Alternative, the amount of total dispersal habitat would remain almost constant over time, fluctuating between 87% and 92% of habitat-capable acres on BLM-administered lands across the entire planning area. The amount of suitable habitat, however, would steadily increase over time, until it would constitute 76% of habitat-capable acres in 2106. Therefore, the No Action Alternative would maintain the current total quantity of dispersal habitat, and would increase the quality of dispersal habitat over time because the proportion of dispersal habitat that is suitable habitat would increase.

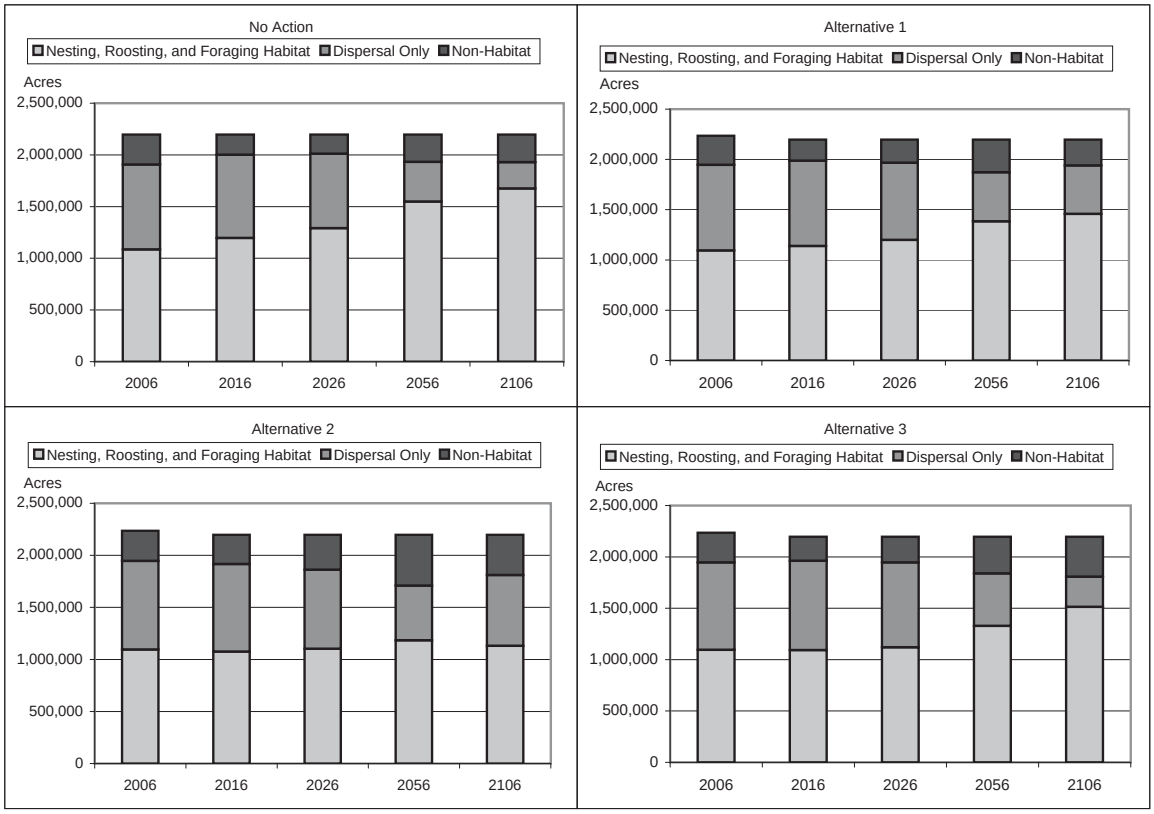
Under Alternative 1, the amount of total dispersal habitat would also remain almost constant over time, although fluctuating between 85% and 90% of habitat-capable acres on BLM-administered lands. The amount of suitable habitat, however, would steadily increase over time, but less so than under the No Action Alternative: suitable habitat would constitute 66% of habitat-capable acres in 2106. Therefore, like the No Action Alternative, Alternative 1 would maintain the current total quantity of dispersal habitat, and would increase the quality of dispersal habitat over time.

Under Alternative 2, the amount of total dispersal habitat would decrease, although it would fall only to 77% of habitat-capable acres on BLM-administered lands by 2056 and then increase to 82% by 2106). However, the amount of suitable habitat would not increase over time as in the No Action Alternative and Alternative 1; it would fluctuate between 49% and 53% to end at 49% by 2106. Therefore, Alternative 2 would decrease the total quantity of dispersal habitat, and would maintain approximately the current quality of dispersal habitat over time.

Alternative 3 would not create large blocks of suitable habitat, and the conservation need for dispersal habitat is predicated on a large block design. Therefore, dispersal habitat under Alternative 3 would not have the same relevance as under the other alternatives, and the analysis of dispersal habitat under Alternative 3 is provided here to provide comparison to the other alternatives.

Under Alternative 3, the amount of total dispersal habitat would steadily decrease to eventually reach the same total amount as Alternative 2 - 82% in 2106. However, unlike Alternative 2, the amount of suitable habitat would increase over time. After remaining stable for the first 20 years, the amount of suitable habitat would increase to 69% of habitat-capable acres - slightly more than Alternative 1. Therefore, Alternative 3 would decrease the total quantity of dispersal habitat, but eventually would increase the quality of dispersal habitat over time.

Figure 223. Dispersal habitat conditions on BLM-administered lands across the planning area by alternative



Under the No Action Alternative, Alternative 1, and Alternative 2, the changes in dispersal habitat quantity and quality at the district/province divisions would generally be consistent with the overall changes across the planning area, with the following slight variations:

- The No Action Alternative would result in a decrease in dispersal quantity in Roseburg/West Cascades, Medford/Western Cascades, and Medford/Klamath, although dispersal quality would increase.
- Alternative 1 and Alternative 2 would result in a decrease in dispersal quantity and quality in Klamath/Eastern Cascades.
- Alternative 2 would result in an increase in dispersal quality in the Salem/Coast Range, Eugene/Coast Range, and Coos Bay/Coast Range, because Alternative 2 would allocate more acres to late-successional management areas in the Coast Range than any other province. However, the increase in dispersal quantity and quality in the Coast Range under Alternative 2 would still be less than under the No Action Alternative and Alternative 1.
- Alternative 2 would result in a decrease in dispersal quantity and quality in Salem/Western Cascades, because it would allocate no late-successional management areas in Salem/Western Cascades.

Under Alternative 3, the changes in dispersal habitat quantity and quality would vary among the district/province divisions:

- In Roseburg/Coast Range and Roseburg/Western Cascades, dispersal quantity and quality would decrease until 2056, and then increase from 2056 to 2106.
- In Roseburg/Klamath, dispersal quality would fluctuate, but total dispersal quantity would decrease to 64% of habitat-capable acres in 2106 - lower than any other district/province divisions in any alternative.
- In Coos Bay/Coast Range, dispersal quantity and quality would increase until 2056, and then decrease from 2056 to 2106.
- In Klamath/Eastern Cascades, Alternative 3 would result in an increase in total dispersal quantity and a substantial decrease in dispersal quality – suitable habitat would decrease to 28% of habitat-capable acres in 2056.
- In other district/province divisions, the changes would generally be consistent with the overall changes across the planning area: a slight decrease in total dispersal habitat quantity and an increase in dispersal habitat quality.

Data on each district/province division by alternative is provided in *Appendix G, Wildlife.*

The evaluation of dispersal habitat across all ownerships requires use of the structural stage classifications, rather than the habitat classification, because the

habitat classification relies on some stand parameters that are not available for non-BLM lands, such as snag and coarse woody debris levels. The structural stages of young, mature, and structurally complex forest approximate dispersal habitat. The lower threshold for young forest is not exactly equivalent to the lower limit of dispersal habitat: the use of young, mature, and structurally complex forest probably overestimates dispersal habitat for stands without structural legacies and underestimates dispersal habitat for stands with structural legacies. Nevertheless, the structural stages are a close enough approximation of dispersal habitat to compare the relative effects of the alternatives and evaluate changes in dispersal habitat over time.

Currently, 35% of sixth-field watersheds have more than 50% dispersal habitat. See *Figure 224* (*Current conditions of dispersal habitat across all ownerships by sixth-field watershed*). The percentage of sixth-field watersheds that would have more than 50% dispersal habitat would increase under all alternatives over time. The percentage of sixth-field watersheds that would have 25-50% dispersal habitat would decrease under all alternatives over time. The percentage of sixth-field watersheds that would have less than 10% or 10-25% dispersal habitat would change very little over time under all alternatives.

For the reference analysis of allow no harvest on BLM-administered lands, the percentage of sixth-field watersheds that would have more than 50% dispersal habitat would increase to 44% in 2056 and would stay at that level until 2106. The percentage of sixth-field watersheds that would have more than 50% dispersal habitat would increase in 2106 to 41% under the No Action Alternative; 40% under Alternative 1; 39% under Alternative 2; and 38% under Alternative 3. Most of the sixth-field watersheds that would become more than 50% dispersal habitat in 2106 include U.S. Forest Service lands, especially in the Siskiyou National Forest and Siuslaw National Forest. See *Figure 225* (*Dispersal habitat across all ownerships by sixth-field watershed for the no harvest reference analysis 2106*).

Figure 224. Current condition of dispersal habitat across all land ownerships by sixth-field watershed

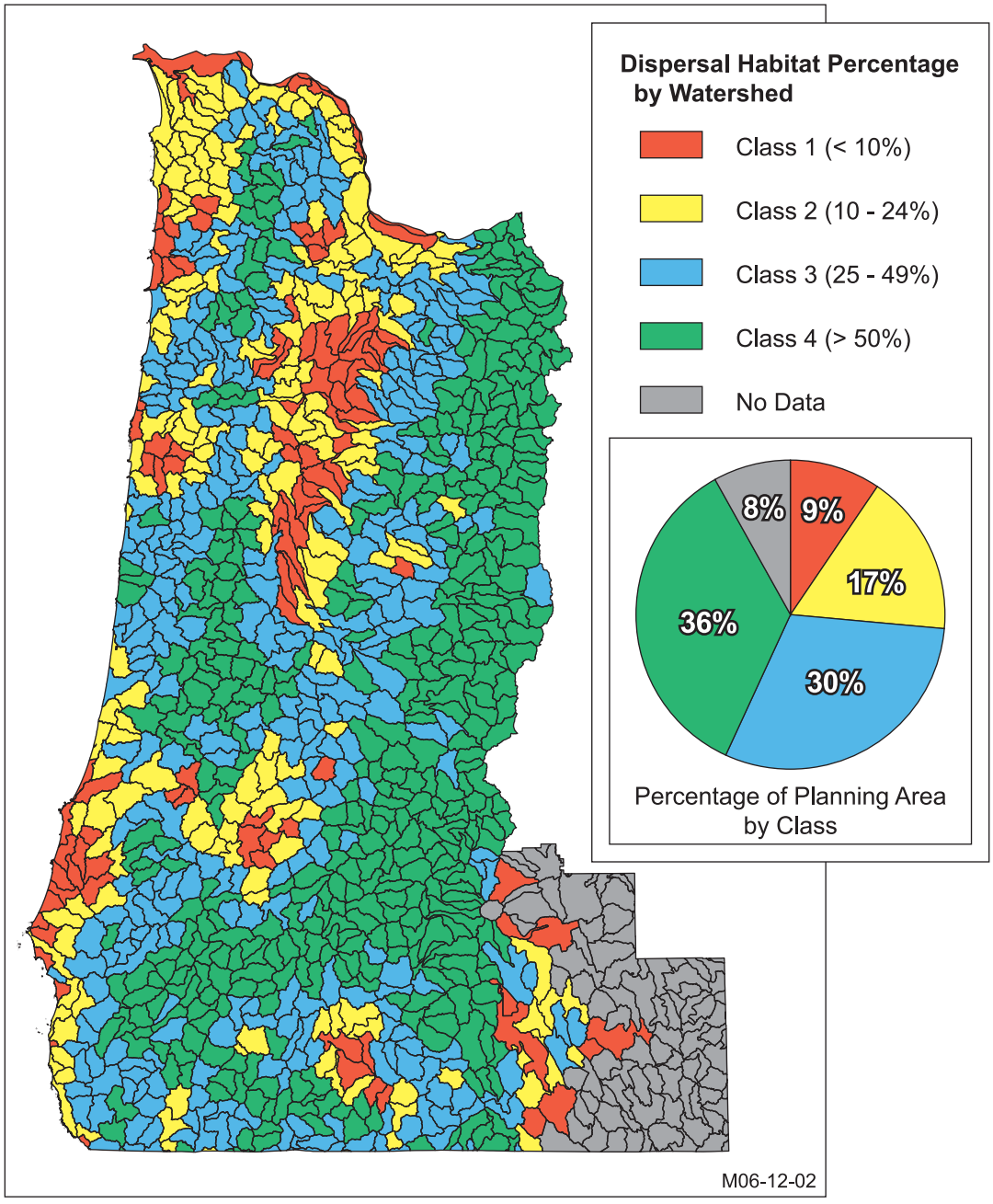
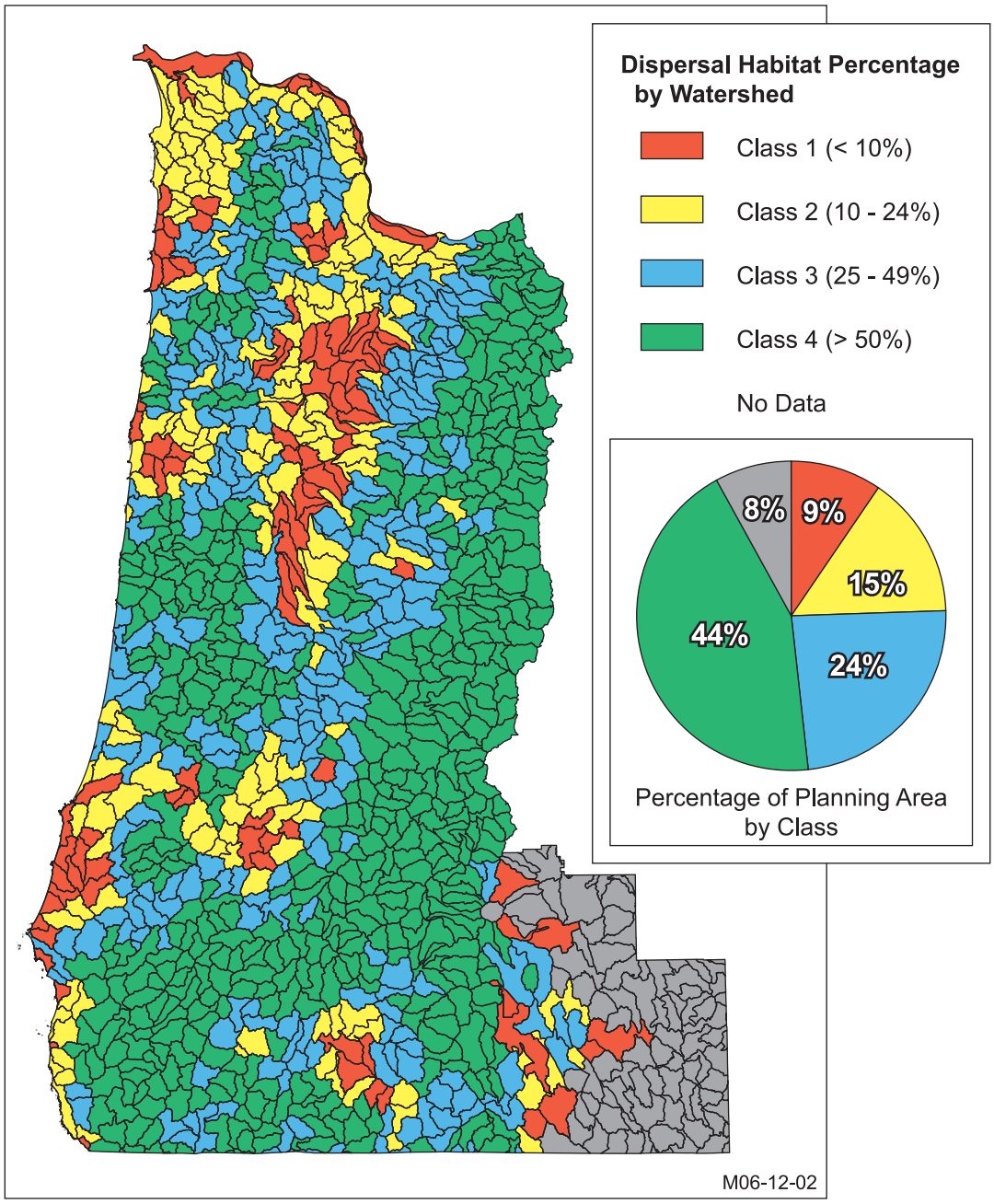


Figure 225. Dispersal habitat by 2106 across all land ownerships by six-field watershed for the no harvest reference analysis



Areas of Concern

This section evaluates the amount of total dispersal habitat and the amount of suitable habitat within the Areas of Concern on BLM-administered lands and across all ownerships. See *Table 192* (*Total dispersal habitat on BLM-administered lands in areas of concern);* and *Table 193* **(***Suitable habitat on BLM-administered lands in areas of concern*).

The areas of concern have limited federal ownership, which limits the ability of the federal land base to support the movement of northern spotted owl populations between the provinces. The three areas of concern are South Willamette-North Umpqua, Rogue-Umpqua, and Ashland (see the *Wildlife* section of Chapter 3). As with dispersal habitat, there are no explicit thresholds for habitat conditions with the areas of concern below which owl movement would be disrupted, but the ability of habitat conditions within an area of concern to maintain genetic interchange between northern spotted owl populations would increase with increasing amounts of total dispersal habitat, and increasing amounts of suitable habitat.

The evaluation of dispersal and suitable habitat on BLM-administered lands in the areas of concern uses the habitat classification directly. However, evaluation of dispersal and suitable habitat across all ownerships requires use of the forest structural stage classification, rather than the habitat classification, as explained above for the large block analysis of Alternative 3 and the analysis of dispersal habitat across all ownerships. Young, mature, and structurally complex forest structural stage classifications are used as a surrogate for total dispersal habitat, and mature and structurally complex forest structural stage classifications are used as a surrogate for suitable habitat. There are some differences in absolute results between the habitat classifications of BLM-administered lands in the areas of concern and the structural stage classifications of all ownerships, but the relative results and trends are generally similar.

Table 192. Total dispersal habitat on BLM-administered lands in areas of concern

Area of Concern	Habitat-capable acres		Percent of Habitat-Capable Acres				
			2006	2016	2026	2056	2106
South Willamette-North Umpqua	251,100	No Harvest	85	95	98	100	100
		No Action	85	93	94	90	89
		Alt 1	85	92	92	89	92
		Alt 2	85	90	88	84	88
		Alt 3	85	89	87	78	83
Rogue-Umpqua	224,400	No Harvest	86	90	95	100	100
		No Action	86	86	87	83	84
		Alt 1	86	86	88	84	89
		Alt 2	86	84	84	77	87
		Alt 3	86	81	78	70	65
Ashland	62,000	No Harvest	89	92	93	100	100
		No Action	89	90	89	90	86
		Alt 1	89	89	89	89	90
		Alt 2	89	90	89	89	88
		Alt 3	89	92	92	98	98

Table 193. Suitable Habitat on BLM-administered Lands in areas of concern

Area of Concern	Habitat-capable Acres		Percent of Habitat-capable Acres				
			2006	2016	2026	2056	2106
South Willamette-North Umpqua	251,100	No Harvest	44	50	57	85	100
		No Action	44	48	54	73	77
		Alt 1	44	46	50	64	68
		Alt 2	44	45	46	58	58
		Alt 3	44	45	46	60	77
Rogue-Umpqua	224,400	No Harvest	54	58	63	82	99
		No Action	54	55	56	64	74
		Alt 1	54	54	56	61	70
		Alt 2	54	52	52	54	60
		Alt 3	54	49	47	52	57
Ashland	62,000	No Harvest	51	57	61	72	86
		No Action	51	64	66	69	71
		Alt 1	51	59	56	59	66
		Alt 2	51	54	56	60	65
		Alt 3	51	55	56	61	81

In the South Willamette-North Umpqua area of concern, the current amount of total dispersal habitat is 85% of habitat-capable acres on BLM-administered lands and 50% across all ownerships. As *Table 192* (*Total dispersal habitat on BLM-administered lands in areas of concern)* and *Figure 226* (*South Willamette-North Umpqua area of concern: total dispersal habitat across all ownerships*) show:

- The reference analysis of allow no harvest on BLM-administered lands would result in dispersal habitat on 53% of habitat-capable acres across all ownerships in 2106.
- The amount of total dispersal habitat would fluctuate under all alternatives, but the alternatives would differ by less than 4% in the amount of dispersal habitat across all ownerships.
- The No Action Alternative is the only alternative that would not decrease total dispersal habitat from current conditions over the next 100 years.
- Alternative 1 would decrease total dispersal habitat in 2056, but increase to the same amount as the No Action Alternative in 2106.
- Alternative 3 would initially increase the amount of total dispersal habitat but would decrease to the lowest amount of all alternatives.

All alternatives would increase the amount of suitable habitat on BLM-administered lands and across all ownerships in the South Willamette-North Umpqua area of concern. See *Table 193* (*Suitable habitat on BLM-administered lands in areas of concern*) and *Figure 227* (*South Willamette-North Umpqua area of concern: suitable habitat across all ownerships*).

- Consistent with the overall trend for the planning area, the No Action Alternative would result in the most suitable habitat.
- Alternative 2 would result in the least suitable habitat.
- The difference among the alternatives would be less than 3% across all ownerships.

Note that even though Alternative 2 located several late-successional management area blocks within this area of concern, Alternative 2 would not create as much dispersal habitat or suitable habitat as the No Action Alternative or Alternative 1 in the area of concern.

Figure 226. South Willamette-North Umpqua area of concern: Total Dispersal Habitat across All Ownerships

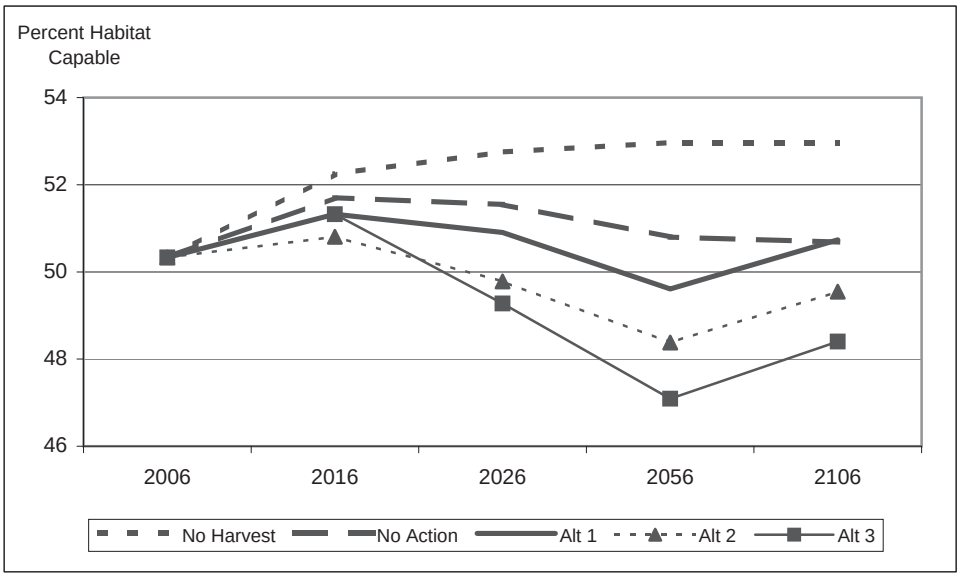
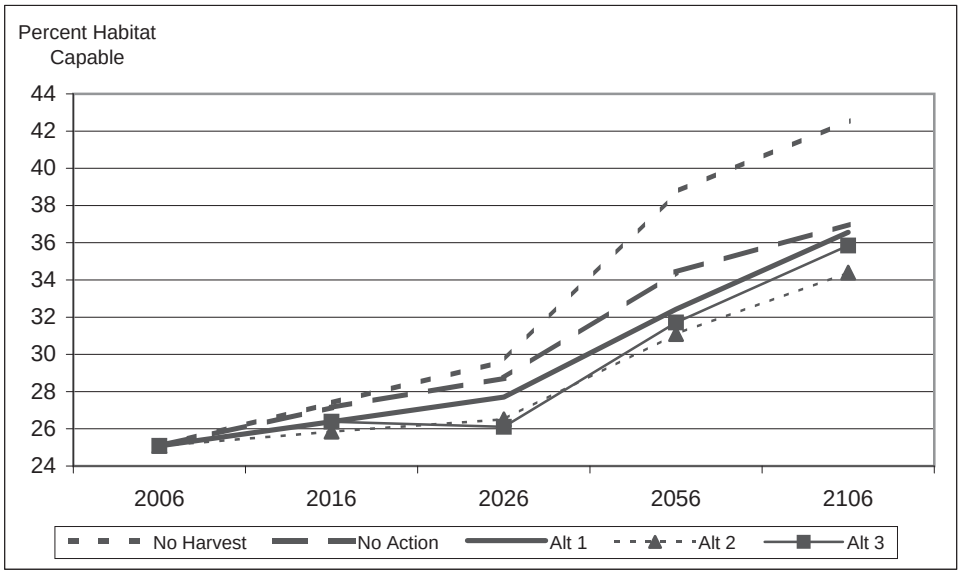


Figure 227. South Willamette-North Umpqua area of concern: suitable habitat across all ownerships*



*Note change in range of y-axis values

In the Rogue-Umpqua area of concern, the current amount of total dispersal habitat is 86% of habitat-capable acres on BLM-administered lands (almost the same as in South Willamette-North Umpqua area of concern) and 60% across all ownerships (much higher than in the South Willamette-North Umpqua area of concern). See *Table 192* (*Total dispersal habitat on BLM-administered Lands in areas of concern)* and *Figure 228* (*Rogue- Umpqua area of concern: total dispersal habitat across all ownerships*).

- The reference analysis of allow no harvest on BLM-administered lands would result in dispersal habitat on 65% of habitat-capable acres across all ownerships in 2106.
- The amount of total dispersal habitat would fluctuate under all alternatives, but the difference among the alternatives would result in less than a 4% difference across all ownerships.
- As in the South Willamette-North Umpqua area of concern, the No Action Alternative is the only alternative that would not decrease total dispersal habitat from current conditions.
- Alternative 1 and Alternative 2 would decrease total dispersal habitat in 2056, but increase to the same amount as the No Action Alternative in 2106.
- Alternative 3 would initially increase the amount of total dispersal habitat but would decrease to the lowest amount of all alternatives.

The current amount of suitable habitat (54% of habitat capable acres on BLM-administered lands and 47% on all ownerships) is higher than in the other Areas of Concern. As shown in *Table 193* (*Suitable habitat on BLM-administered lands in areas of concern*) and *Figure 229* (*Rogue-Umpqua area of concern: total suitable habitat across all ownerships*):

- Under all alternatives, the amount of suitable habitat across all ownerships would decrease for the first twenty years, and then increase after 2026.
- The No Action Alternative, Alternative 1, and Alternative 2 would increase the amount of suitable habitat in 2106 from current levels.
- Alternative 3 would result in approximately the same amount of suitable habitat across all ownerships in 2106 as the current condition.
- All alternatives would result in a 10% decrease in the amount of suitable habitat across all ownerships in 2106 – a bigger decrease than in the other Areas of Concern.

Figure 228. Rogue-Umpqua area of concern: total dispersal habitat across all ownerships

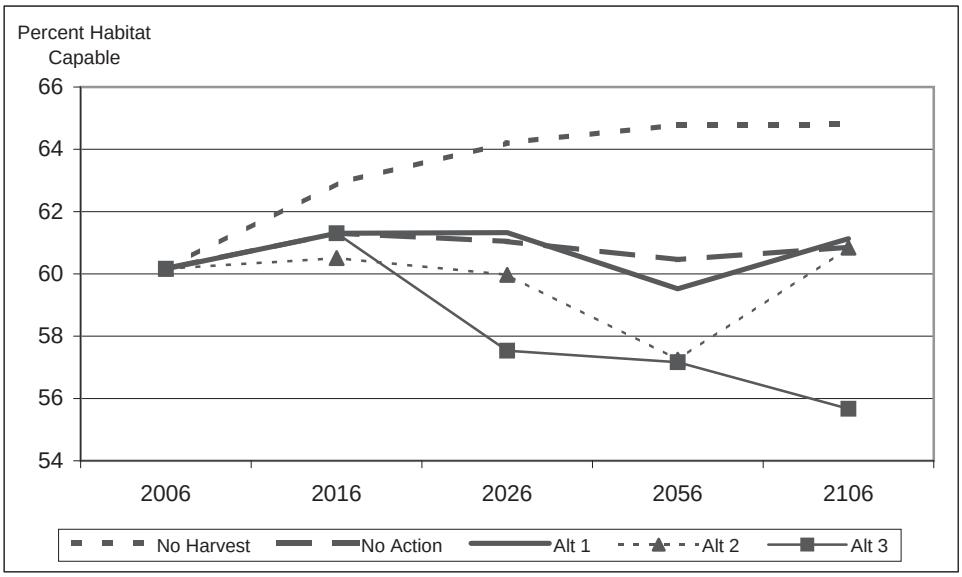
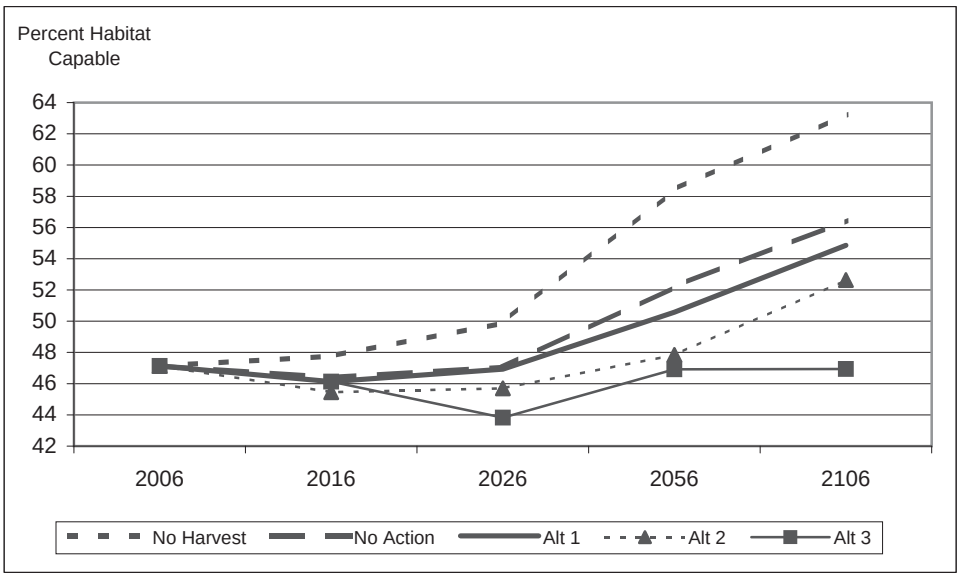


Figure 229. Rogue-Umpqua area of concern: suitable habitat across all ownerships.*



*Note change in range of y-axis values.

In the Ashland area of concern, the current amount of total dispersal habitat is 89% of habitat-capable acres on BLM-administered lands and 61% across all ownerships - higher than in the other Areas of Concern. See *Table 192* (*Total Dispersal Habitat on BLM-administered Lands in Areas of Concern)* and *Figure 230* (*South Willamette-North Umpqua area of concern: total dispersal habitat across all ownerships*).

- The reference analysis of "Allow No Harvest" on BLM-administered lands would result in dispersal habitat on 63% of habitat-capable acres across all ownerships in 2106.
- The amount of total dispersal habitat would decrease from current conditions under all alternatives.
- There is a 4% difference among the alternatives across all ownerships.
- As in the other Areas of Concern, the No Action Alternative would result in the most total dispersal habitat, and Alternative 3 would result in the least total dispersal habitat of all alternatives.

All alternatives would increase the amount of suitable habitat in the Ashland area of concern. See *Table 193* (*Suitable habitat on BLM-administered lands in areas of concern*) and *Figure 231* (*Ashland area of concern: suitable habitat across all ownerships*).

- The No Action Alternative would consistently result in at least 4% more suitable habitat than other alternatives.
- Unlike in other Areas of Concern and the planning area as a whole, Alternative 1 would result in approximately the same amount of suitable habitat as Alternative 2 and both would be less than the No Action Alternative and Alternative 3 in 2106.

Figure 230. Ashland area of concern: total dispersal habitat across all ownerships

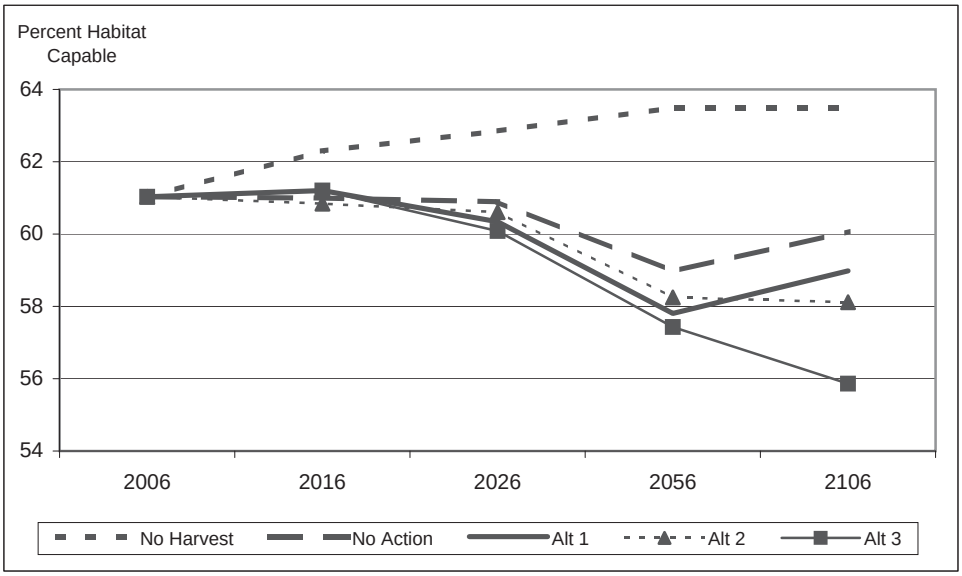
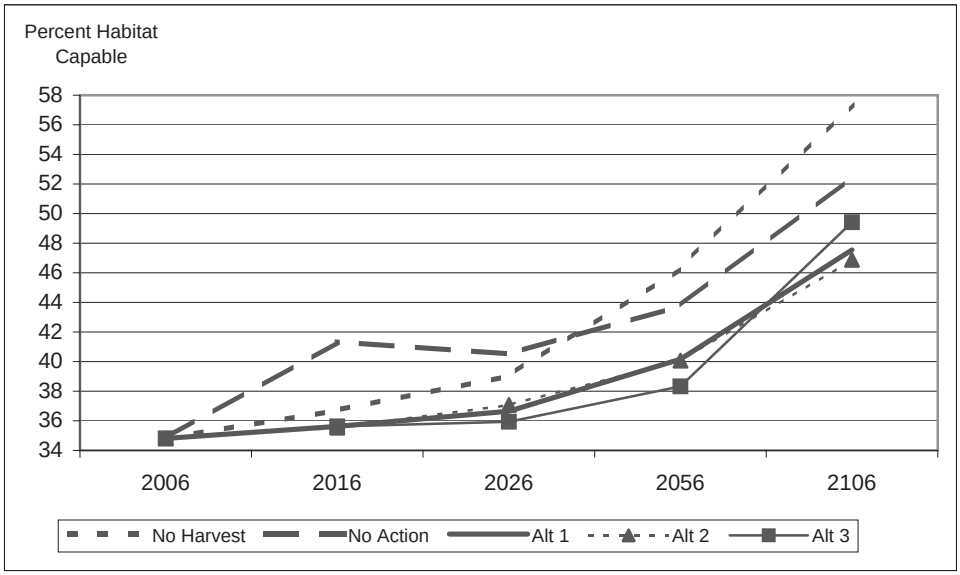


Figure 231. Ashland area of concern: suitable habitat across all ownerships*



*Note change in range of y-axis values.

Marbled Murrelet

This analysis describes the abundance and development of marbled murrelet nesting habitat and the patch dynamics of marbled murrelet nesting habitat.

Effects to populations were not analyzed because population size is affected by numerous factors other than habitat. A large portion of the marbled murrelet life cycle is tied to at-sea conditions including food supplies and mortality due to oil spills. Changes in sea conditions are likely to vary widely over the next 100 years. The interaction of sea conditions and habitat changes is currently unknown.

Surveys and Marbled Murrelet Sites

Under all alternatives, known, occupied marbled murrelet sites would receive protection from harvest. There are currently 226 known, occupied marbled murrelet sites on BLM-administered lands. These sites were found between 1993 and 2006.

The No Action Alternative includes management direction that would require marbled murrelet surveys prior to any habitat-disturbing activities which is consistent with the recommendation in the marbled murrelet recovery plan. The analysis for Alternatives 1 and 3 also assumes that surveys would occur.

The analysis for the No Action Alternative, Alternative 1, and Alternative 3 projects discovery and protection of future marbled murrelet sites. Based on past find rates (between 1993 and 2006), the analysis projects that surveys over the next 10 years would discover:

- 592 new sites under the No Action Alternative,
- 601 new sites under Alternative 1, and
- 801 new sites under Alternative 3.

Under the No Action Alternative and Alternative 1, the analysis assumes that these additional sites would be protected from timber harvest. Under Alternative 3, occupied marbled murrelet sites would be protected from harvest until 50% of the acres in an assessment area are older than defined threshold stand ages. The year until which marbled murrelet sites would be protected under Alternative 3 is shown in *Table 194* (*Year at which the threshold age would be reached under Alternative 3*).

Analysis of Alternative 2 assumes that surveys would not occur. Because of the hidden nature of nesting marbled murrelets, it is not reasonably foreseeable that additional sites would be found without surveys. Therefore, the analysis of Alternative 2 does not project protection of additional sites beyond the currently known, occupied sites.

Table 194. Year at which the threshold age would be reached under Alternative 3

Sustained Yield Unit (District) /Province	Year
Salem/Coast Range	2046
Eugene/Coast Range	2046
Roseburg/Coast Range	2016
Roseburg/Klamath	2106
Coos Bay/Coast Range	2056
Coos Bay/Klamath	2026
Medford/Klamath	2056

Marbled Murrelet Nesting Habitat

There are 891,000 acres of BLM-administered lands that are capable of growing nesting habitat for the marbled murrelet. As shown in *Table 195* (*Available marbled murrelet nesting habitat on BLM-administered lands within the planning area*), 641,000 acres occur within marbled murrelet Zone 1 and 250,000 acres occur within marbled murrelet Zone 2. A map of the two Zones is contained in the *Wildlife* section of Chapter 3.

For this analysis, marbled murrelet habitat is classified as the mature, multiple canopy and structurally complex structural stage classifications. This classification is based on marbled murrelet nesting suitability category 4 from Raphael et al. (2006). Category 4 structural classifications are generally stands greater than 20 inches quadratic mean diameter with complex canopy structures. Raphael et al. (2006) also classified simple canopy stands with a quadratic mean diameter greater than 30 inches as nesting suitability class 4. Although the data used for this analysis does not distinguish between the 30 inch and greater diameter class, the assumption is that the majority of those stands would fall into the structurally complex structural stage classification.

By the year 2106, marbled murrelet nesting habitat would increase from the current condition of 373,000 acres to:

- 715,000 acres under the No Action Alternative (an increase of 92%)
- 620,000 acres under Alternative 1 (an increase of 66%)
- 439,000 acres under Alternative 2 (an increase of 18%)
- 493,000 acres under Alternative 3 (an increase of 32%)

Figure 232 (*Marbled murrelet nesting habitat by the year 2106*) shows how habitat develops over time. In the first 50 years, there would be a decrease in marbled murrelet nesting habitat under Alternatives 2 and 3 compared to the current condition of 373,000 acres. There would be a 16% decrease (to 313,000 acres) under Alternative 2 and a 14% decrease (to 321,000 acres) under Alternative 3.

Figure 232. Marbled murrelet nesting habitat by the year 2106

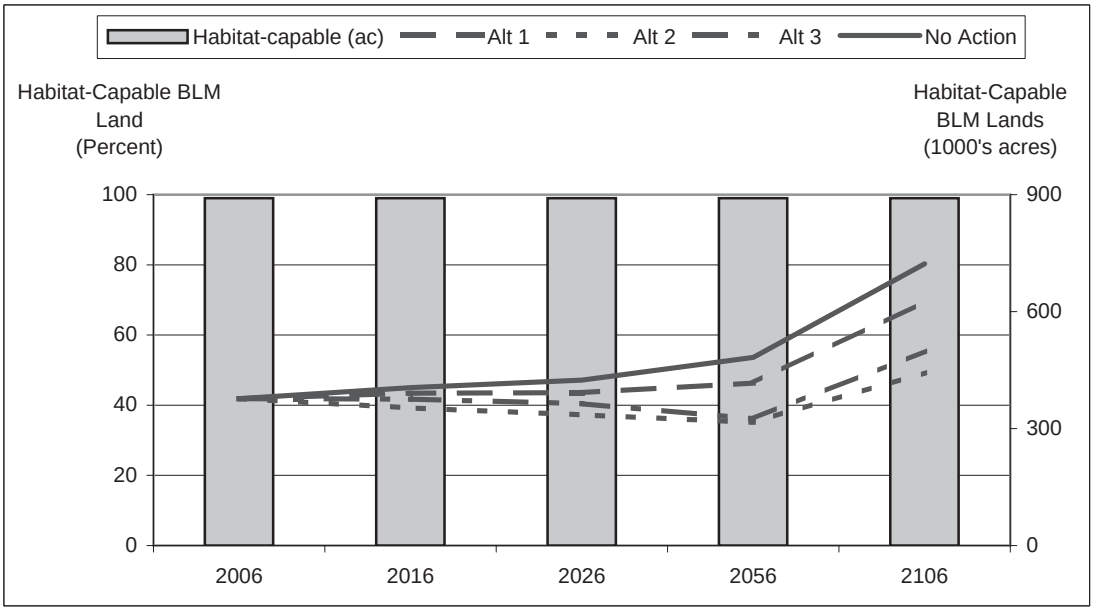


Table 195. Available marbled murrelet nesting habitat on BLM-administered lands within the planning area

	District	Alternative	Habitat-capable (acres)	Marbled murrelet nesting habitat (acres)				
				2006	2016	2026	2056	2106
ZONE 1	Coos Bay	Alt 1	298,000	122,000	118,000	117,000	124,000	199,000
		Alt 2		122,000	104,000	93,000	83,000	129,000
		Alt 3		122,000	119,000	117,000	108,000	144,000
		No Action		122,000	123,000	126,000	137,000	227,000
	Eugene	Alt 1	108,000	37,000	43,000	47,000	52,000	80,000
		Alt 2		37,000	38,000	40,000	37,000	49,000
		Alt 3		37,000	41,000	46,000	45,000	68,000
		No Action		37,000	44,000	51,000	61,000	93,000
	Medford	Alt 1	1,000	500	600	600	600	900
		Alt 2		500	400	300	300	300
		Alt 3		500	500	500	600	600
		No Action		500	600	600	600	800

	District	Alternative	Habitat-capable (acres)	Marbled murrelet nesting habitat (acres)				
				2006	2016	2026	2056	2106
ZONE 1	Roseburg	Alt 1	37,000	18,000	18,000	18,000	18,000	25,000
		Alt 2		18,000	17,000	17,000	16,000	21,000
		Alt 3		18,000	17,000	15,000	9,000	21,000
		No Action		18,000	19,000	19,000	20,000	28,000
	Salem	Alt 1	197,000	67,000	81,000	84,000	92,000	151,000
		Alt 2		67,000	74,000	76,000	77,000	114,000
		Alt 3		67,000	77,000	75,000	63,000	114,000
		No Action		67,000	84,000	92,000	111,000	169,000
	Total Zone 1	Alt 1	641,000	244,500	260,600	266,600	286,600	455,900
		Alt 2		244,500	233,400	226,300	213,300	313,300
		Alt 3		244,500	254,500	253,500	225,600	347,600
		No Action		244,500	270,600	288,600	329,600	517,800
ZONE 2	Coos Bay	Alt 1	4,000	1,300	1,000	900	1,000	2,200
		Alt 2		1,300	1,100	700	500	700
		Alt 3		1,300	1,200	1,000	1,200	2,300
		No Action		1,300	1,400	1,500	1,400	2,700
	Eugene	Alt 1	40,000	12,000	14,000	15,000	15,000	25,000
		Alt 2		12,000	14,000	14,000	14,000	24,000
		Alt 3		12,000	13,000	14,000	14,000	24,000
		No Action		12,000	15,000	17,000	19,000	31,000
	Medford	Alt 1	46,000	24,000	24,000	23,000	24,000	27,000
		Alt 2		24,000	21,000	18,000	19,000	22,000
		Alt 3		24,000	23,000	22,000	22,000	25,000
		No Action		24,000	27,000	26,000	33,000	36,000
	Roseburg	Alt 1	142,000	81,000	77,000	75,000	78,000	103,000
		Alt 2		81,000	71,000	66,000	60,000	76,000
		Alt 3		81,000	70,000	59,000	50,000	82,000
		No Action		81,000	77,000	77,000	84,000	114,000
	Salem	Alt 1	18,000	10,000	10,000	8,000	8,000	7,000
		Alt 2		10,000	9,000	7,000	6,000	3,000
		Alt 3		10,000	10,000	11,000	9,000	13,000
		No Action		10,000	10,000	10,000	11,000	14,000
	Total Zone 2	Alt 1	250,000	128,300	126,000	121,900	126,000	164,200
		Alt 2		128,300	116,100	105,700	99,500	125,700
		Alt 3		128,300	117,200	107,000	96,200	146,300
		No Action		128,300	130,400	131,500	148,400	197,700

Marbled Murrelet Habitat in Zone 1

In Zone 1, the increase in marbled murrelet nesting habitat by the year 2106 would range from 68,800 acres or a 28 % increase under Alternative 2 to 273,300 acres or a 112% increase under the No Action Alternative. Zone 1 is important because it represents the approximate area identified in the marbled murrelet recovery plan as the recovery area for the species (USDI, USFWS 1997).

Alternative 1 would increase nesting habitat 86% (to 455,900 acres) by 2106 in Zone 1. In all districts, Alternative 1 would increase marbled murrelet nesting habitat. The increase would range from 39 and 125%. The Coos Bay District would be the only district with a short-term decline in marbled murrelet nesting habitat. The decline would be 3.3% over the next 10 years.

Alternative 2 would increase marbled murrelet nesting habitat in all districts by 2106 in Zone 1 with one exception. The Medford District would decline 200 acres. The Salem District would have an increase in marbled murrelet nesting habitat in each time increment.

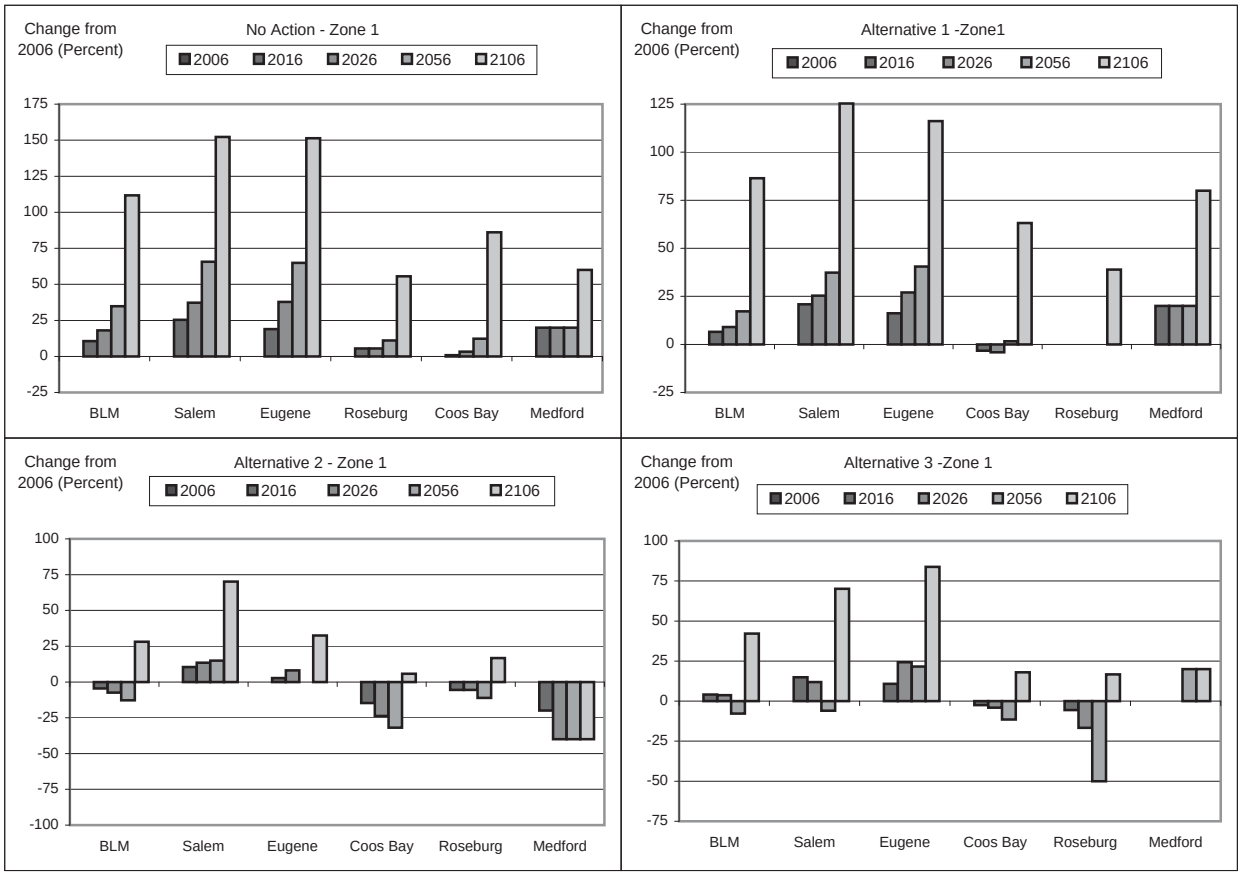
Alternative 3 would increase marbled murrelet nesting habitat 42% (or 103,000 acres) in Zone 1 by 2106. The largest increases in nesting habitat would occur in the Eugene, Coos Bay, and Salem districts.

In the shorter term (50 years), there would be an overall decrease in marbled murrelet nesting habitat of 16% under Alternative 2 and 14% under Alternative 3 compared to the current condition. The Coos Bay and Roseburg districts show decreases at 10, 20, and 50 years under Alternatives 2 and 3.

Declines in the amount of marbled murrelet nesting habitat are caused by the increase in the amount of lands being harvested each decade, compared to No Action and Alternative 1. The decline is also attributable to the lack of legacy retention after harvest which delays the development of new nesting habitat (See the *Ecology* section of this Chapter).

Figure 233 (*District marbled murrelet nesting habitat fluctuations in Zone 1*) compares habitat fluctuations by district in Zone 1.

Figure 233. District marbled murrelet nesting habitat fluctuations in Zone 1.



Marbled Murrelet Habitat in Zone 2

In Zone 2, marbled murrelet nesting habitat would increase by 2106 from the current condition of 128,000 acres to 198,000 acres under the No Action Alternative, 164,000 acres under Alternative 1, and 146,000 acres under Alternative 3. Under Alternative 2, nesting habitat would decrease approximately 2000 acres by 2106.

Under the No Action Alternative, marbled murrelet nesting habitat would increase in all districts, in Zone 2 by 2106. There would be a decrease in habitat in the shorter term in the Roseburg District in 2026.

Under Alternative 1 overall nesting habitat on BLM-administered lands in the planning area would decline 12% over the next 10 years. Specifically, there would be a 23% decrease in the Coos Bay District and a 5% decrease in the Roseburg District. There would be no change in habitat in the Medford and Salem districts. By 2056, overall nesting habitat in Zone 2 would decline 2%. There would be a decline of 23% in the Coos Bay District, 4% in the Roseburg District, and 20% in the Salem District. Salem would be the only district in which marbled murrelet nesting habitat would decline in Zone 2 in 2106. The decline of 3,000 acres represents 30% of nesting habitat.

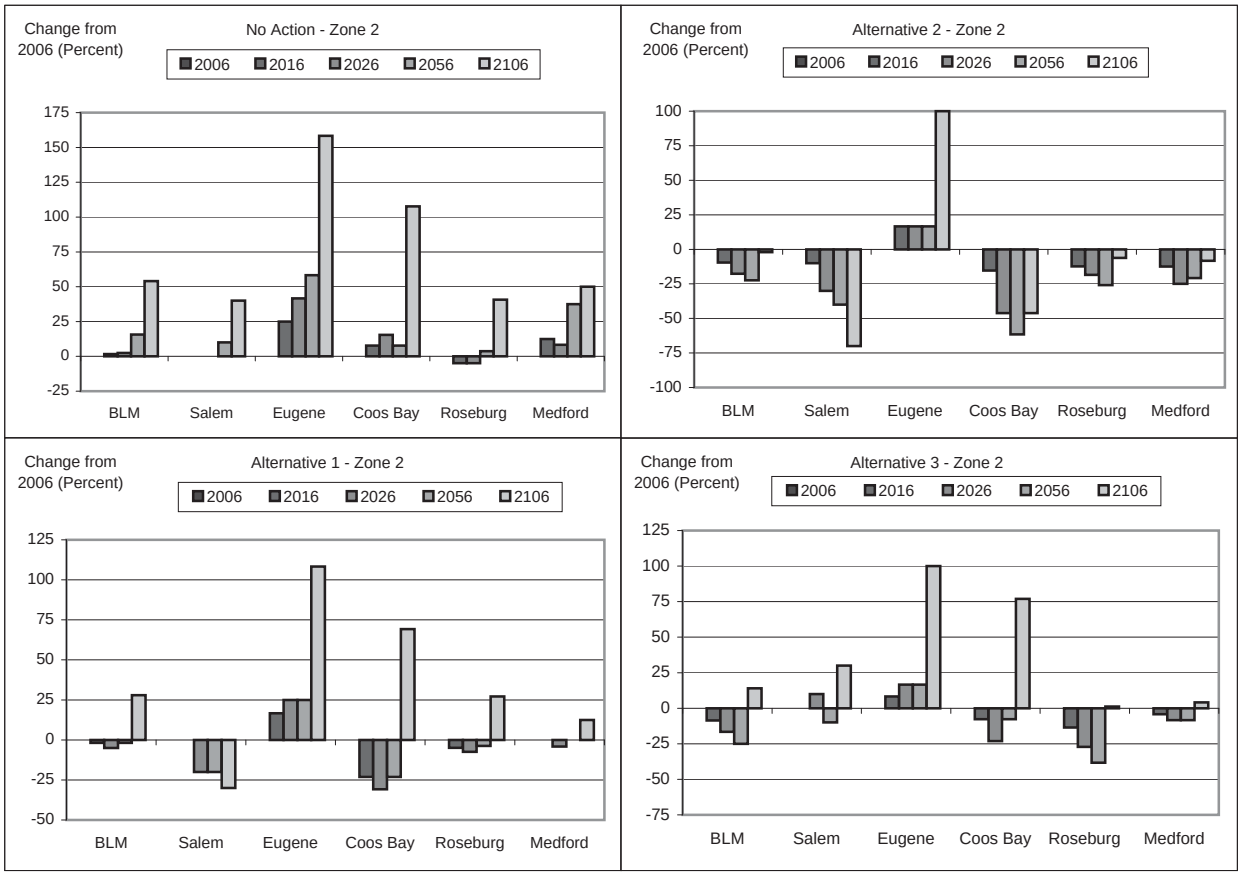
Short-term declines in habitat are important to consider, especially with a threatened or endangered species. This is because the short-term decline of habitat could depress the population abundance to a level from which they may not recover. The larger the short-term decline, the greater the impact to recovery.

Under Alternative 2, there would be less marbled murrelet nesting habitat in Zone 2 in all time periods compared to the current condition in all districts except Eugene. There would be an overall decrease of 22% in 2056 compared to 2006 on BLM-administered lands in the planning area. By 2106, however, there would be an upward trend in the amount of overall habitat in the planning area to the point that there would only be 2% less habitat than in 2006.

Under Alternative 3, overall marbled murrelet nesting habitat on BLM-administered lands in the planning area would increase 14% (18,000 acres) in Zone 2 by 2106. There would be an increase in marbled murrelet nesting habitat in all districts. These increases would range from 1% to 100%. The largest increases in habitat would occur in the Eugene, Coos Bay, and Salem Districts. In the shorter term (by 2056), marbled murrelet nesting habitat would decrease 17% in the first two decades and would decrease 25% by 2056 compared to current conditions. Eugene is the only district in which there would be an increase in marbled murrelet nesting habitat in all time periods.

Figure 234 (*District Marbled murrelet nesting habitat fluctuations in zone 2*) compares habitat fluctuations by district in Zone 2

Figure 234. District marbled murrelet nesting habitat fluctuations in Zone 2.



Patch and Core Area Size

The *Ecology* section of this chapter analyzed the development of patch size over time for the mature and structurally complex forest structural stage classifications. Marbled murrelet habitat includes the mature, structurally complex forest structural stage classification, so the absolute patch sizes would be different, but relative relationships would be similar. In the Coast Range physiographic province, in comparing the current patch size of 111 acres to the patch size that would exist in 2106, the mean patch size of mature and structurally complex forest on BLM-administered lands in the planning area would:

- increase to 338 acres under the No Action Alternative,
- increase to 254 acres under Alternative 1,
- decrease to 101 acres under Alternative 2, and
- decrease to 37 acres under Alternative 3.

Mean core area size would follow the same trends as mean patch size. An increase in the size of core areas would indicate that more nesting opportunities further from edge habitat would develop. This would result in a decrease in potential nest predation.

Edge density would increase under all alternatives. The increase compared to the current condition of 54 feet per acre would range from 72 feet per acre under the No Action Alternative to 96 feet per acre under Alternative 3. Potential nest predation increases with increased forest fragmentation and the amount of edge (Raphael et al. 2002a and 2002b, Meyer et al. 2002).

In the Klamath province, in comparing the current patch size of 137 acres to the patch size that would exist in 2106, the mean patch size of mature and structurally complex forest on BLM-administered lands in the planning area would:

- increase to 192 acres under the No Action Alternative,
- decrease to 91 acres under Alternative 1,
- decrease to 79 acres under Alternative 2, and
- decrease to 27 acres under Alternative 3.

Edge density would increase under all alternatives. The increase compared to the current condition of 62 feet per acre, would range from 73 feet per acre under Alternative 2 to 91 feet per acre under Alternative 3.

The quantity of marbled murrelet nesting habitat on BLM-administered lands in the planning area would increase under all alternatives, in 100 years. In the shorter term (50 years), there would be decreases in the quantity of marbled murrelet nesting habitat under Alternatives 2 and 3.

The quality of marbled murrelet nesting habitat (as measured by patch and core area size and edge density) would vary under the alternatives.

Under the No Action Alternative, long term patch and core area size increases in mature and structurally complex stands in the Coast Range and Klamath provinces would indicate improving habitat conditions for the marbled murrelet. The increase in core area size would offset increases in edge density. Edge density would only become a limiting factor when core area sizes remain the same. There would also be an increase in overall marbled murrelet nesting habitat.

Under Alternative 1, long term patch size and core area size increases in mature and structurally complex stands in the Coast Range province would indicate improving habitat conditions. In the Klamath province, considering increases in the quantity of marbled murrelet nesting habitat and a decrease in patch size area, habitat conditions would be maintained.

Under both the No Action Alternative and Alternative 1, short term impact to available nesting habitat would be nonexistent or small (less than 5% available habitat).

Under Alternatives 2 and 3 in Coast Range and Klamath provinces, a decline in habitat conditions would be expected given decreased patch size, decreased core area, increasing edge density, and decreases in nesting habitat over the next 50 years.

Deer

The Douglas County population segment of the Columbian white-tailed deer would continue to be managed on the North Bank Habitat Management Area in accordance with the habitat management plan (BLM 2001c).

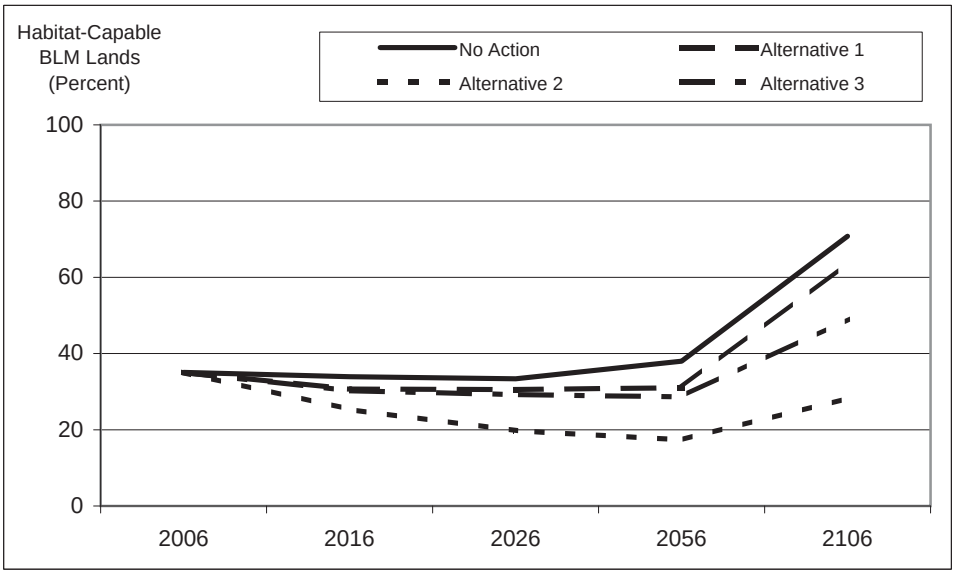
Management that converts forest from the mature and structurally complex forest structural stages to the stand establishment stage would result in the loss of winter cover. This would occur only in those stands located adjacent to the valley bottom habitats utilized as foraging habitat. Under all alternatives, there would be incidental impacts to the Columbian white-tailed deer commensurate with the amount of regeneration harvest activities that would occur and the amount of mature and structurally complex forest habitat located adjacent to occupied valley bottomlands.

Management of the BLM's forests that are adjacent to the Umpqua Valley and Columbia River, where the deer are located, would have little impact on the survival of the species. This is because the recovery of the Douglas County population is tied to the presence of secure valley habitat and not the upland coniferous forest where timber harvest under the alternatives would occur. The recovery of the Columbia River population is tied to habitat conditions on the Julia Butler Hansen National Wildlife Refuge and surrounding valley bottom habitat.

Mule deer and black-tailed deer occur across BLM-administered lands within the planning area. Specific limited habitat includes important wintering areas and areas that provide summer thermal cover. There are 26 such designated deer habitat management areas (See *Wildlife* section of Chapter 3). Stable thermal conditions and summer thermal habitat are provided by mature, multiple canopy and structurally complex structural stage classifications. Five of the 26 deer habitat management areas (approximately 30,000 acres) would be designated to provide summer thermal cover in the Coos Bay District. With the exception of Alternative 2, all other alternatives would exhibit little change in these habitat management units until 2056. Thermal cover, primarily a function of stand age, would develop predominantly after 50 years. See *Figure 235* (*Average summer thermal habitat availability on deer habitat management units in the Coos Bay District*). These five habitat management areas would have stable to increasing levels of thermal habitat under the No Action Alternative and Alternatives 1 and 3. All habitat management areas would develop at least 50% thermal cover under the No Action Alternative and Alternative 1. Four out of five habitat management areas would remain stable or decline up to 28% in available thermal cover under Alternative 2.

Other habitat factors include core area size (or distance from edge) and open road density on BLM-administered lands. Habitat models indicate that cover values increase with distance from the edge and decrease with increasing density of open roads open to vehicles. Compounding the effects of decreasing thermal cover under Alternatives 2 and 3 are the decreasing patch size, and core area size of thermal cover (mature or structurally complex forests) from the current condition in the Coast Range, on BLM-administered lands (see the *Ecology* section in this chapter for complete analysis of patch size).

Figure 235. Average summer thermal habitat availability on the deer habitat management units in the Coos Bay District.*



* Expressed as a percentage of the habitat-capable BLM-administered lands (n=5).

There would be 21 deer habitat management areas totaling 191,000 acres designated as winter habitat areas in the Medford District and the Klamath Falls Resource Area. These deer habitat management areas would provide areas of adequate forage habitat and limited disturbance.

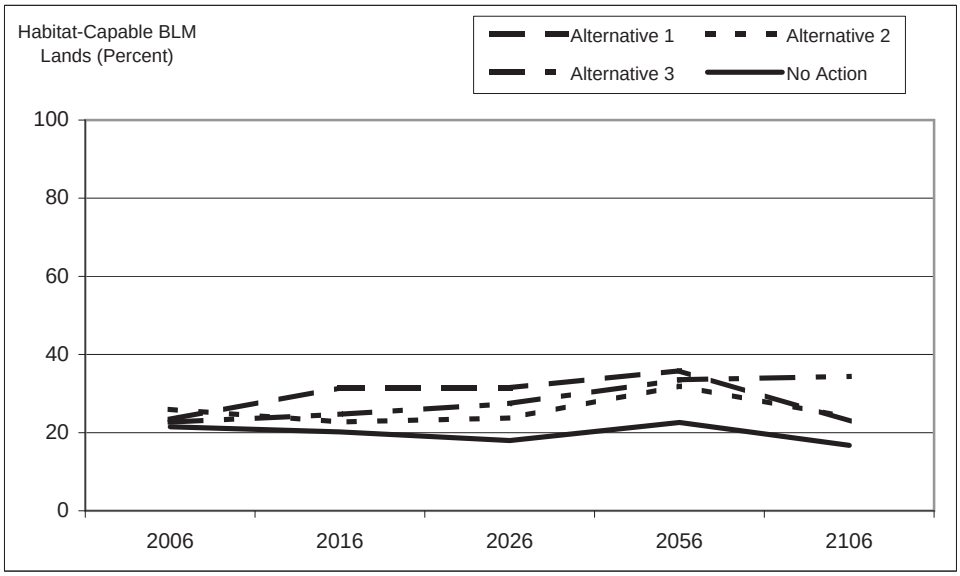
There are 12 of the 21 areas within the western part of the planning area. The amount of forage habitat would remain relatively stable or slightly decrease under all alternatives. On average, the alternatives would vary no more than 11% as shown in *Figure 236* (*Percent of foraging habitat availability on the deer habitat management units in the Medford District and Klamath Falls Resource Area*). Factors affecting the quality of foraging habitat include:

- Fuels treatment after harvesting and its effects on the resulting vegetation.
- Size of the forage units. Deer use would decrease with an increased distance from hiding cover.
- Disturbance caused by vehicles. Forage habitat quality would decrease with increasing density of roads open to vehicular traffic.

The creation of foraging habitat would occur as a result of regeneration harvests. Forest stands would remain in the stand establishment phase and provide foraging habitat for up to two or three decades following regeneration harvest. Non-forested areas would provide stable background levels of foraging habitat.

Under the No Action Alternative, the amount of foraging habitat would decrease from the current condition up to 16 % on nine deer habitat management areas in western Oregon. Under Alternatives 1 and 2, foraging habitat would decrease 16% on six areas and 32% on five areas. Alternative 3 would increase the amount of foraging habitat up to 36% in 10 management areas.

Figure 236. Percent of foraging habitat availability on the deer habitat management units in the Medford District and Klamath Falls Resource Area

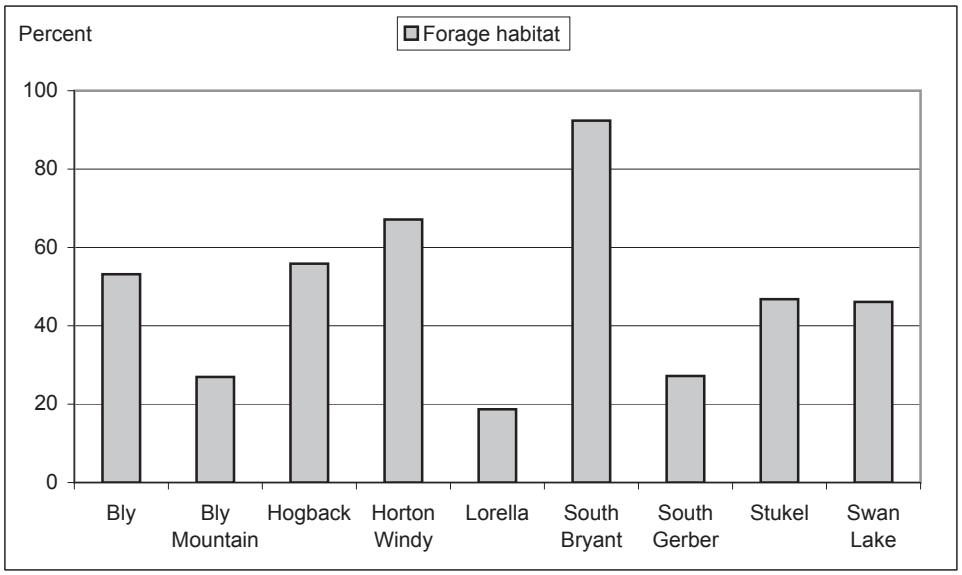


Note: Does not include eastside management lands.

There are 9 of the 21 deer habitat management areas on eastside management lands in the Klamath Falls Resource Area. Forests in those areas would be managed with an uneven-aged management regime under all alternatives. It is assumed that the overall distribution of forest structural stages would not change in this area as a result of uneven-aged management. Current conditions on these eastside management lands vary from approximately 20 to 90 % foraging habitat as shown in *Figure 237* (*Percent of foraging habitat in deer habitat management areas on eastside management lands in the Klamath Falls Resource Area*).

Foraging habitat would be created as harvested stands regenerate, but would not persist as long as foraging habitat created under even-aged management. This is because the openings created to regenerate the stand would be much smaller. Intensive forest management on intermingled private forestlands would provide more foraging habitat per unit area than BLM-administered lands, because the foraging habitat would last longer.

Figure 237. Percent of foraging habitat in Deer Habitat Management Areas on eastside management lands in the Klamath Falls Resource Area.



The standard for density of roads that are open is 1.5 miles per square mile in deer habitat management areas. Under all alternatives, road density on BLM-administered lands within the habitat management areas would vary from 4.65 to 0.56 miles per square mile. When considering roads that are open, the density varies from 4.12 to 0.26 miles per square mile as shown in *Table 196* (*Current road density on BLM-administered lands within deer habitat management units*).

There are twelve deer habitat management areas currently exceed the 1.5 mile standard of which seven are important deer wintering areas**.** Up to 65% of all existing, open roads in some deer habitat management areas would be seasonally restricted to meet these objectives.

Table 196. Current road density on BLM-administered lands within deer habitat management units

Deer habitat management area	District	Road density (mi/mi^2)		Miles of road closures to meet standard	
		Open Roads	All Roads	(mile)	(%)
Camp Creek	Coos Bay	3.02	3.70	29.9	50
Edson Butte	Coos Bay	1.55	3.34	0.35	4
Millicoma Tree Farm N Edge	Coos Bay	4.12	4.21	2.56	65
Millicoma Tree Farm NE Edge	Coos Bay	2.98	4.15	14.09	49
Rock Creek	Coos Bay	3.82	4.65	24.91	61
Bly	Klamath Falls	1.39	1.39		
Bly Mt	Klamath Falls	1.42	1.42		
Hogback	Klamath Falls	0.98	0.98		
Horton Windy	Klamath Falls	1.09	1.09		
Keno Worden	Klamath Falls	1.38	1.38		
Lorella	Klamath Falls	0.94	0.94		
South Bryant	Klamath Falls	1.55	1.55	0.14	2
South Gerber	Klamath Falls	0.64	0.64		
Stukel	Klamath Falls	1.13	1.13		
Swan Lake	Klamath Falls	0.64	0.56		
Topsy Pokegama	Klamath Falls	2.92	3.54	30.25	48
Little Applegate	Medford	1.30	1.99		
Little Butte Creek South[b]	Medford	1.12	2.26		
		0.26	1.64		
Burnt Creek	Medford	0.59	1.62		
Elk Creek	Medford	3.33	4.02	54.53	55
Salt Creek	Medford	2.00	2.50	13.79	25
Shady Cove West	Medford	1.61	1.78	1.33	7
Camel Hump	Medford	1.47	1.94		
Williams	Medford	2.74	4.34	56.54	45
DHMA Monument East	Medford	1.58	3.03	1.29	5
DHMA Monument West	Medford	0.52	2.10		
Total All DHMAs		**1.83**	**2.53**	**129.5**	**18**

An estimated 12 miles of new, permanent roads would be constructed over the next 10 years in 23 deer habitat management areas under the No Action Alternative, along with and 25, 22, and 21 miles under Alternatives 1, 2, and 3 (respectively). This would slightly increase road densities in the deer habitat management areas under all alternatives. As shown in the shaded area of *Table 197*, 18 deer habitat management units would exceed the standard of 1.5 miles per square mile. There are 13 of these 18 that are designated for winter range.

Table 197. Road densities by 2016 for deer habitat management areas

Deer Habitat Management Area	District	Projected Road Density (all roads) (mi/mi²)			
		No Action	Alt 1	Alt 2	Alt 3
Camp Creek	Coos Bay	3.79	3.88	3.93	3.78
Edson Butte	Coos Bay	3.38	3.37	3.44	3.37
Millicoma Tree Farm N Edge	Coos Bay	4.80	4.45	4.44	4.44
Millicoma Tree Farm NE Edge	Coos Bay	4.15	4.22	4.16	4.38
Rock Creek	Coos Bay	4.89	5.07	5.01	4.80
Bly	Klamath Falls	1.42	1.42	1.42	1.42
Bly Mt	Klamath Falls	1.45	1.45	1.45	1.45
Hogback	Klamath Falls	1.07	1.07	1.07	1.07
Horton Windy	Klamath Falls	1.09	1.09	1.09	1.09
Keno Worden	Klamath Falls	1.41	1.43	1.40	1.44
Lorella	Klamath Falls	0.94	0.94	0.94	0.94
South Bryant	Klamath Falls	1.53	1.53	1.53	1.53
South Gerber	Klamath Falls	0.65	0.65	0.65	0.65
Stukel	Klamath Falls	1.14	1.14	1.14	1.14
Swan Lake	Klamath Falls	0.70	0.70	0.70	0.70
Topsy Pokegama	Klamath Falls	3.57	3.54	3.56	3.56
Burnt Peak	Medford	1.60	1.61	1.66	1.60
Camel hump	Medford	1.94	2.03	2.04	1.99
Elk Creek	Medford	4.05	4.09	4.17	4.19
Little Applegate	Medford	2.03	2.07	2.06	2.06
DHMA Monument East	Medford	3.02	3.02	3.02	3.02
DHMA Monument West	Medford	2.11	2.12	2.11	2.11
Little Butte Creek South	Medford	2.27	2.29	2.31	2.35
		1.66	1.68	1.67	1.69
Salt Creek	Medford	2.55	2.60	2.60	2.58
Shady Cove West	Medford	1.78	1.84	1.92	1.91
Williams	Medford	4.37	4.56	4.49	4.58
Total for all areas		**2.57**	**2.61**	**2.62**	**2.62**

Under all alternatives, off-highway vehicles travel would be limited to designated roads and trails. These limitations, along with the closure of roads in deer management areas, would limit the amount of disturbance caused to wintering animals. Reduced disturbance would decrease the amount of unnecessary movements animals would make and therefore would reduce energy expenditure. Additionally, road closures would result in more available foraging habitat since animals would not need to shift away from frequently used roads and trails.

Assuming that winter forage was the only limiting factor to population growth, population numbers in deer habitat management areas in the Klamath Falls Resource Area and Medford District would increase in response to newly created or newly available forage areas.

By 2056, available forage habitat and deer population responses under the No Action Alternative would remain stable. Under the action alternatives, available foraging habitat and populations would increase approximately 50 %.

By 2106, Alternative 3 would increase available forage habitat and deer population responses by almost 50%. Under Alternatives 1 and 2, habitat and populations would remain stable. Under the No Action Alternative, habitat and populations would decrease approximately 25%.

In the Coos Bay District, winter road closures would not have any effect on the five deer habitat management areas since these areas were created for summer thermal protection. Road density is projected to increase under all alternatives and would cause corresponding increases in deer disturbance within patches of thermal cover.

The No Action Alternative and Alternatives 1 and 3 would create additional mature-multiple canopy and structurally complex forest stands capable of providing summer thermal habitat and would therefore result in a corresponding increases in deer populations. This is based on the assumption that summer thermal cover is the only limiting factor.

Mitigation could be applied that would mitigate increased road densities in the deer habitat management areas that exceed the 1.5 miles of open road per square mile standard on the Coos Bay District. Any new roads on BLM-administered lands in deer habitat management areas should be temporary rather than permanent. Where there are no reciprocal rights-of-way, existing roads could be closed or seasonal closures could be applied to BLM-administered roads. Sufficient closures would be necessary to achieve a density of 1.5 miles of open road per square mile, on BLM-administered lands. Summer seasonal restrictions would need to be applied between May 1 and August 31.

Elk

There are 16 elk habitat management areas on BLM-administered lands (see the *Wildlife* section of Chapter 3). These areas provide specific limited habitat needs for elk. Specific limited habitat includes important wintering areas and areas that provide summer thermal cover. Elk forage on grasses, forbs, shrubs, and trees species that are characteristic of the nonforest or stand establishment forest structural stage classifications. Additional forage (lichens) would be found in older structural stages. Stable thermal conditions and summer thermal habitat are provided by stands in the mature, multiple canopy or structurally complex forest structural stage classifications.

Five of the 16 elk habitat management areas (approximately 30,000 acres) would be designated to provide summer thermal cover in the Coos Bay District.

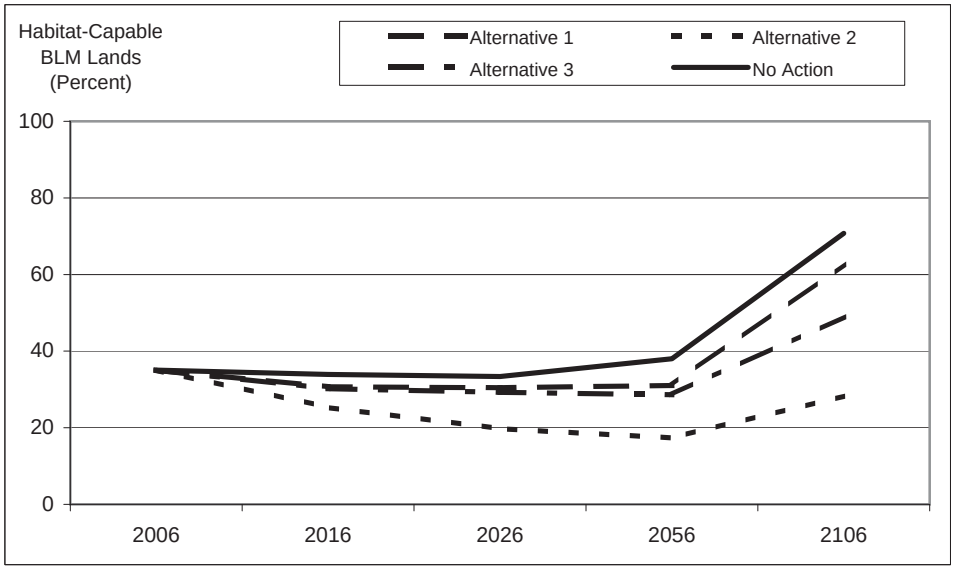
Under the No Action Alternative and Alternatives 1 and 3, thermal cover would increase or remain stable in all elk habitat management areas in the Coos Bay District.

On average, the No Action Alternative would increase thermal cover from 35 to 71 % compared to existing conditions while Alternative 1 would increase it to 63 %, and Alternative 3 would increase it to 49 %. See *Figure 238* (*Average summer thermal habitat availability on the elk habitat management units in the Coos Bay District*) for how summer thermal habitat would change over time.

Under Alternative 2, thermal cover would remain stable or decrease in four of five elk habitat management areas. The amount would average between the current amount of 35% to a low of 28%.

Other habitat factors include core area size (or distance from edge) and open road density. Habitat models indicate that cover value increases from the edge up to 200 yards into the stand. Cover value decreases with increasing density of roads that are open to vehicles (Wisdom et al. 2004). Thermal cover patch size on BLM-administered lands would increase by 2106 under the No Action Alternative and Alternative 1 and would decrease under Alternative 2 and 3. See discussion of patch size in the *Ecology* section of this chapter.

Figure 238. Average summer thermal habitat availability on the elk habitat management units in the Coos Bay District



Under all alternatives, nine elk habitat management areas (totaling 123,700 acres) would be designated in areas of important winter habitat in the Medford District.

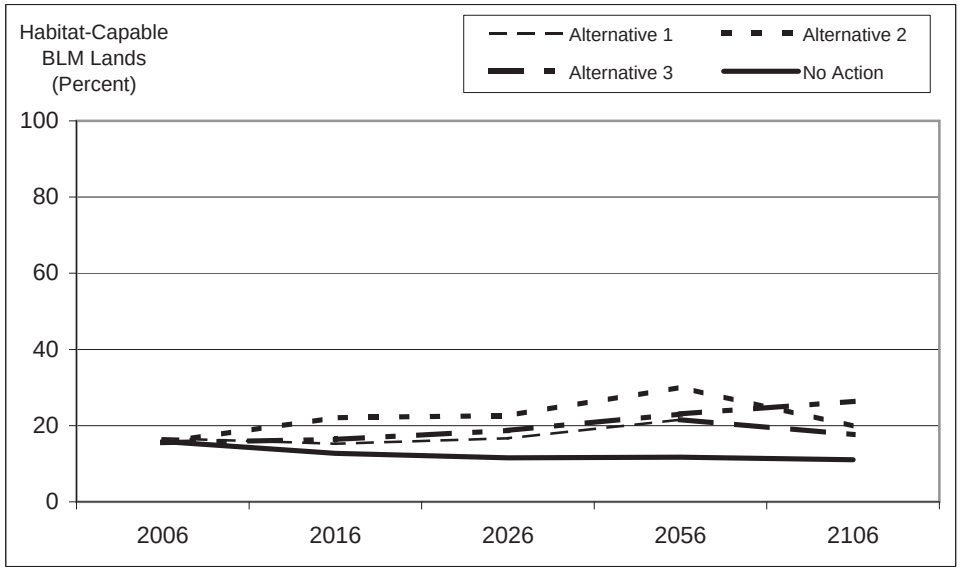
Following are several factors that affect the quality of elk foraging habitat:

- The affect to vegetation of fuels treatment after harvesting.
- The size of the forage units. Elk use would decrease with increased distance (greater than 100 yards) from hiding cover (Wisdom et al. 2004).
- The disturbance caused by vehicles. Forage habitat quality would decrease with increasing density of roads open to vehicular traffic (Wisdom et al. 2004).

The creation of foraging habitat would occur as a result of regeneration harvests. Forest stands would remain in the stand establishment phase and provide foraging habitat for up to two to three decades following regeneration harvest. The differences between alternatives would be a result of regeneration harvests and partial harvests that would create the stand establishment forest structural stage classification. Nonforested areas would provide stable background levels of foraging habitat. Intensive forest management on intermingled private forestlands would provide additional foraging habitat. It is assumed that the amount of forage habitat on privately owned commercial forest lands would remain approximately the same over time.

Forage habitat would vary little across the alternatives. Foraging habitat would increase from the current condition of 16% to 18% under Alternatives 1, to 20% under Alternative 2, and to 26% under Alternative 3. Forage habitat would decrease to 11% under the No Action Alternative. *Figure 239* (*Average foraging habitat on the elk habitat management units in the Medford District*) shows how the habitat would change over time.

Figure 239. Average foraging habitat on the elk habitat management units in the Medford District



Two elk management areas (totaling 5600 acres) in the Salem District would limit the disturbances caused by roads and off-highway vehicles. As shown in *Table 198* (*Current road density on BLM-administered lands within elk habitat management units*), the density of roads that are open in these areas ranges from 0.92 and 0.24 miles per square mile. The density of all roads ranges from 2.11 miles per square mile to 2.78 miles per square mile. New permanent road construction would range from 0.3 miles under the No Action Alternative to 1.3 miles under Alternative 3.

New roads would raise the density of roads in the Luckiamute elk management area. Road density would increase from 2.11 miles of road per square mile to 2.12 miles under the No Action Alternative, to 2.15 miles under Alternative 1, to 2.13 miles under Alternative 2, and to 2.32 miles under Alternative 3. The new roads would also raise road densities in the Bummer Ridge elk management area. Road density would increase from

2.78 miles of road per square mile to 2.83 miles under the No Action Alternative, to 2.90 miles under Alternative 1, to 2.99 miles under Alternative 2, and to 2.88 miles under Alternative 3.

Under all alternatives, there would be a road density target of 1.5 miles of roads that are open to vehicles per square mile of BLM-administered lands within the habitat management areas designated for winter habitat in the Medford District. As shown in *Table 198* (Current *road density on BLM-administered lands within elk habitat management units*), road densities on BLM-administered lands in these areas vary from 4.71 to 1.62 miles per square mile. Road densities for the roads that are open vary from 4.12 to 0.24 miles per square mile Twelve elk habitat management areas currently exceed the 1.5 mile standard. Seven of these areas, occurring in the Medford District, are important elk wintering areas. Up to 65% of all roads that are open in some elk habitat management areas would need to be seasonally restricted to meet the road density target.

Table 198. Current road density on BLM-administered lands in elk habitat management units

Elk Habitat Management Area	District	Road density (mi/mi²)		Amount of road closure necessary to meet density targets	
		Open Roads	All Roads	(miles)	(%)
SALT CREEK	Medford	2.01	2.52	13.93	25
CAMEL HUMP	Medford	1.47	1.94		
SHADY COVE WEST	Medford	1.81	1.79	1.33	7
BURNT PEAK	Medford	0.59	1.62		
ELK CREEK	Medford	3.33	4.02	54.38	55
PEAVINE	Medford	1.92	2.82	17.55	22
FAR OUT	Medford	2.42	3.57	12.74	38
ELK VALLEYI	Medford	3.46	4.71	43.81	57
MULE CREEK	Medford	1.77	3.63	8.26	15
CAMP CREEK	Coos Bay	3.02	3.7	29.9	50
MILLICOMA TREE FARM NE EDGE	Coos Bay	2.98	4.16	14.09	49
MILLICOMA TREE FARM N EDGE	Coos Bay	4.12	4.21	2.56	65
ROCK CREEK	Coos Bay	3.82	4.65	24.91	61
EDSON BUTTE	Coos Bay	1.55	3.34	0.35	4
LUCKIAMUTE	Salem	0.92	2.11		
BUMMER RIDGE	Salem	0.24	2.78		
Total ALL EHMAS		**2.35**	**3.34**	**212.2**	**36**

An estimated 18.6 miles of new, permanent road would be constructed in the first decade in 15 elk habitat management areas under the No Action Alternative, 38.5 miles would be constructed Under Alternative 1, 43.0 miles under Alternative 2, and 32.6 miles under Alternative 3 This would slightly increase road densities in all elk habitat management areas under all alternatives. All elk habitat management areas would exceed the road

density target of 1.5 miles per square miles as shown in *Table 199 (Road densities in 2016 for all elk habitat management areas).*

Table 199. Road densities in 2016 for all elk habitat management areas

Elk Habitat Management Area	District	Projected Road density (all roads) (mi/mi²)			
		No Action	Alt 1	Alt 2	Alt 3
SALT CREEK	Medford	2.56	2.62	2.62	2.60
CAMEL HUMP	Medford	1.94	2.03	2.04	1.99
SHADY COVE WEST	Medford	1.78	1.84	1.92	1.92
BURNT PEAK	Medford	1.60	1.61	1.66	1.60
ELK CREEK	Medford	4.03	4.08	4.16	4.18
PEAVINE	Medford	2.86	2.89	2.87	3.00
FAR OUT	Medford	3.61	3.77	3.92	3.81
ELK VALLEY	Medford	4.87	5.01	4.95	4.79
MULE CREEK	Medford	3.83	3.96	3.95	3.77
CAMP CREEK	Coos Bay	3.80	3.88	3.96	3.79
MILLICOMA TREE FARM NE EDGE	Coos Bay	4.14	4.14	4.14	4.14
MILLICOMA TREE FARM N EDGE	Coos Bay	4.89	5.35	4.59	6.99
ROCK CREEK	Coos Bay	4.89	5.07	5.01	4.80
EDSON BUTTE	Coos Bay	3.38	3.37	3.44	3.37
LUCKIAMUTE	Salem	2.12	2.15	2.13	2.32
BUMMER RIDGE	Salem	2.83	2.90	2.99	2.88
Total All Areas		**3.41**	**3.49**	**3.51**	**3.47**

Under all alternatives, off-highway vehicles travel would be limited to designated roads and trail. These limitations along with the closure of roads in elk management areas would limit the amount of disturbance and risks of poaching. Reduced disturbance would decrease the amount of unnecessary movements animals would make and therefore would reduce energy expenditure. Additionally, road closures would result in more available foraging habitat since animals would not need to shift use away from frequently used roads and trails.

Assuming that winter forage was the only limiting factor to population growth, population numbers in elk habitat management areas in the Medford District would increase in response to newly created or newly available forage areas.

By 2056, available forage habitat and elk population responses under the No Action Alternative would decrease by 25%. Available foraging habitat and populations would increase by 37% under Alternative 1, would increase by 87% under Alternative 2, and would increase by 43% under Alternative 3.

By 2106, the No Action Alternative would decrease available forage habitat and deer population responses by 30%. Under Alternative 1, habitat and populations would remain stable. Under Alternative 2, habitat and populations would increase by 25%. Under Alternative 3 habitat and populations would increase by almost 62%.

Winter road closures would not have any effect on the elk habitat management areas in the Coos Bay and Salem districts since these areas were created for summer thermal protection and year-round protection from disturbance. An increase in the density of roads that are open would result in decreased use of cover and forage habitat adjacent to those roads.

The No Action Alternative and Alternatives 1 and 3 would create additional mature-multiple canopy or structurally complex forest structural classifications capable of providing summer thermal habitat and would result in an increase in elk populations. This assumes that summer thermal cover is the only limiting factor to population growth.

Mitigation could be applied that would mitigate adverse effects due to increased road densities in the Coos Bay and Salem districts. Any new roads on BLM-administered lands in elk habitat management areas should be temporary rather than permanent. Where there are no reciprocal rights-of-way, existing roads could be closed or seasonal closures could be applied to BLM-administered roads. Sufficient closures would be necessary to achieve a density of 1.5 miles of open road per square mile, on BLM-administered lands. Summer seasonal restrictions would need to be applied between May 1 and August 31.

Bald Eagle

There are approximately 1,630,000 acres of BLM-administered land capable of growing bald eagle nesting and roosting habitat within the planning area (those forest-capable lands within 4 miles of foraging waters). Approximately 800,000 acres are currently providing bald eagle nesting and roosting habitat. There are 3,600 miles of stream and 291,000 acres of pond and lakes which have been identified as bald eagle foraging habitat.

As shown in *Figure 240* (*Bald eagle nesting and roosting habitat development under the alternatives*), under the No Action Alternative, bald eagle nesting and roosting habitat would increase from approximately 800,000 acres to 1,290,000 acres by 2106. Under Alternative 1, this habitat would increase to 1,150,000 acres. Approximately 965,000 and 1,000,000 acres of eagle nesting and roosting habitat would develop by 2106 under Alternatives 2 and 3 respectively.

Eastside management lands in the Klamath Falls Resource Area contain approximately 50,000 acres of bald eagle nesting and roosting habitat; approximately 31% of the available lands within 4 miles of assumed foraging habitat. Uneven-aged management (under all of the alternatives) would not change the availability of bald eagle nesting and roosting habitat. Since management of these lands does not change under any of the alternatives, they will not be discussed further.

Figure 240. Bald eagle nesting and roosting habitat development under the alternatives

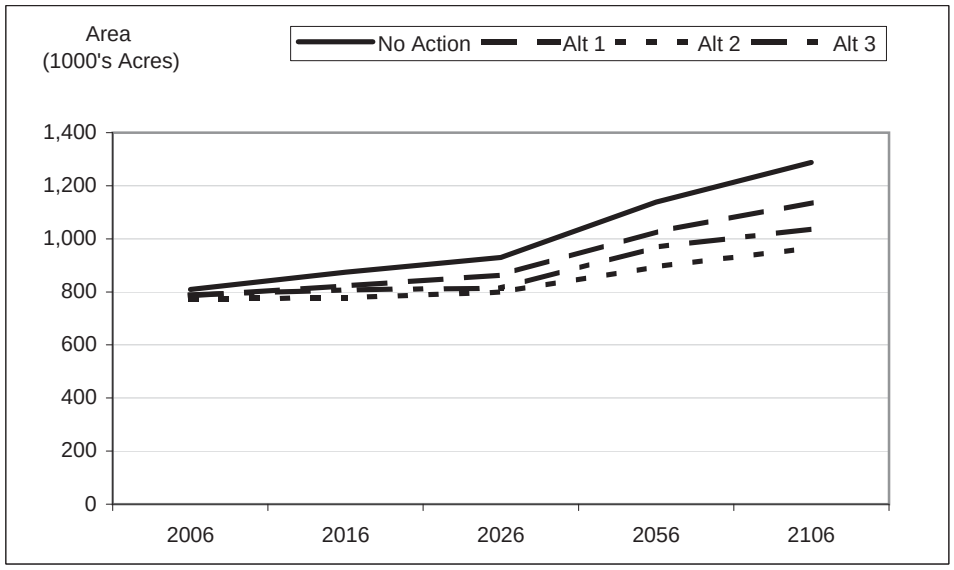
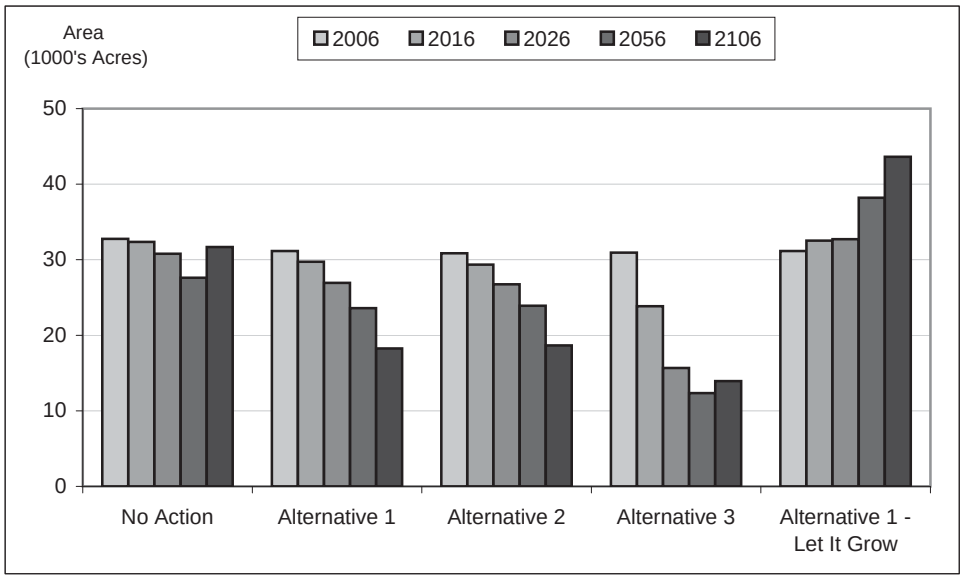


Figure 241 (*Summary of bald eagle nesting and roosting habitat development in the west-side of the Klamath Falls Resource Area*) shows how bald eagle nesting and roosting habitat changes over time on the west-side lands of the Klamath Falls Resource Area. Bald eagle nesting and roosting habitat would remain relatively stable or decrease in 100 years. The amount of habitat would change from the current condition of 31,000 acres to:

- 31,500 acres under the No Action Alternative,
- 18,000 acres under Alternative 1,
- 19,000 acres under Alternative 2, and
- 14,000 acres under Alternative 3.

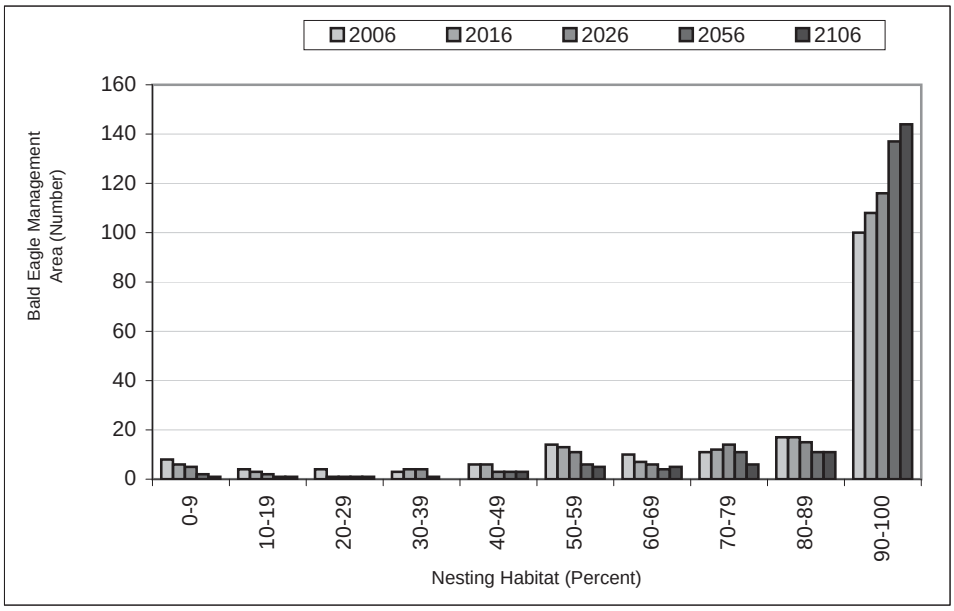
Over 100 years, bald eagle nesting and roosting habitat would decline under Alternatives 1 and 2 due to lower site classes on the forests of the Klamath Falls Resource Area and a lack of retention trees in the harvest units. Both of these factors decrease the rate at which habitat would recover from timber harvest activities. Under Alternative 3, uneven-aged management coupled with the higher rate of stand entry would cause a higher rate of habitat loss compared to the other alternatives. Uneven-aged management would remove trees equally from all size classes and stands would be entered more frequently. Structural stage development may be delayed or reversed depending on the resultant numbers of large diameter trees and how they compare against structural stage thresholds. Under Alternative 3 the amount of available nesting and roosting habitat would stabilize around 13,000 acres in the west-side of the Klamath Falls Resource Area.

Figure 241. Summary of bald eagle nesting and roosting habitat development in the west-side of the Klamath Falls Resource Area



Under all alternatives, occupied bald eagle nest sites, historic sites, potential sites and wintering and congregation areas would be protected. Under all alternatives, the only management activity that would occur in bald eagle management areas would be treatments to lower fire risk and thinning to foster the development of large trees. All bald eagle management areas would increase in the amount of available eagle nesting and roosting habitat (see *Figure 241)*. In 2106, 144 bald eagle management areas (out of a total of 177) would contain more than 90% suitable nesting and roosting habitat. This is an increase of 44% from the current condition of 100 bald eagle management areas that contained more than 90% nesting and roosting habitat as shown in *Figure 242* (*A histogram illustrating the abundance and development of bald eagle nesting and roosting habitat in bald eagle management areas*). Under the bald eagle recovery plan, the BLM activities that would disturb nesting bald eagle would be restricted during critical nesting periods (1 January – 31 August).

Figure 242. A histogram illustrating the abundance and development of bald eagle nesting and roosting habitat in bald eagle management areas



Under all alternatives, in the Salem, Eugene, Coos Bay, Roseburg and Medford districts, current or higher levels of eagle nesting and roosting habitat would be maintained. This would provide ample opportunities for the movement of existing bald eagle pairs and the addition of new sites. Under all alternatives, in the Klamath Falls Resource Area, nesting and roosting habitat would decline and the opportunities for additional nest sites on BLM-administered lands would diminish. BLM-administered lands account for 16% of all the federal lands within the Klamath Falls Resource Area. Although habitat would decline in the Klamath Falls Resource Area, the bald eagle population in the Klamath Basin is increasing (Anthony and Isaacs 2007). The Bald Eagle Protection Act would provide protection for sites on both federal and private lands. Monitoring indicates increasing population and productivity numbers (Anthony and Isaacs 2007) and under all alternatives available nesting and roosting habitat would be stable or would increase.

Measures could be implemented to mitigate the decrease in nesting and roosting habitat in the Klamath Falls Resource Area. These measures include maintaining all trees greater than forty inches in diameter at breast height in all stands within 4 miles of bald eagle foraging habitat.

Fisher

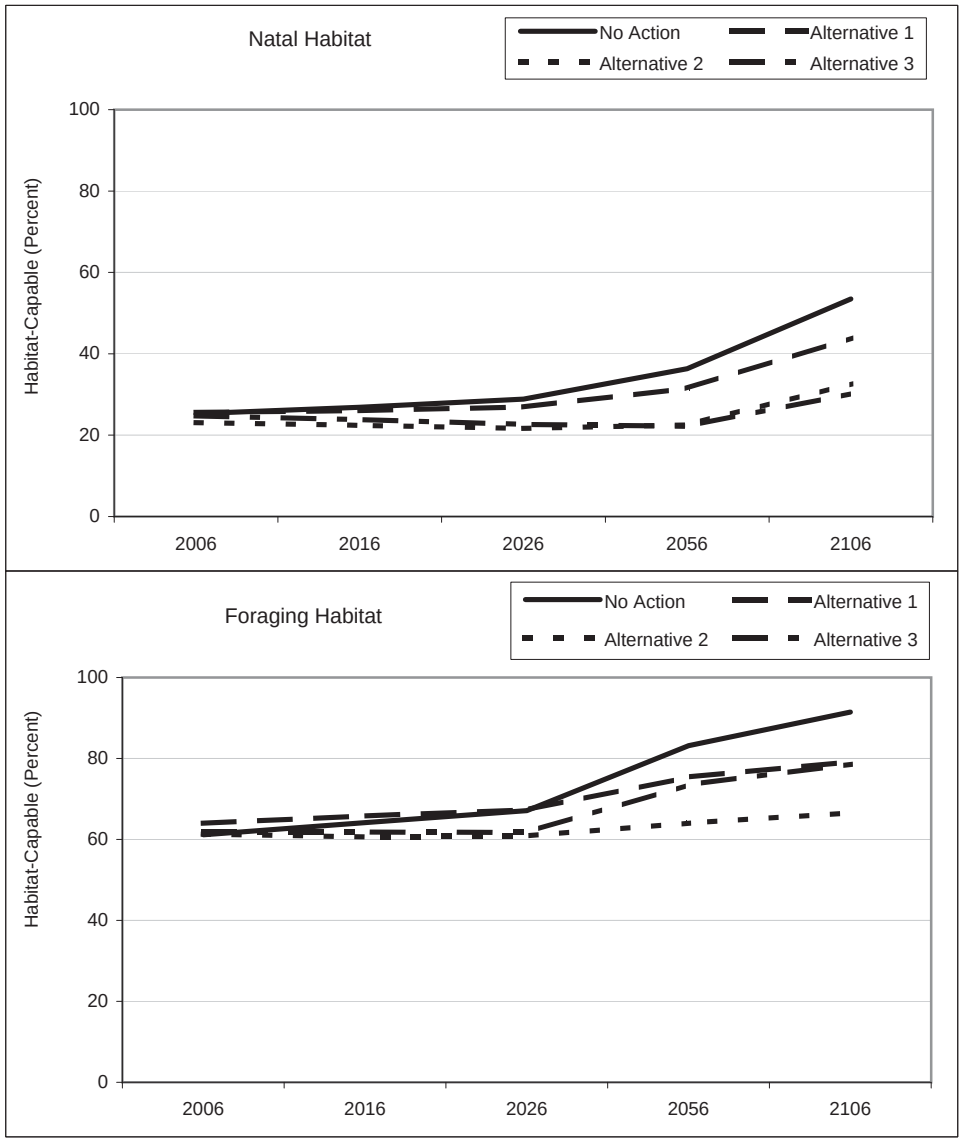
Fisher historically ranged throughout BLM-administered lands within the planning area. The only remaining recognized population centers are in the southern Cascade Mountains and the northern Siskiyou Mountains of the Medford District. The fisher selects habitat based on factors measured at the home-range scale or higher and are strongly associated with forest cover (Carroll et al. 1999). There are currently 560,000 acres of natal habitat on BLM-administered lands within the planning area (25% of breeding habitat-capable lands) and 1,354,000 acres (61%) of foraging habitat (includes overlap with natal habitat).

Table 200. Available fisher natal and foraging habitat on BLM-administered lands within the planning area

Alternative	Habitat-capable (ac)	Natal habitat (percent of habitat-capable)				
		2006	2016	2026	2056	2106
No Action	2,197,000	25	27	29	37	54
Alt 1	2,197,000	25	25	26	30	42
Alt 2	2,197,000	25	22	22	23	33
Alt 3	2,197,000	25	24	23	22	30
		Foraging Habitat (percent of habitat-capable)				
No Action	2,197,000	62	65	68	84	92
Alt 1	2,197,000	62	63	65	73	76
Alt 2	2,197,000	62	61	61	64	67
Alt 3	2,197,000	62	62	62	74	79

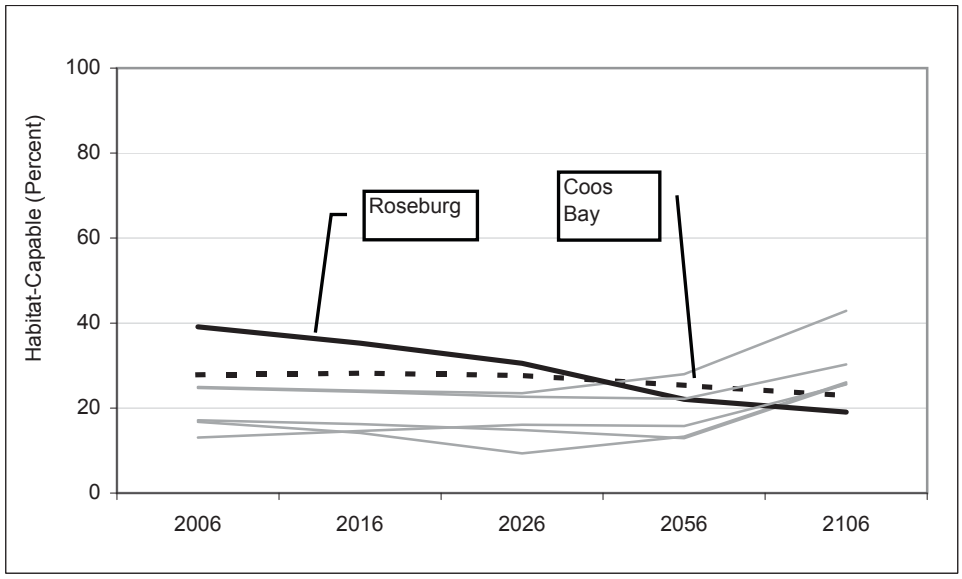
Across BLM-administered lands, within the planning area, fisher natal habitat would increase under all alternatives as shown in *Figure 243* (*Fisher natal and foraging habitat summarized for BLM-administered land within the planning area*) and *Table 200 (Available fisher natal and foraging habitat on BLM-administered lands within the planning area)*. The No Action Alternative would increase habitat to 53% of habitat-capable acres while Alternatives 1, 2, and 3 would increase habitat to 44, 33, and 30%, respectively.

Figure 243. Fisher natal and foraging habitat summarized for BLM-administered lands within the planning area



Natal habitat would decrease under Alternative 3 from 395 to 19% in the Roseburg District and from 285 to 23 % in the Coos Bay District as shown in *Figure 244* (*Abundance of fisher natal habitat under Alternative 3*). This is due to the increase in the areas of partial and regeneration harvesting in this alternative. Areas of regeneration or partial harvesting would only provide natal habitat for a short period under Alternative 3 at which point they would be scheduled for treatment again. In some areas stands would never again reach natal habitat conditions.

Figure 244. Abundance of fisher natal habitat under Alternative 3



Natal habitat in the Klamath Falls Resource Area would decline under all of the action alternatives initially, but would be slightly higher in 2106 than in 2006. These habitat trends would occur as a result of the small amount of habitat-capable areas that would be reserved from regeneration harvest. Continued and repeated entry into the stands would preclude fisher natal habitat from developing. Fisher populations are not known to occur in the Klamath Falls Resource Area, but this area is adjacent to the southern Cascade Mountain population center (Hayner, pers comm. 2007).

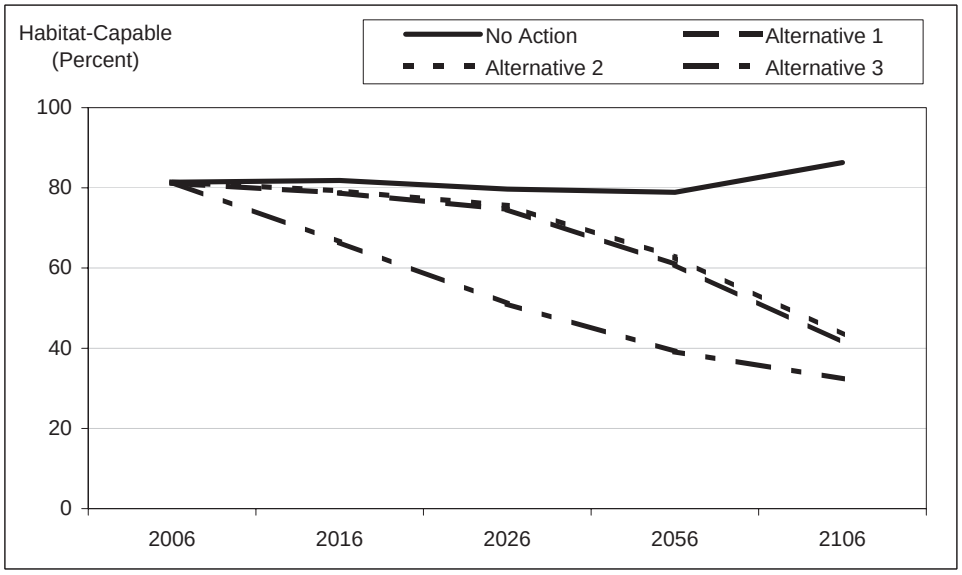
For this analysis, fisher are assumed to forage in all habitat types that are capable of providing high canopy cover and which have some legacy component. Foraging habitat estimates are likely underestimates because they do not include the stand establishment with legacy forest structural stage classification that would provide foraging habitat. This underestimate would be higher for the No Action Alternative and Alternative 3, where legacy retention would be required for all timber harvesting. Under all alternatives, fisher foraging habitat would increase on BLM-administered lands within the planning area. As shown in *Table 200,* by 2106, foraging habitat would increase by:

- 30% under the No Action Alternative,
- 15% under Alternative 1,
- 6% under Alternative 2, and
- 17% under Alternative 3.

All BLM districts would follow this trend with the exception of the Klamath Falls Resource Area. As shown in *Figure 245* (*Response of fisher foraging habitat in the Klamath Falls Resource Area*), by 2106, foraging habitat would decrease from 81% of habitat capable acres to:

- 41% under Alternative 1,
- 43% under Alternative 2, and
- 32% under Alternative 3

Figure 245. Response of fisher foraging habitat in the Klamath Falls Resource Area



In the Klamath Falls Resource Area, the two factors that would cause the decline in fisher foraging habitat include the large percentage of the resource area in the harvest land base (approximately 60% in the No Action Alternative and 70% under the action alternatives) and lower site productivity compared to the other districts. Lower site productivity causes an increase in the amount of time it takes for foraging habitat to recover after timber harvest.

The spatial configuration of natal habitat is as important as the amount. Lewis and Hayes (2004) concluded that landscapes comprised of large, contiguous patches of late-seral forests were more likely to support the fisher than a more fragmented landscapes. Large blocks of mature or structurally complex forest habitat would be expected to form within the late-successional reserves under the No Action Alternative and the late-successional management areas under Alternatives 1 and 2.

The patterns found in mature and structurally complex forest habitat are used as indicators of natal habitat development. Landscape comparisons were done between the current condition and the condition in 2106 (see the *Ecology* section of this Chapter). The analysis concludes that the principal controls on the condition of the entire forested landscape are the development of the U.S. Forest Service reserves into mature & structurally complex forest and the continued intensive management of the nonfederal forests. BLM-administered lands play a significant role at the provincial scale by linking the physiographic provinces and the U.S. Forest Service lands within them. Genetic research on the fisher population centers in the southern Cascade Mountains and the

northern Siskiyou Mountains indicate no genetic exchange has occurred (Aubry et al. 2004). The specific reasons for this lack of genetic exchange are unknown but could include poor habitat quality and anthropogenic barriers (Aubry et al. 2004).

Patch size, core area and connectance would vary on BLM-administered lands in the physiographic provinces as follows:

- Coast Range: Mean patch size and mean core area of mature and structurally complex forest would increase under the No Action Alternative and Alternative 1. Mean patch size would increase from 44 acres to 138 and 103 acres, under the No Action Alternative and Alternative 1, respectively. Connectance would increase over time in the No Action Alternative and Alternatives 1 and 2 but would decrease under Alternative 3.
- Western Cascades and Klamath: Mean patch size and mean core area of mature and structurally complex forests would increase under the No Action Alternative. Mean patch size would decrease under all action alternatives. Connectance would remain stable over time under the No Action Alternative and Alternative 1, while patch size would decrease under Alternatives 2 and 3.
- Eastern Cascades: Mean patch size of mature and structurally complex forests would decrease under all alternatives. Connectance would decline under all alternatives.

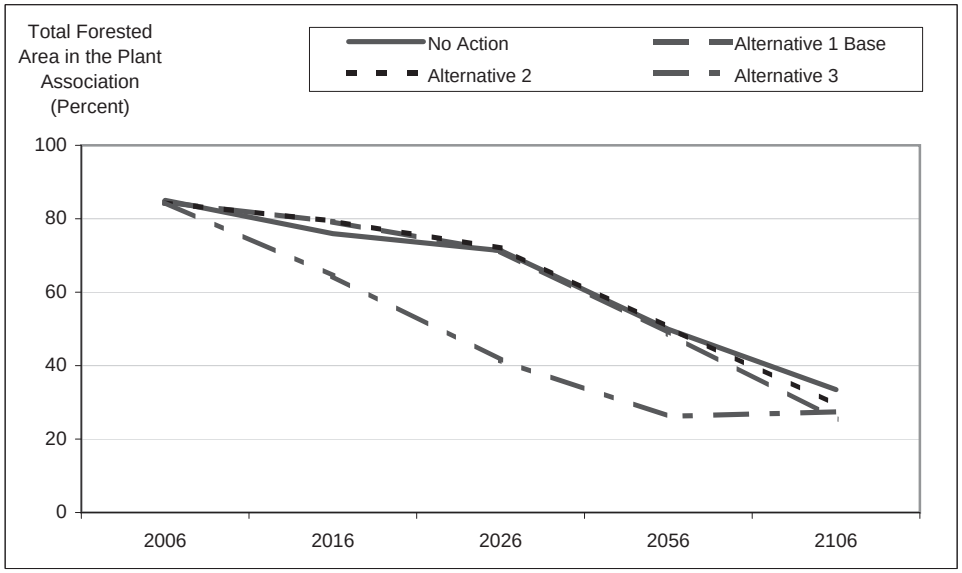
Assuming fisher respond positively to the increases in the amount, mean patch size, mean core patch size, and connectance of natal habitat, the number of fishers would increase under the No Action Alternative and Alternative 1 in the Coast Range province. Fisher populations would increase under the No Action Alternative in the Klamath and Western Cascades provinces. Decreasing patch size, mean core area size, and connectance would lead to decreasing populations of fishers under Alternatives 2 and 3. Habitat connectivity between the provinces is a limiting factor to fisher movements between the Klamath Province and the Western Cascades province. Connectance would remain relatively stable in the Klamath and Western Cascade provinces and the mean patch size of mature and structurally complex forest habitat would increase under the No Action Alternative.

Landbirds

Landbirds are associated with stand establishment, young, mature and structurally complex forest structural stage classifications. The amount of these structural stages that currently exist and would develop under the alternatives is described in the *Ecology* section of this chapter. Landscape objectives developed by the group Partners-in-Flight "…provide targets for designing management plans and benchmarks for measuring success of management actions" (Altman 1999). Although they are not BLM objectives, they are useful for comparing the effects of the alternatives.

Conservation objectives identified by Altman (2000a) for landbirds in the East Cascade Mountains identify the need for "no net loss" of structurally complex eastside conifer forests and the retention of large diameter trees (greater than 20 inches in diameter). Under all alternatives, in the Klamath Falls Resource Area, BLM-administered lands would not meet the objective of "no net loss" of habitat. As shown in *Figure 246* (*Klamath Falls Resource Area landbird habitat trends for eastside coniferous forests, expressed as a percentage of total forested area in the plant association*), mature or structurally complex forest habitat would decrease under all alternatives; from over 80% of the habitat-capable area to approximately 30%.

Figure 246. Klamath Falls Resource Area landbird habitat trends for eastside coniferous forests, expressed as a percentage of total forested area in the plant association



Assuming that bird abundance responds directly to habitat abundance, this loss of habitat would result in a corresponding decrease of approximately 50% of the birds associated with large trees, snags, and multi-layered dense canopy within eastside conifer forests on BLM-administered lands. *Table 201* (*Habitat features and focal bird species of conservation concern in the eastside conifer plant group in central, eastside Oregon and Klamath Basin*) shows habitat features and associated species (Altman 2000a). Private forest lands would not contribute to structurally complex forest habitat because it is assumed that private forest lands are generally managed on short rotations.

Table 201. Habitat features and focal bird species of conservation concern in the eastside conifer plant group in central, eastside Oregon and Klamath Basin

Habitat Feature/Conservation Focus	Focal species
Large trees	Brown creeper
Large snags	Williamson's sapsucker
Multi-layered dense canopy	Hermit thrush

Bird abundance is assumed to follow habitat abundance in a one to one relationship. That is, a 10% increase in habitat abundance results in a 10% increase in bird abundance. This

simplistic assumption allows a relative comparison of the alternatives. In reality, other factors such as immigration rates, home range size, food abundance, and nesting structure abundance would contribute to the ability of bird populations to respond to newly available habitat.

Uneven-aged management under Alternative 3 would result in multi-layered stands. Because it is assumed that all size classes would be harvested proportional to their occurrence in the stand, the harvested stands under this alternative would not meet the mature, multiple canopy, or structurally complex forest structural stage classifications. This would result in a decrease in those structural stages. In the Klamath Falls Resource Area, private forest lands would provide stand establishment and young forest habitat while on the U.S. Forest Service lands, it is assumed the amount of mature, multiple canopy, or structurally complex forest would increase in the late successional reserves.

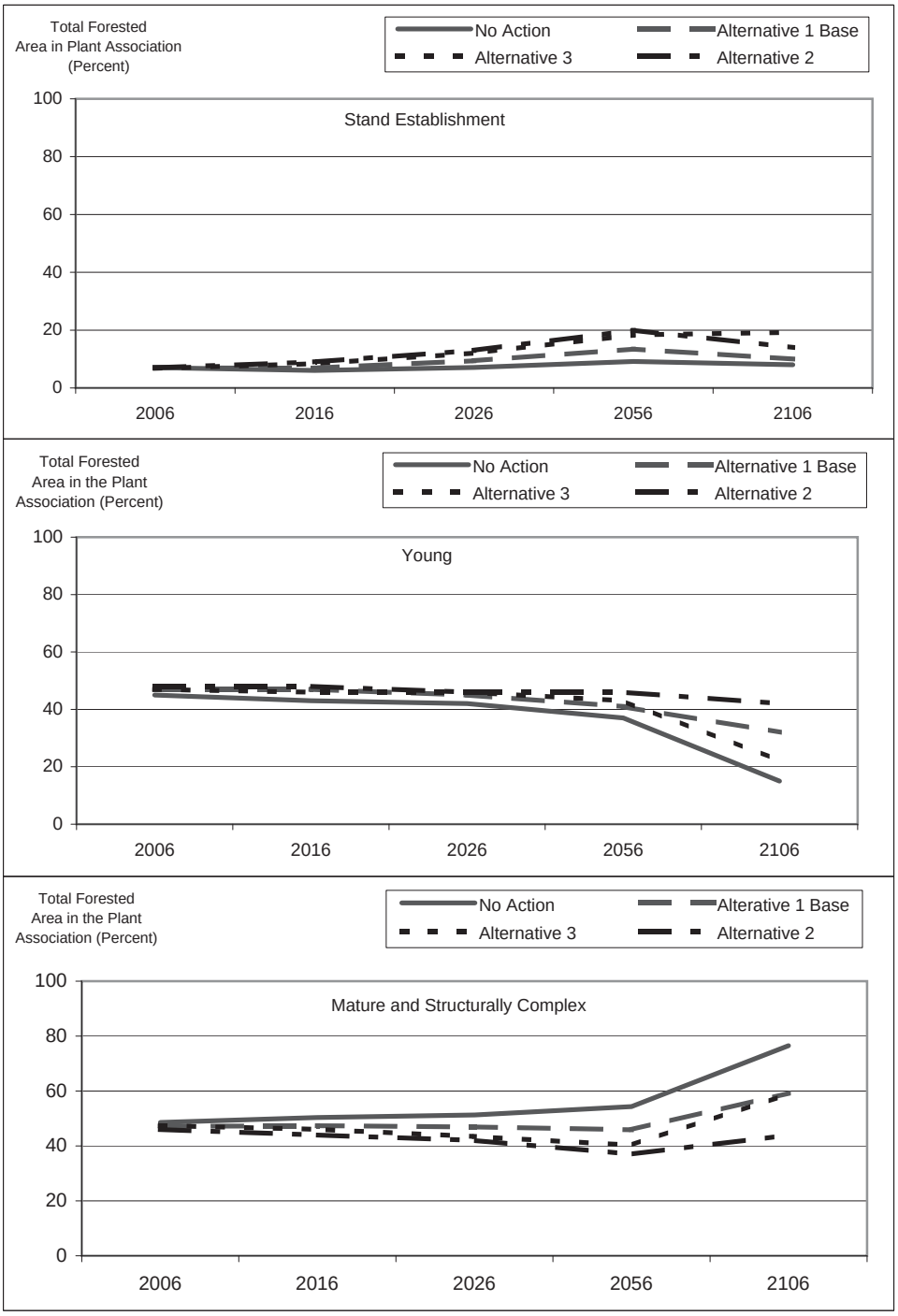
The Oregon-Washington Partner's in Flight published the following habitat objectives for coniferous forests west of the Cascade Mountains.

- Maintain existing old-growth forest where there is less than 15% of the landscape within a sub-province (physiographic province), and initiate actions to develop old-growth forest to provide greater than 15% old-growth forest in each sub-province.
- Maintain existing mature, multiple canopy forest where there is less than 15% of the landscape within a sub-province, initiate actions to develop mature, multiple canopy forest to provide greater than 15% forest in each physiographic province (Altman 1999).

A landscape that would provide for landbirds in western Oregon coniferous forests would contain roughly one third each of the stand establishment, young forest, and mature and structurally complex forest structural stage classifications within each physiographic province (Altman 1999).

Under all alternatives, the landbird conservation objectives for mature and structurally complex forests would be met on BLM-administered lands as shown in *Figure 247* (*Westside coniferous forest landbird habitat trends, expressed as a percentage of total forested acres in the plant association*).

Figure 247. Westside coniferous forest landbird habitat trends, expressed as a percentage of total forested area in the plant association



The *Ecology* section of this chapter analyzed the development of patch size over time for the mature and structurally complex forest structural stage classifications. Landbird habitat includes the mature, structurally complex forest structural stage classification, so the absolute patch sizes would be different, but relative relationships would be similar. An analysis of all ownerships in the planning area, however, reveals that all alternatives would decrease the abundance of stand establishment and young forests from current

levels (see Chapter 4, Ecology). Mature, multiple canopy and structurally complex forests would increase in abundance under the No Action Alternative and Alternatives 1 and 3 from the current condition of 47% to 77% under the No Action Alternative and to 59% under Alternatives 1 and 3. Alternative 2 would maintain a relatively stable amount of habitat. Landbird species reliant on mature, multiple canopy and structurally complex forests are shown in *Table 202* (*Habitat features and focal bird species of conservation concern in the western Oregon conifer forests*). Their abundance would be expected to increase, similarly, from 10-30 % (assuming bird abundance responds directly to habitat abundance) across BLM-administered lands in western Oregon.

Table 202. Habitat features and focal bird species of conservation concern in the western Oregon conifer forests

Habitat Feature	Focal Species
Structurally Complex	
Large snags	Vaux's swift
Large trees	Brown creeper
Conifer cones	Red crossbill
Mature Forest Multi-canopy	
Large snags	Pileated woodpecker
Large trees	Brown creeper
Conifer cones	Red crossbill
Closed canopy	Hermit warbler
Deciduous canopy trees	Pacific-slope flycatcher
Mid-story tree layers	Varied thrush
Open mid-story	Hammond's flycatcher
Deciduous understory	Wilson's warbler
Forest floor complexity	Winter wren
Young structural stage *(Young stand initiation and Pole stem exclusion[a])*	
Closed canopy	Hermit warbles
Deciduous canopy trees	Pacific-slope flycatcher
Open mid-story	Hammond's flycatcher
Deciduous canopy trees	Black-throated gray warbler
Deciduous understory	Wilson's warbler
Forest floor complexity	Winter wren
Deciduous subcanopy/understory	Hutton's vireo
Stand Establishment	
Residual canopy trees	Olive-sided flycatcher
Snags	Western bluebird
Deciduous vegetation	Orange-crowned warbler
Nectar-producing plants	Rufous hummingbird

[a]Altman's seral stages (Altman 1999) are in italics.

Over 100 years, young stands would decline on BLM-administered lands under all alternatives. The current level of 47% if west-side coniferous forests would decline to 15% under the No Action Alternative, and to 32, 42, and 22% under Alternatives 1, 2, and 3 respectively. Populations of bird species which rely exclusively on the young

forest structural stage classification would similarly decline in abundance on BLM-administered lands.

The abundance of the specific habitat components important to landbirds including snags, residual trees, deciduous shrubs, and nectar producing flowers would vary between the alternatives. The No Action Alternative and Alternative 3 would retain residual trees and snags in regeneration harvest units while Alternatives 1 and 2 would not retain residual trees or snags as shown in *Table 203* (*Comparison of snag and residual tree retention by alternative*). Under Alternatives 1 and 2, the stand establishment and young forest structural stage classifications created as a result of regeneration harvest would have little or no value for landbird species which require residual trees or snags.

Table 203. Comparison of snag and residual tree retention by alternative

Retention Component	No Action (# per acre)	Alternative 1 (# per acre)		Alternative 2 (# per acre)		Alternative 3 (# per acre)	
		LSMA	TMA	LSMA	TMA	GLMA (Regen)	GLMA (Partial)
Snags created or retained*	1.1	2-6	0 1	2-6	0 1	2-4	2-4
Residual trees	6-8 (north) 18-25 (south) 12-18 (connectivity)	0	0	0	0	6-9	20-30

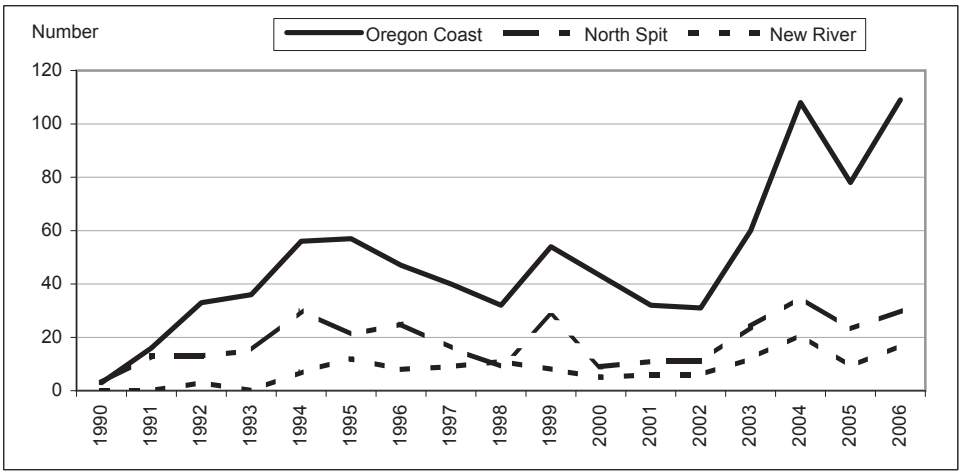
As analyzed in the *Ecology* section of this chapter, mature and structurally complex forests would be provided on BLM-administered lands along with U.S. Forest Service lands under all alternatives. Private forest lands are expected to contribute a stable amount of the stand establishment and young forest structural stage classifications. The No Action Alternative and Alternative 3 would create the best quality stand establishment and young forest habitat compared to Alternatives 1 and 2 because of the requirements to retain snags, and legacy trees. The stand establishment and young forests located on private forest land would generally contain low amounts of legacy components (old, large trees, and snags) and limited amounts of hardwood shrubs and other herbaceous material which are important to a diverse bird community.

Western Snowy Plover

Under all alternatives, existing plans for the western snowy plover habitat at North Spit and New River areas of critical environmental concern would continue to be implemented. These plans are designed to prevent disturbance to known western snowy plover nest sites, to restore natural dune process with a goal of providing additional nesting habitat, and provide predator control. Designated critical habitat for the western snowy plover is located within the North Spit and New River areas of critical environmental concern.

The Pacific coast distinct population segment of the western snowy plover has exhibited "significant" progress towards recovery as shown in *Figure 248* (*Total number of western snowy plover young fledged along the Oregon Coast from 1990-2006*) (Lauten et al. 2006). Since the management that has led to this recovery would continue, it is anticipated that population numbers and nesting success in the long term would remain stable or increase under all alternatives.

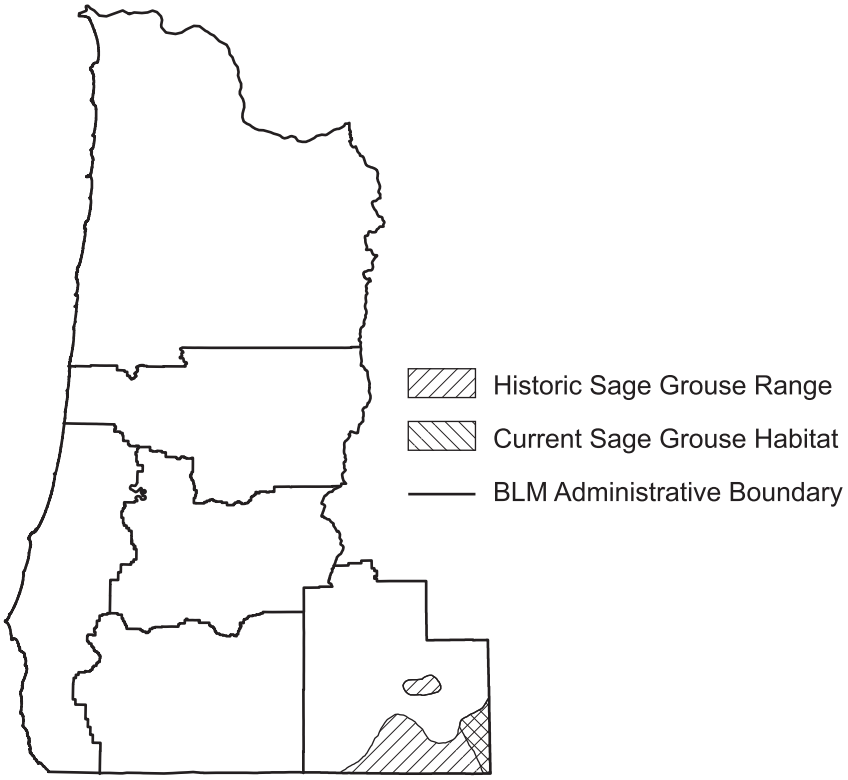
Figure 248. Total number of western snowy plover young fledged along the Oregon Coast from 1990-2006)



Sage Grouse

Sage grouse are not currently known to occupy any lands within the Klamath Falls resource Area or in the planning area. The last occupied lek, of the four historically known leks on BLM-administered lands, was in 1993 (Hagen 2005). The historic range for sage grouse encompasses 630,000 acres (all ownerships) in the Klamath Falls Resource Area as shown in *Figure 249* (*Historic range of sage grouse within the planning are of the western Oregon plan revision*).

Figure 249. Historic range of sage grouse within the planning area of the western Oregon plan revision



Approximately 47,000 acres of potential habitat (including all biological and behavioral needs; lekking, nesting, brood rearing, and wintering habitat) were identified on BLM-administered lands using data derived from the Ecological Site Inventory as shown in *Table 204* (*Sage grouse habitat on the Gerber block, Klamath Falls Resource Area*).

Table 204. Sage grouse habitat on the Gerber block, Klamath Falls Resource Area

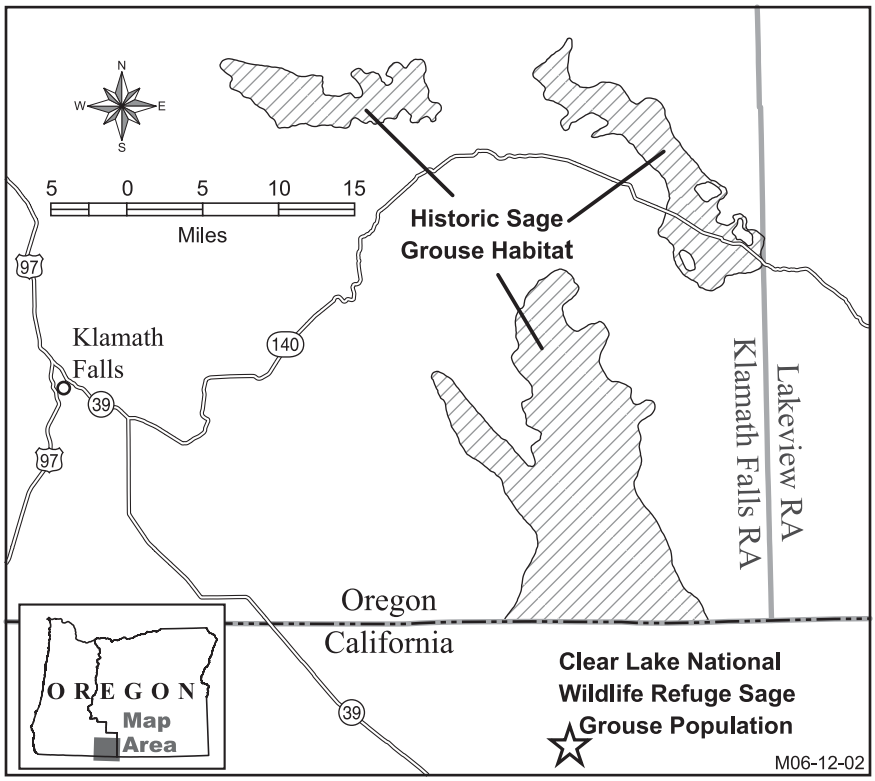
Unit	Total BLM Area (acre)	Habitat-Capable[b]		Habitat[a]		Non-habitat	
		(acre)	(%)	(acre)	(%)[c]	(acre)	(%)[c]
Gerber block	83,276	47,143	57	27,707	59	19,436	41

a Provides for all biological and behavioral needs – lekking, nesting, brood rearing, wintering.
b Vegetative communities the would likely develop into, or could be converted into sage grouse habitat.
c Percent of habitat-capable.

Ecological Site Inventory data does not contain sufficient information to differentiate between the individual habitat needs (lekking, nesting, brood rearing, and wintering). Therefore, they are lumped together and referred to as suitable sage grouse habitat. Potential habitat includes sage brush communities, meadows, ephemeral wetlands, and non-forested riparian habitats. Potential natural communities (within the natural range of plant species occurrences) and late seral habitats provide for the biological needs for the sage grouse.

Figure 250 (*Sage grouse habitat within the Klamath Falls Resource Area*) shows that suitable sage grouse habitat occurs on BLM-administered lands in two units, the Campbell and the Gerber blocks. The Campbell block contains less than 10% of BLM-administered lands and will not be analyzed further because of the dispersed nature of the BLM-administered lands. The Gerber block contains 83,176 acres and is the largest and most important block of potential sage grouse habitat on BLM-administered lands within the planning area. The Gerber block currently contains approximately 27,000 acres of sage grouse habitat.

Figure 250. Sage grouse habitat within the Klamath Falls Field Office



The treatment of the lands east of Highway 97 in the Klamath Falls Resource Area would not vary between the alternatives; therefore the following impacts would occur under all alternatives.

The Oregon conservation strategy for sage grouse was completed in 2005. The BLM was a partner in that process, along with the U.S. Forest Service and state agencies (Hagen et al. 2005). The conservation strategy for sagebrush habitat includes managing for at

least 70% of the sage grouse habitat-capable lands in habitat condition and 30% in a potential condition. Within the Gerber block this would equate to approximately 33,000 acres out of the 47,000 acres of habitat-capable lands. Currently there are 27,000 acres of sage grouse habitat (59% of habitat-capable) within the Gerber block. Current levels of juniper removal, grazing, and wildfire suppression activities would increase the amount of sage grouse habitat. These activities would continue under all alternatives.

Juniper encroachment prevents sage grouse non-habitat from developing into suitable habitat because it competes for moisture and light. Juniper encroachment is a major cause of the loss of sage grouse habitat in the Gerber block. Juniper woodlands occupy approximately 40,000 acres within the Gerber block. Juniper expansion has increased by a factor of 10 since the 1880s (Miller and Tausch 2001, as cited in Hagen 2005).

It is assumed that forest management activities in the next decade would occur at the same rate as in the past decade in the Klamath Falls Resource Area. This would result in removal of between 12,000 and 30,000 acres of juniper for fuels reduction and an additional 3,000 to 6,000 acres for biomass production and/or utilization for chips, sawlogs, firewood and other commercial uses over the next 10 years. Removal of juniper would remove competing vegetation and allow sage grouse habitat to re-establish.

The spread of invasive, non-native grasses also causes the loss of sage grouse habitat. Site disturbing activities can include the use of heavy equipment or burning which allows the spread of invasive, non-native grasses. These non-native grasses prevent the establishment of sagebrush and other native forage species for sage grouse. Similar to juniper, they limit the availability of food source and hiding cover for the sage grouse.

Measures that would mitigate the spread of invasive grasses to sage grouse habitat include eradicating isolated patches of invasive plants, prioritizing sage brush areas for invasive control and prevention, and maximizing site occupancy of desired vegetation (Hagen 2005).

Grazing allotments overlay the entire Gerber block. Rangeland surveys in the Gerber block have shown that range conditions have been on an upward trend towards late successional forest and potential natural community since the late 1930's. In 1938, surveys indicated that 68% of range was dominated by cheatgrass communities. A 2004 report states: "[n]ative perennial bunchgrasses, desirable shrub species, and native forbs have all increased in abundance [since 1938], leaving only 4.5% dominated by cheatgrass (and other non-native annual grasses) and in an early to mid-seral successional forest state (USDI unpublished)." Grazing under the No Action Alternative has been compatible with the maintenance and the creation of sage grouse habitat. Grazing levels and practices in the Gerber block would not change under the action alternatives, therefore grazing would not result in the loss of sage grouse habitat under any of the alternatives.

Sage grouse do not utilize forested areas; therefore any timber harvest of the eastside lands in the Klamath Falls Resource Area would have no impact on the sage grouse.

Wildfires have had very little impact on sage grouse habitat in the Klamath Falls Resource Area. In the last 15 years, wildfire has affected less than 1,000 total acres

(Hayner, pers. com. 2007). With continuing fuels reduction efforts and aggressive suppression under all alternatives, wildfire would continue to have little or no impact on sage grouse habitat.

Sage grouse do not occur within the planning area, therefore effects to sage grouse populations are difficult to predict. Disturbances, primarily noise, would limit suitable grouse habitat from becoming occupied. Conservation measures to reduce or restrict disturbances would be implemented if a site were to become occupied or if reintroduction were attempted. Off-highway vehicle use in the Gerber block would be restricted to designated roads and trails. This would result in a reduction of disturbance due to off-highway vehicle use. No new campground or other large-scale recreation developments would occur under any of the alternatives. There would be 18.2 miles of potential trail development for non-motorized users in the action alternatives. Avoiding historic lekking areas and seasonal trail closures would limit disturbance impacts to any new leks.

Currently, sage grouse show no resistance to West Nile virus and mortality is assumed to be 100% (Naugle et al. 2004). West Nile virus has not been documented in sage grouse in Oregon (Hagen 2005). None of the alternatives would affect the likelihood of West Nile virus from occurring.

Special Status Species

There are 117 special status animal species known or suspected to occur on BLM-administered lands within the planning area. For analytical purposes, they have been place into seven groups based on habitat needs. *Table 205* (*BLM special status animal species known or suspected to occur on BLM-administered lands in the planning area*) shows species by group. Species in groups 1 and 3 are analyzed elsewhere in this *Wildlife* section. Species in group 2 are found either inconsistently on BLM-administered lands or on highly specialized non-forested habitats such as noncommercial forests, oak woodlands, shrublands, grasslands, cliffs, rock outcrops, talus slopes, meadows, wetlands, spring, fens, ponds, and vernal pools where harvest would not occur. These species are assumed to not be affected by the alternatives and are not further analyzed here. Species in groups 4 and 5 are analyzed below.

Table 205. BLM special status animal species known or suspected to occur on BLM-administered lands within the planning area

Group	Habitat	Species	Discussion
Species Group 1.	Various	BALD EAGLE	Analyzed Individually elsewhere in Wildlife Section
		WESTERN SNOWY PLOVER	
		SAGE GROUSE	
		NORTHERN SPOTTED OWL	
		MARBLED MURRELET	
		FISHER	
		COLUMBIANN WHITE-TAILED DEER	

Group	Habitat	Species	Discussion
Species Group 2.	Includes species associated with special habitats or features (non O&C Timber lands). Assume protection of known sites for all alternatives. Also includes accidental or occasional migrants where impacts are unlikely.	RHINOCEROS AUKLET	Not affected. According to Birds of Oregon, marine island associate
		CASSIN'S AUKLET	Not affected. According to Birds of Oregon, marine island associate
		TUFTED PUFFIN	Not affected. According to Birds of Oregon, marine island with deep soils and coastal headland nester
		UPLAND SANDPIPER	Not affected- According to Birds of Oregon, only 4 records from western OR, 3 within boundaries of Coos Bay BLM, question if on BLM-administered land? Accidental occurrence on BLM.
		FORK-TAILED STORM PETREL	Not affected- marine species breeds on off-shore islands. Only inland record was dead bird used as prey item, probably of great-horned owl according to Birds of Oregon.
		ALEUTIAN CANADA GOOSE	Non breeding migrant, delisted ESA SSS on BLM-administered land. Has its own plan on New River ACEC which is non forested Public Domain area. Assume effect of all action alt the same.
		DUSKY CANADA GOOSE	Non breeding, unlikely migrant on BLM-administered land, Not Affected
		CALIFORNIA BROWN PELICAN	Not affected, according to Birds of Oregon a coastal marine species that rarely occurs inland.
		AMERICAN WHITE PELICAN.	Use on the BLM is non breeder. Open and wetland associate. Not affected.
		RED-NECKED GREBE	According to Birds of Oregon, the only consistent breeding population in OR is found at Upper Klamath Lake NWR. Winters mainly along the coast. Unlikely migrant on BLM-administered land, Not Affected.
		TRUMPETER SWAN	According to Birds of Oregon, non-breeding west of the Cascades, unlikely migrant on BLM-administered land, Not Affected.
		FERRUGINOUS HAWK	Klamath Basin, open arid plain associate. Occasional winter visitor west of the Cascades.
		COMMON NIGHTHAWK (Willamette Valley Population)	Non-forest species, unlikely to be affected, no BLM-administered land.
		TULE GOOSE	Not Affected. Uses open water and ag wetlands. Accidental on the BLM.
		MERLIN	Insufficient data; no way to analyze. Occasional - non breeder?

Group	Habitat	Species	Discussion
		WHITE-TAILED KITE	Ag land, wet meadows, prairie and open land associate. Not affected by forest activities.
		YELLOW RAIL	Upper Klamath Basin Plan, PD wetland
		AMERICAN PEREGRINE FALCON	Nests on cliff features, possible effects to prey species (landbirds). Covered with landbird analysis.
		INSULAR BLUE (BUTTERFLY)	Coastal Grasslands, clover is the host plant. No known sites on BLM-administered lands. Potential habitat on the BLM.
		HOARY ELFIN (BUTTERFLY)	No known populations on the BLM or FS lands. Kinnikinnik associate on coastal bluffs. Potential habitat on the BLM.
		OREGON SILVERSPOT BUTTERFLY	Coastal species associated with salt-spray meadows.
		FENDER'S BLUE BUTTERFLY	Westside prairie species associated with - Lupine suphereus var. kincaidii, use the lupine analysis
		NEWCOMB'S LITTORINE SNAIL	Intertidal species; was documented on N Spit; most likely does occur on the BLM as pickerel weed (their closely associated plant) occurs on both the BLM and state land on the bay side of the Spit. Primary impact = OHV use.
		VERNAL POOL FAIRY SHRIMP	Vernal Pools. Has own plan for Table Rock which is non forested PD area. May be stand alone plan from WOPR. Assume effect of all action alt may be the same. Potential recreational effects.
		LARCH MOUNTAIN SALAMANDER	New data showing it restricted to Columbia Gorge and talus-skree habitat. The BLM does not have this habitat. Based on extensive surveys on Mt Hood NF. WA habitat data not seem to apply to OR.
		AMERICAN GRASS BUG	Associated with Deschampsia cespitosa in wet native grasslands in Benton and Yamhill counties.
		SISKIYOU SHORT-HORNED GRASSHOPPER	Grassland/herbaceous habitats associated with elderberry plants. Assumes forest mgmt will encourage more habitat or not negatively impact if elderberry is maintained and enhanced. If herbicides are applied, it will be a negative effect.
		WHULGE (Taylor's) CHECKERSPOT (BUTTERFLY)	No known sites on BLM or FS lands. Westside prairie species, with strawberry appearing to be a principal adult nectar source in OR.

Group	Habitat	Species	Discussion
		MARDON SKIPPER (BUTTERFLY)	Westside grass/shrub - open; grazing and burning effects. Associated with fescue. Only known sites are on Medford.
		DIMINUTIVE PEBBLESNAIL	Springs with perennial flows. Actions that effect groundwater flow to spring is a concern.
		FALL CREEK PEBBLESNAIL	Springs with perennial flows. Actions that effect groundwater flow to spring is a concern.
		KEENE CREEK PEBBLESNAIL	Springs with perennial flows
		KLAMATH PEBBLESNAIL	Springs with perennial flows
		NERITE PEBBLESNAIL	Springs with perennial flows
		CRATER LAKE TIGHTCOIL - (SNAIL)	Springs, wetlands
		MONTANE PEA CLAM	Springs, wetlands. On Coos Bay District, this species most likely does occur on the BLM as pickerel weed (their closely associated plant) occurs on both the BLM and state land on the bay side of the Spit. Primary impact = OHV use.
		EVENING FIELDSLUG	Springs, wetlands
		CROWNED TIGHTCOIL-(SNAIL)	Springs, wetlands
		ROBUST WALKER	Springs, seeps, wetlands
		PACIFIC WALKER	Springs, seeps, wetlands
		TOOTHED PEBBLESNAIL	Springs with perennial flows
		PISTOL RIVER POCKET GOPHER	Coastal meadow, agriculture/pasture/ mixed environs associate. Any alternatives' effects to coastal meadows could have negative effect. Very little known. Very limited range - no known BLM sites. This species only collected from mouth of Pistol River.
		GOLD BEACH POCKET GOPHER	Coastal meadow associate. Any alternative effects to this habitat could have negative effect. Very little known. Very limited range - no known BLM sites. Taxonomy questionable. May not have enough data to analyze.
		TOWNSEND'S BIG-EARED BAT	Caves, mines, tunnels, bridges, old buildings
		SPOTTED BAT	Cliffs
		FRINGED MYOTIS	Caves, mines, tunnels, bridges
		PALLID BAT (Pacific Pallid and Pallid considered the same)	Caves, mines, tunnels, bridges, old buildings

Group	Habitat	Species	Discussion
Species Group 3.	Various	PURPLE MARTIN	Analysis covered in Landbird section
		YELLOW BREASTED CHAT	
		WHITE-HEADED WOODPECKER	
		THREE-TOED WOODPECKER	
		BLACK-BACKED WOODPECKER	
		GRASSHOPPER SPARROW	
		TRICOLORED BLACKBIRD	
		BURROWING OWL	
		FLAMMULATED OWL	
		LEWIS WOODPECKER	
		OREGON VESPER SPARROW	
		WESTERN MEADOWLARK	
		STREAKED HORNED LARK	
	Snag Dependent	FRINGED MYOTIS	See landbird discussion for stand establishment species
		PALLID BAT (Pacific Pallid and Pallid considered the same)	
	Mature and structurally complex structural stage associate	RED TREE VOLE	Assume similar effects as those for the northern spotted owl.
		NORTHERN GOSHAWK	
		JOHNSON'S HAIRSTREAK (BUTTERFLY)	
		SURVEY AND MANAGE SPECIES	Included under the No Action Alternative only. Assume similar effects as those for the northern spotted owl.
Species Group 4.	Aquatic/Riparian Associates	HADDOCK'S RHYACOPHILAN CADDIS FLY	Stream Order 1 & 2
		COPE'S GIANT SALAMANDER	Stream Order 1 & 2- any healthy salmon stream is healthy for this species
		SCOTT'S APATANIAN CADDIS FLY	Stream Order 1 & 2
		CASCADE TORRENT SALAMANDER	Stream Order 1 & 2
		COLUMBIA TORRENT SALAMANDER	Stream Order 1 & 2
		WILLAMETTE FLOATER - (MUSSEL)	Stream Order 3 & 4
		HARLEQUIN DUCK	Stream Order 3 & 4
		FOOTHILL YELLOW-LEGGED FROG	Slow moving water with rocky substrate
		OREGON SPOTTED FROG	Slow moving water

Group	Habitat	Species	Discussion
		SCALE LANX - (SNAIL)	Fast water, on the BLM in Klamath River Canyon (WSR, ACEC)
		ROTUND LANX - (SNAIL)	Fast Water, main stream of Umpqua -limited in range
		NORTHWESTERN POND TURTLE	Slow water / wetlands
		PAINTED TURTLE	Slow water / wetlands
Species Group 5.	Forest Floor Associates	PUGET OREGONIAN	Range is Salem, Eugene, and Roseburg districts
		TILLAMOOK WESTERNSLUG	
		SALAMANDER SLUG	
		SPOTTED TAIL-DROPPER	
		BALD HESPERIAN	
		OAK SPRINGS HESPERIAN	
		OREGON GIANT EARTHWORM	
		ROTH'S BLIND GROUND BEETLE	
		OREGON SLENDER SALAMANDER	
		TRAVELING SIDEBAND - (SNAIL)	Range is Southern Oregon Cascades Province including South River Resource Area - east, Glendale, Butte Falls, Ashland, and Klamath Falls Resource Areas
		KLAMATH TAILDROPPER	
		MODOC SIDEBAND (SNAIL)	
		SISKIYOU HESPERIAN	
		CHASE SIDEBAND (SNAIL)	
		CALIFORNIA SLENDER SALAMANDER	
		OREGON SHOULDERBAND (SNAIL)	
		BLACK SALAMANDER	
		SISKIYOU MTNS SALAMANDER	
		SISTERS HESPERIAN	Range is Coos Bay and Roseburg Districts
		GREEN SIDEBAND - (SNAIL)	

Under all alternatives, the 12 federal candidate and listed species identified in *Table 206* (*Federally listed candidate, threatened, and endangered species not associated with forested ecosystems*) would be managed to provide for the conservation of the species. Individual and programmatic actions would be consistent with the conservation needs of the species.

Table 206. Federally listed candidate, threatened, and endangered species not associated with forested ecosystems

Status[a]	Scientific Name	Common Name	Habitat Conditions
FC	Eremophila alpestris strigata	Streaked Horned Lark	Found in the Willamette Valley. Nesting habitat included native prairies and a wide range of agricultural fields (Marshall et al. 2003)
FC	Euphydryas editha taylori	Whulge Checkerspot (Butterfly)	Low-elevation upland prairies; host plant is narrow-leaved plantain (Plantago lanceolata) (ODFW 2006)
FC	Polites mardon	Mardon Skipper (Butterfly)	Meadow habitats; host plants are native fescues (ODFW 2006).
FC	Rana pretiosa	Oregon Spotted Frog	Permanent ponds, marhses and meandering streams through meadows; bottom of dead and decaying vegetation. Springs and other slow moving water (ODFW 2006)
FT	Branchinecta lynchi	Vernal Pool Fairy Shrimp	Ephemeral pools, small, cooler (ODFW 2006). Found on the BLM in Medford District;
	Critical Habitat		432 acres in the Medford District
FT	Eumetopias jubatus	Steller Sea Lion	Marine habitats include coastal waters near shore and over the continental slope; sometimes rivers are ascended in pursuit of prey. The most commonly used terrestrial habitat types are beaches used as rookeries and haulouts (NatureServe 2006)
FT	Speyeria zerene hippolyta	Oregon Silverspot Butterfly	Salt spray meadows; host plants early blue and western blue violets (Viola spp.) (ODFW 2006
	Critical Habitat		Critical habitat not designated for BLM-administered lands.
FE	Balaenoptera musculus	Blue Whale	Mainly pelagic; generally prefers cold waters and open seas (NatureServe 2006).
FE	Eschrichtius robustus	Gray Whale	Mostly in coastal and shallow shelf waters. Young are born in lagoons and bays (NatureServe 2006).
FE	Icaricia icarioides fenderi	Fender's Blue Butterfly	Seasonally wet native prairies; host plant is Kincaid's lupine (Lupinus sulphureus kincaidii) (ODFW 2006).
	Critical Habitat		Eugene District
FE	Megaptera novaeangliae	Humpback Whale	Pelagic and coastal waters, sometimes frequenting inshore areas such as bays (NatureServe 2006).
FE	Pelecanus occidentalis californicus	California Brown Pelican	A coastal marine species rarely found inland. Roost on sandy shores and offshore rocks; nests on islands and offshore rocks (Marshall et al. 2003)

[a] **Status Codes:** **FC** - Federal candidate for listing, **FT** - Federally listed as threatened, **FE** - Federally listed as endangered.

On all BLM-administered lands under the No Action Alternative, and on public domain lands and on the non-harvest land base on O&C lands under the action alternatives, special status species would be managed to avoid contributing to the need to list as threatened or endangered under the Endangered Species Act. This management would be consistent with existing conservation strategies. Public domain lands account for 16% of the BLM-administered lands in the planning area. The majority of these lands are in the Klamath Falls Resource Area. Public domain lands account for 10% of BLM-administered lands in the Salem, Eugene, Coos Bay, Roseburg and Medford districts (See the *Introduction* section of Chapter 3).

Species in group 4 are aquatic or riparian species that are highly dependent on water quality and aquatic and terrestrial species. The discussion of the environmental consequences of the alternatives to fisheries and water quality (See the *Fish* and *Water* sections of this chapter) are important in understanding the effects to these species.

Analysis of effects to fisheries and water quality that effect anadromous fish species and drinking water supplies, water temperature, and sedimentation are pertinent to species in group 4. Riparian management areas would constitute approximately 37% of BLM-administered lands under the No Action Alternative, 20% under Alternative 1, 13% under Alternative 2, and 11% under Alternative 3 as shown in *Table 207* (*Riparian management areas across all land use allocations under the alternatives*).

Table 207. Riparian management areas across all land use allocations under the alternatives

Alternative	Riparian Management Area (% Total BLM-administered Lands)
No Action	37
Alternative 1	20
Alternative 2	13
Alternative 3	11

Riparian reserves under the No Action Alternative and riparian management areas under the action alternatives are designated along streams. While the areas in riparian reserves or riparian management areas beyond the width of one site-potential tree (generally greater than 150 feet in western Oregon) on either side of the stream would add little to maintenance of lotic and riparian species assemblages (Cockle and Richardson 2003, McComb et al 1993, Vessely and McComb 2002, Haggerty et al. 2004, Gomez and Anthony 1996) studies found differences for at least some species out to 150-300 feet. Vesely and McComb (2002) found buffer strips 66 feet wide contained approximately 80% of detectable torrent, Pacific giant and Dunn's salamanders. Additional width, out to 90-100 feet would assist in stabilizing diurnal variations in temperature and relative humidity. Riparian and stream associated species abundance would be maintained under the No Action Alternative and Alternative 1 along intermittent streams because riparian management areas 100 feet wide would be sufficient to maintain the environmental conditions, moisture and temperature, necessary to support the riparian associates.

Under Alternatives 2 and 3, riparian management areas would extend to 100 feet on either side of perennial and fish bearing streams. Additionally, under Alternative 2,

intermittent streams at high risk of debris flows would have a 100 feet stream buffer. These riparian management areas would be managed to maintain stream temperature, organic matter inputs, and large wood. Stands would be managed to maintain or develop mature or structurally complex forest structural stage classifications. Habitat for species associated with the stream channel and the area immediately adjacent to the streams would be maintained. Species not as strongly associated with the stream would decline in abundance, because the canopy openings that would occur in the area between 25 and 100 feet from the stream and the regeneration of habitat beyond 100 feet from the stream channel would create habitat unfavorable to those species. Thinnings have been shown to increase the amount of solar radiation reaching the forest floor, increasing both air and soil temperature and decreasing relative humidity (Anderson et al. in press). Stream salamanders are thinned skinned and especially vulnerable to desiccation.

Riparian management areas under Alternative 2 would allow harvest within 25 feet of intermittent streams, except for debris-flow prone areas which would allow no harvest within 25 feet and in addition would develop into mature or structurally complex forests between 25 out to 100 feet on either side of the stream channel. The non-commercial vegetation which would be retained within 25 feet of intermittent streams (except debris-flow prone) would not maintain the thermal regime of the streamside ecosystem.

The retention of trees in the 25 feet riparian management area under Alternative 3 would have similar effects to Alternative 2. This is because, the canopy provided by trees within 25 feet of the stream channel would be sparse and the forest edges created between riparian management areas and upland regeneration harvest would increase diurnal and seasonal temperature fluctuation and decrease the relative humidity and the microclimate within the riparian management area (Vesely and McComb 2002, Anderson et al. in press). Plethodontid salamanders found in and adjacent to streams are especially susceptible to desiccation in dry environments.

Bury (2005) concluded that "…the retention of shade from riparian zones and adjacent forests may be critical to the survival and dispersal of even those stream amphibians with high fidelity to the stream channel." The effects of clearcut harvesting are seen in stream amphibian populations last from 25 to over 50 years post harvest (Karraker and Welsh 2006, Bury and Pearl 1999, Ashton et al. 2006).

Approximately 4,000 acres of harvest would occur over the next 10 years along non-debris flow prone, non-fish bearing intermittent streams under Alternative 2 (approximately 1% of the total area within 100 feet of all intermittent streams) on BLM-administered lands within the planning area. A similar amount of harvest would occur within riparian management areas under Alternative 3. At a local scale, riparian management areas under Alternatives 2 and 3 adjacent to these intermittent streams would not maintain a stable assemblage of stream and riparian associated species. With 4,000 acres of harvest per decade adjacent to intermittent streams, at the 5th field watershed or larger scale, impacts to species assemblages and their connectivity are not anticipated under Alternatives 2 and 3.

Species in group 5 are comprised of amphibians and mollusk species associated with mature or structurally complex forests, upland, forest floor communities. These species respond to changes to canopy cover, down wood, and soil moisture. Regeneration harvests

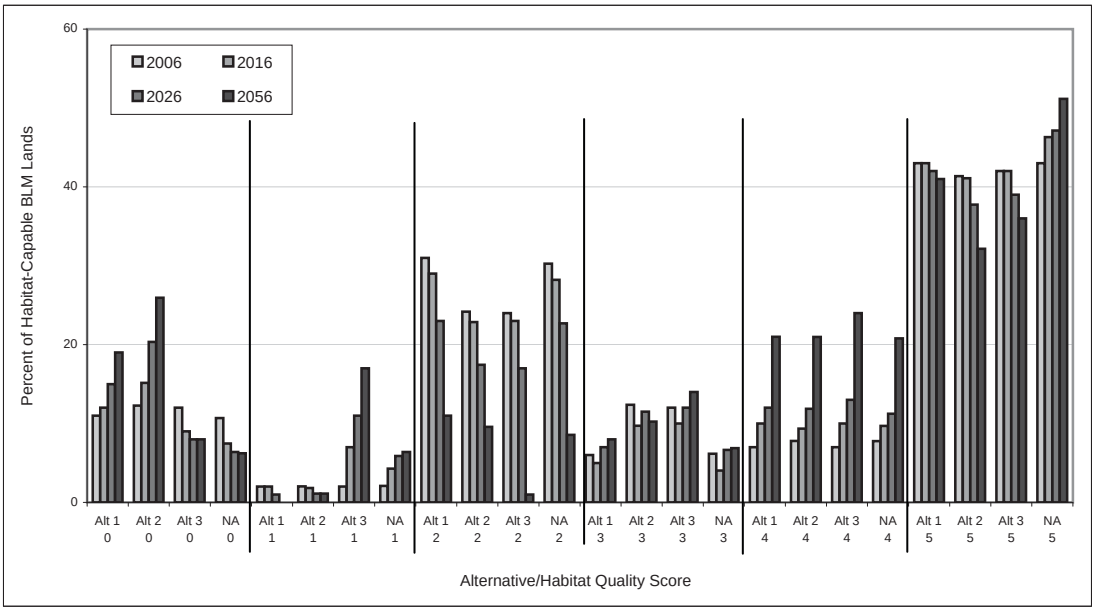
and the associated impact to adjacent forests would result in the loss of habitat. This is due to the breakage and movement of existing forest structure during harvest and the decreases in soil and down wood moisture levels due to increased light and wind penetration into adjacent stands. Twenty random watersheds were modeled to evaluate the effects of regeneration harvests and legacy requirements on forest floor species. Structural stages from nonforest and stand establishment to structurally complex stands were scored based on habitat value as shown in *Table 208* (*Forest floor habitat quality ratings*). Structural stage scores were decreased if there was a lack of legacy, if canopy cover was low, and if location occurred within 50 feet of a stand in the stand establishment structural stage. Habitat values for young stands (without legacy) were increased one point when they reached 50 years of age to account for the natural development of legacy. The habitat quality scores have no proportional relationship to each other. A stand with a score of 4 would not provide twice as much habitat benefit as a score of 2.

Table 208. Forest floor habitat quality rating criteria

Structural stage condition	Habitat quality score	Structural stage condition	Habitat quality score
Road and Non-Forest	0	Young high density with legacy	3
Stand establishment with legacy	1	Young high density without legacy	2
Stand establishment without legacy	0	Young high density without legacy, >50 years old	3
Young low density with legacy	2	Mature single canopy	4
Young low density without legacy	1	Mature multiple canopy	5
Young low density without legacy, > 50 years old	2	Structurally complex	5

As shown in *Figure 251* (*Forest floor habitat quality summary for each alternative*), under all alternatives at least 50% of the forested habitat would receive a habitat quality score of 4 or 5 by 2056. Differences between the alternatives in the amount of habitat within habitat quality categories 0 to 3 would occur as a result of legacy retention and the amount of harvesting activities. Since Alternatives 1 and 2 do not have legacy retention requirements, they would have more habitat with a 0 to 3 score compared to the No Action Alternative and Alternative 1. Habitat quality 2, under Alternative 3, would be comprised mainly of young, low density forest stands with legacy; this category would drop to 1% of the BLM-administered lands in 2056. This is due primarily to the fact that harvested stands under Alternative 3 would move more quickly from the stand establishment (with legacy) structural stage directly to the mature, or structurally complex structural stages. Legacy structures (downed wood and snags) are key habitat features in enabling forest floor species to maintain a presence in a stand when regeneration harvests occur.

Figure 251. Forest floor habitat quality summary for each alternative



Under all alternatives, trends in each physiographic province would resemble those displayed in Figure 251. The model assumes that forest floor associates persist through harvest activities or recolonize from adjacent habitats, either riparian management areas or upland areas. Based on the results of this modeling, at least 50% of the forest floor habitat would persist in habitat quality category 4 or 5, and therefore, forest floor associates would persist on BLM-administered lands under all alternatives.

Under the action alternatives, 60,000 to 143,000 acres (2.6 – 6.5% of forest capable lands) would be harvested over the next 10 years as shown in *Table 209* (*Harvest levels as percent of forest capable acres under each alternative*). Given the low percentage of harvest over the next 10 years, only species with fewer than 20 known sites and highly endemic to one or several locations would be at risk of declines in abundance and distribution severe enough that extinction might become a concern. In this case, protection measures would be applied to maintain populations of the species (see *Chapter 2, Management Common to All Action Alternatives, Wildlife*).

Table 209. Harvest levels as percent of forest capable acres under each alternative

Alternative	Harvest* (acres)	Forest capable (%)
No Action	62,000	2.6
Alternative 1	91,000	3.8
Alternative 2	143,000	6.5
Alternative 3	133,000	6.1

[1]*Note: Total of regeneration and selection harvest activities.

Fish

This analysis examines how the alternatives would affect fish habitat by the delivery of large wood and fine sediments to streams and by the alterations to peak water flows and stream temperature.

Key Points

- Large wood contributions would be the same in all four alternatives and would nearly reach the maximum potential in two of the five representative watersheds. In the other three representative watersheds, large wood contributions would be nearly the same under the No Action Alternative, Alternative 1, and the no harvesting reference analysis, but lower under Alternatives 2 and 3.
- The No Action Alternative would have nearly twice the acres in the riparian management areas as Alternative 1, and three times the acreage of Alternatives 2 and 3.
- Increases in large wood contribution would cause similar increases in the potential fish productivity under all four alternatives in two of the five representative watersheds. In the other three representative watersheds, fish productivity would be nearly the same under the No Action Alternative, Alternative 1, and the no harvesting reference analysis, and in few cases slightly lower under Alternatives 2 and 3.
- The effect of the alternatives on fish productivity would be highly dependant on the amount of high intrinsic potential stream channels that are within any one watershed.
- Increases in fine sediment delivery under all four alternatives would be less than 1% of the baseline sediment rates, and therefore would not degrade fish habitat under any of the alternatives.
- None of the alternatives would result in increases in peak flows in fifth-field watersheds to a level that would affect fish habitat.
- None of the alternatives would result in increases in stream temperature that would affect fish habitat or populations, except under Alternatives 2 and 3, where there would be some localized increases in stream temperatures in the Coquille management area.

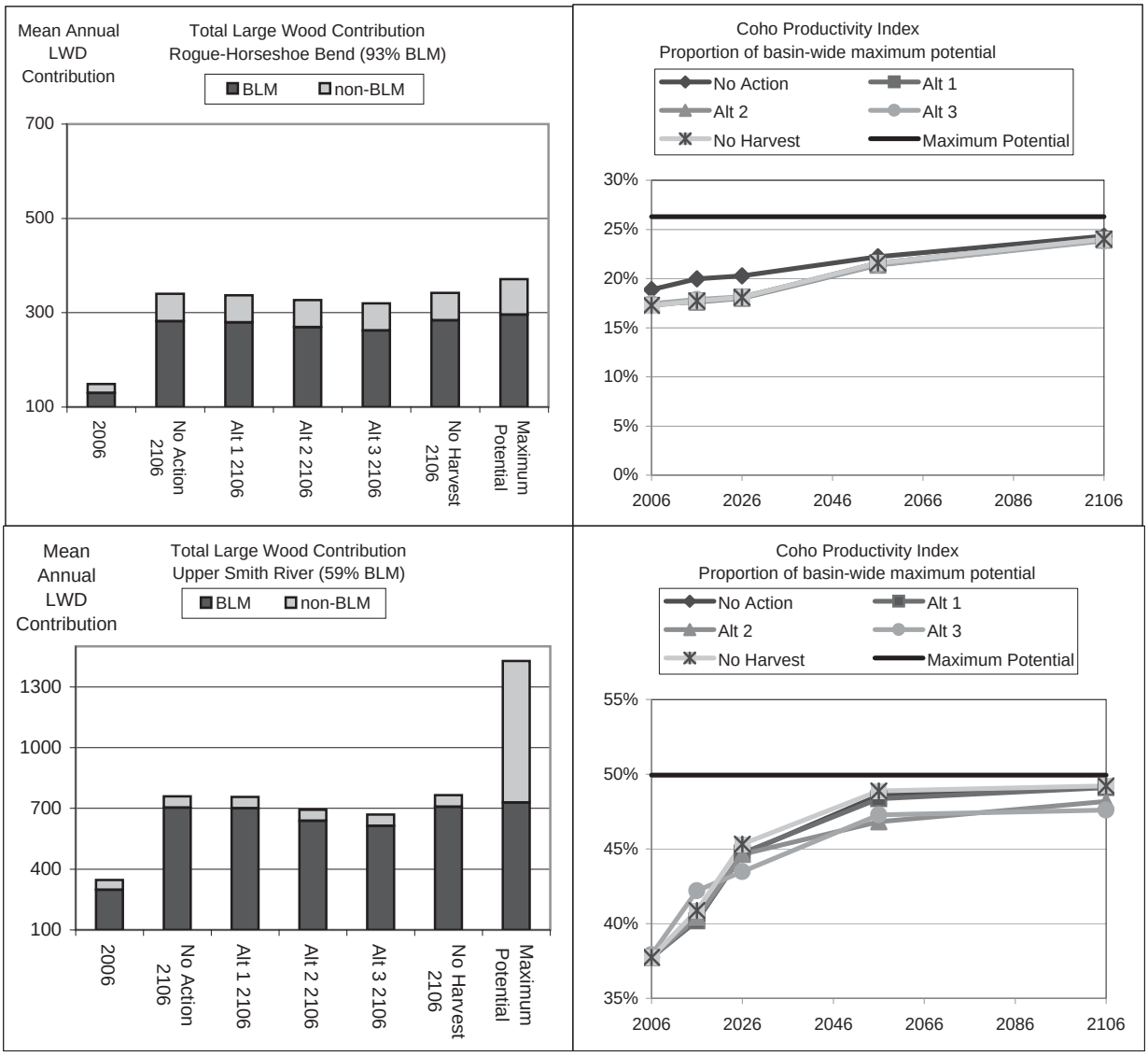
A variety of anadromous and resident fish species occur throughout the planning area (see the *Fish* section in *Chapter 3*). The requirements for habitat and the responses to habitat changes vary by species and vary among age groups within species. However, the fish species that would be affected by the BLM's management are similar enough to permit an analysis of how any changes to large wood, sediment, flow, or temperature would affect fish habitat.

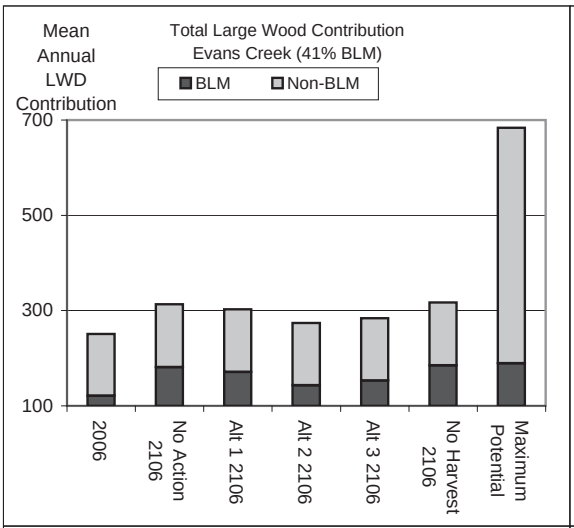
Large Wood

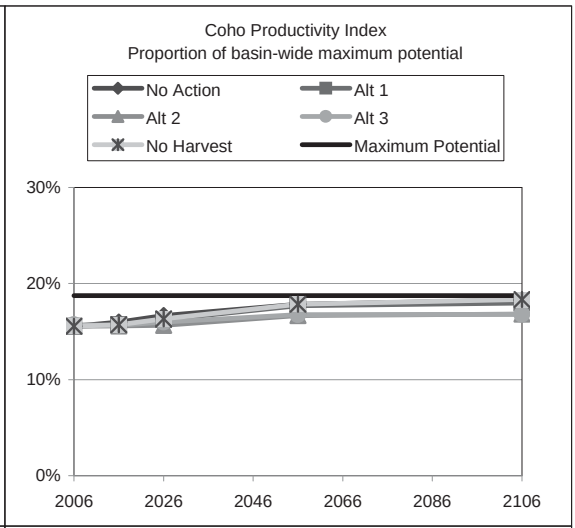
This analysis uses a large wood model to determine the mean annual large wood contribution under each alternative and the maximum potential large wood contribution to fish-bearing streams from BLM-administered lands and non-BLM-administered lands in representative watersheds. See the *Fish* section in *Chapter 3* for the descriptions of the five representative fifth-field watersheds. The model output of mean annual large wood contribution is not a prediction of actual instream conditions at a specific point in time, but represents a potential contribution to instream wood based on forest conditions over time. This analysis compares the mean annual large wood contribution to a maximum biological potential large wood contribution and determines a relative fish productivity index for coho salmon, chinook salmon, and steelhead trout based on the potential large wood contribution. Because the trends are similar for each species, fish productivity indices are displayed only for coho salmon.

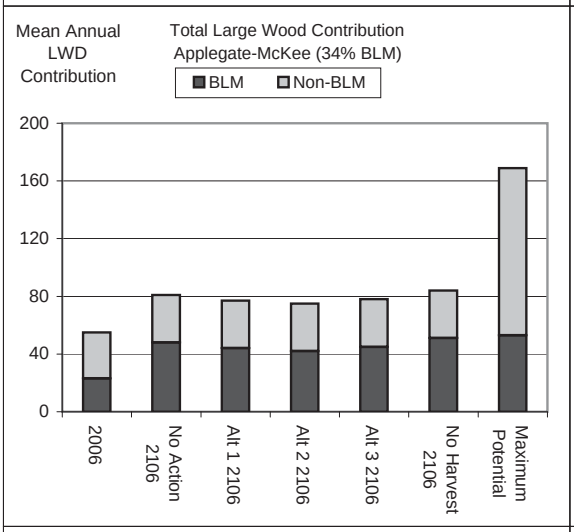
See *Figure 252 (Total large wood contribution and potential coho productivity index for the five representative fifth-field watersheds on the BLM-administered lands)* for the mean annual large wood contribution from BLM-administered lands and non-BLM-administered lands from 2006 to 2106 and the potential coho productivity index from BLM-administered lands in the five representative fifth-field watersheds.

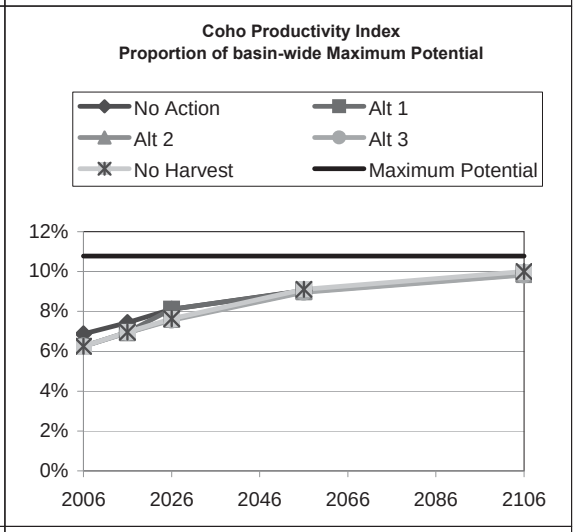
Figure 252. Total large wood contribution and potential coho productivity index for the five representative fifth-field watersheds on the BLM-administered lands

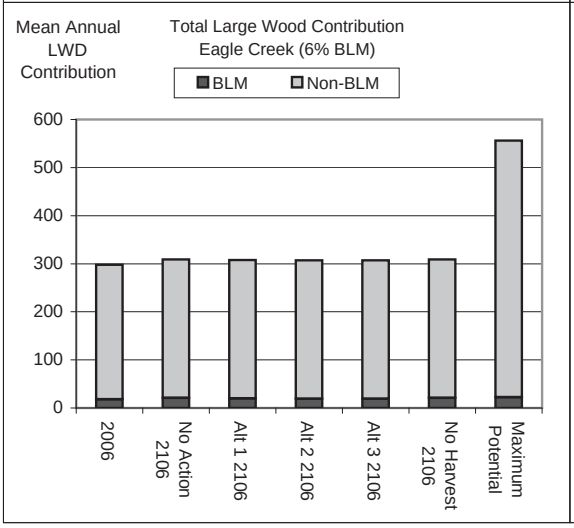


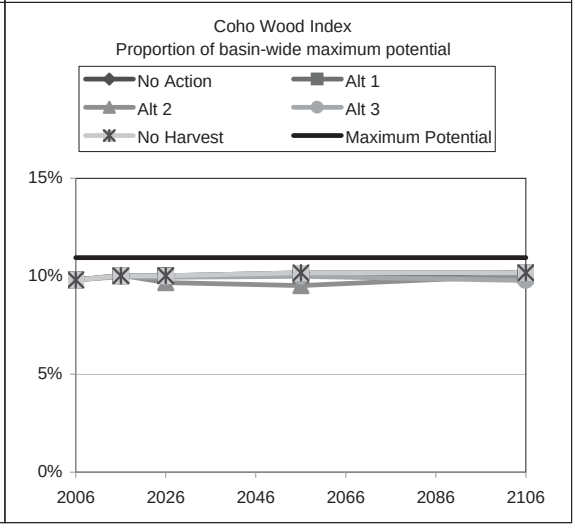

Mean Annual LWD Contribution
Total Large Wood Contribution
Evans Creek (41% BLM)
BLM
Non-BLM
700
500
300
100
2006
No Action 2106
Alt 1 2106
Alt 2 2106
Alt 3 2106
No Harvest 2106
Maximum Potential


Coho Productivity Index
Proportion of basin-wide maximum potential
No Action
Alt 1
Alt 2
Alt 3
No Harvest
Maximum Potential
30%
20%
10%
0%
2006
2026
2046
2066
2086
2106


Mean Annual LWD Contribution
Total Large Wood Contribution
Applegate-McKee (34% BLM)
BLM
Non-BLM
200
160
120
80
40
0
2006
No Action 2106
Alt 1 2106
Alt 2 2106
Alt 3 2106
No Harvest 2106
Maximum Potential


Coho Productivity Index
Proportion of basin-wide Maximum Potential
No Action
Alt 1
Alt 2
Alt 3
No Harvest
Maximum Potential
12%
10%
8%
6%
4%
2%
0%
2006
2026
2046
2066
2086
2106


Mean Annual LWD Contribution
Total Large Wood Contribution
Eagle Creek (6% BLM)
BLM
Non-BLM
600
500
400
300
200
100
0
2006
No Action 2106
Alt 1 2106
Alt 2 2106
Alt 3 2106
No Harvest 2106
Maximum Potential


Coho Wood Index
Proportion of basin-wide maximum potential
No Action
Alt 1
Alt 2
Alt 3
No Harvest
Maximum Potential
15%
10%
5%
0%
2006
2026
2046
2066
2086
2106

In all five fifth-field representative watersheds, the large wood contribution from the BLM-administered lands would increase under all four alternatives to near the maximum potential large wood contribution over the 100 year period. The proportion of large wood contribution from the BLM-administered lands would also increase under all four alternatives from 2006 to 2106. The results focus on long-term effects (100 years), which are driven by the changes in vegetative patterns that result from growth and harvesting. In the short term (within the next 10 years), the differences in effects between the alternatives are no greater than in the long term.

- Under the No Action Alternative, Alternative 1, and the no harvesting reference analysis, the large wood contribution would be nearly the same in all five fifth-field representative watersheds.[17]
- Under all four alternatives, the mean annual large wood contribution from the BLM-administered lands would be nearly the same over the 100-year period for two of the five representative watersheds (Eagle Creek and Applegate River/McKee Bridge).
- Under Alternatives 2 and 3, the mean annual large wood contribution from the BLM-administered lands would be slightly lower than under the No Action Alternative and Alternative 1 in three of the five representative watersheds (Evans Creek, Upper Smith River, and Rogue River/Horseshoe Bend).

In the Evans Creek representative watershed, the proportion of the maximum large wood contribution from the BLM-administered lands would increase from the current level of 64% to 96% by 2106 under the No Action Alternative, to 90% under Alternative 1, to 76% under Alternative 2, to 81% under Alternative 3, and to 98% under the no harvesting reference analysis.

In the Upper Smith River representative watershed, the proportion of the maximum large wood contribution from the BLM-administered lands would increase from the current level of 41% to 97% by 2106 under the No Action Alternative, to 96% under Alternative 1, to 88% under Alternative 2, to 84% under Alternative 3, and to 97% under the no harvesting reference analysis.

In the Rogue-Horseshoe Bend representative watershed, the proportion of the maximum large wood contribution from the BLM-administered lands would increase from the current level of 44% to 95% by 2106 under the No Action Alternative, to 94% under Alternative 1, to 91% under Alternative 2, to 89% under Alternative 3, and to 96% under the no harvesting reference analysis. The differences in percentages would account for less than 10 pieces of large wood per year over the entire representative watershed.

[17] The differences among the alternatives are slight when compared to the total wood contribution, and sources of error in modeling may be greater than any differences in large wood contributions in these representative watersheds. For example, there is a slight difference in how the modeling classified open water as nonforest for each alternative (see the *Ecology* section in *Chapter 3*). As a result, initial large wood contributions may be overestimated until 2056 for the No Action Alternative and Alternative 1 compared to Alternatives 2 or 3. This may in part explain the higher fish productivity values for the No Action Alternative in the Rogue-Horseshoe Bend watershed by 2016 and 2026.

Although the mean annual large wood contribution would increase in all five representative watersheds, it would be lower than the maximum potential in 2106, because not all forests that are capable of delivering large wood to fish-bearing streams would become mature or structurally complex forests by 2106, even under the no harvesting reference analysis.

In three of the five representative watersheds, the mean annual large wood contribution from non-BLM-administered lands would remain the same from 2006 to 2106. In the Eagle Creek representative watershed, non-BLM-administered lands comprise 94% of the watershed. For these non-BLM lands, the proportion of the mean annual large wood contribution of the maximum would increase by 2% from 52% in 2006 to 54% by 2106. In the Rogue-Horseshoe Bend representative watershed, the proportion of the mean annual large wood contribution of the maximum large wood contribution from non-BLM-administered lands would increases by 52% from 25% in 2006 to 77% by 2106. However, the non BLM-administered lands make up only 7% of the watershed. This analysis assumes that U.S. U.S. Forest Service reserves would continue to develop and all other lands would maintain their current abundances. See the *Ecology* section in this chapter.

See *Figure 253 (Riparian reserve and riparian management area widths and large wood contribution)* for an illustration of the riparian reserves and riparian management areas for each alternative and the average annual large wood contribution for the Upper Smith and Eagle Creek representative watersheds at the year 2106.

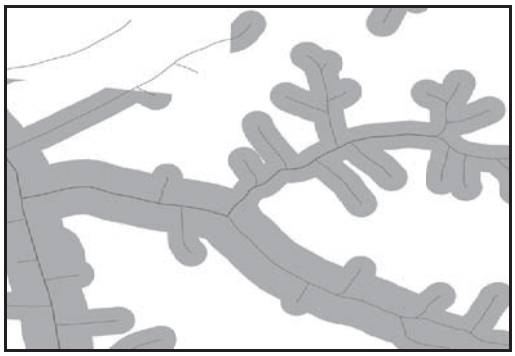
Figure 253. Riparian reserve and riparian management area widths and large wood contribution

No Action Alternative

Riparian reserve: 960,348 acres (37%)

Smith: 704 pieces per year

Eagle: 21 pieces per year

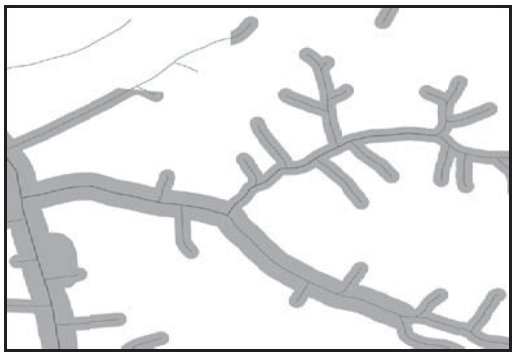


Alternative 1

Riparian management area: 508,763 acres (20%)

Smith: 701 pieces per year

Eagle: 20 pieces per year

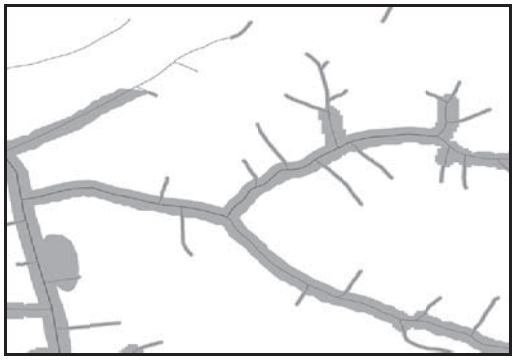


Alternative 2

Riparian management area: 196,421 acres (13%)

Smith: 638 pieces per year

Eagle: 19 pieces per year

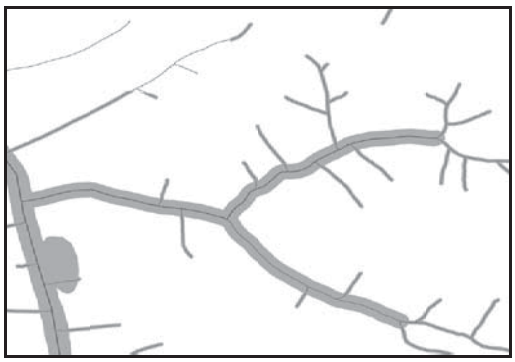


Alternative 3

Riparian management area: 282,837 acres (11%)

Smith: 614 pieces per year

Eagle: 19 pieces per year



The No Action Alternative has twice as many acres in a riparian reserve as Alternative 1. However, in all five representative watersheds, the large wood contribution would be nearly the same for the No Action Alternative and Alternative 1. The large wood contribution is slightly less under Alternatives 2 and 3 in several representative watersheds and nearly the same in the other representative watersheds. However, the amount of acres within the riparian management areas are far less (up to two-thirds less) than the riparian reserves under the No Action Alternative.

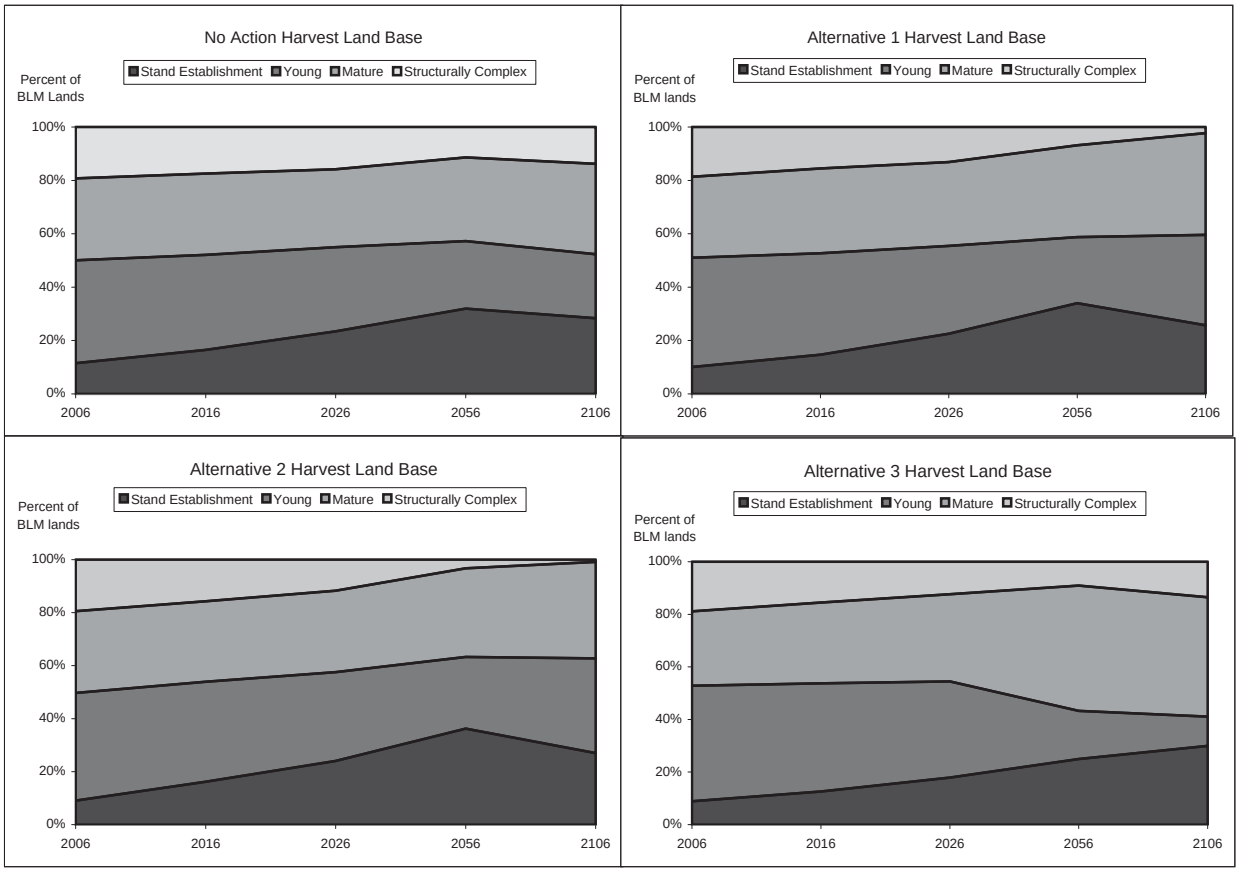
The large wood contributions would increase over time under all four alternatives and vary only slightly among the alternatives for several reasons, as follows.

Reason 1. Areas outside of the riparian management areas would contribute large wood to streams.

Large wood source areas that are not allocated to riparian management areas would contribute large wood to fish-bearing streams if they are in a mature&structurally complex forest condition. For example, large wood source areas would occur in areas withdrawn under the timber productivity capability classification (TPCC) or allocated to late-successional management areas. Under all four alternatives, the amount of the mature&structurally complex forests outside of riparian management areas would increase from 2006 to 2106. See *Figure 254 (Structural stage abundances in the harvest land base by alternative)*.

The large wood model considered all Stand Establishment and Young forests as not capable of providing large wood to streams. This underestimates large wood contribution from outside Riparian management areas under the No Action Alternative and Alternative 3. The No Action Alternative and Alternative 3 require green tree retention in regeneration harvests and partial harvest, which would ensure that future Stand Establishment and Young forests would include some trees greater than 20 inches in diameter, and therefore could provide some large wood to streams (see the *Ecology* section of this Chapter).

Figure 254. Structural stage abundances in the harvest land base by alternative

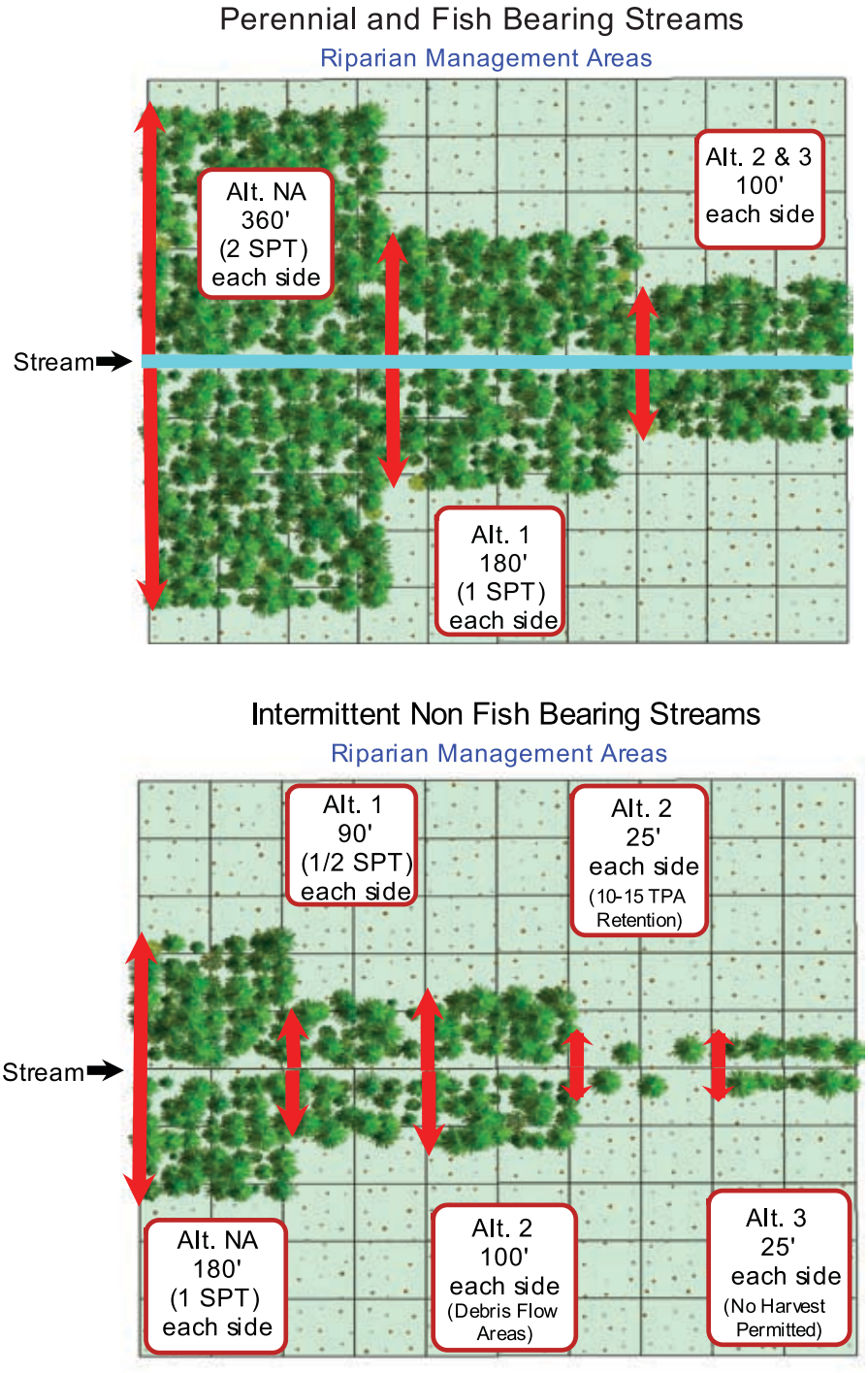


Reason 2. All four alternatives would incorporate most large wood source areas into the riparian reserves or the riparian management areas.

The acreage in the riparian reserves or the riparian management areas under the alternatives would vary more than the large wood contribution. This is because all four alternatives would incorporate most of the large wood source areas into the riparian management areas. In the five representative watersheds, the majority of the large wood comes from streamside areas. See *Figure 255 (Example of riparian management areas under all four alternatives)*.

Under all four alternatives, the riparian management areas would include a distance of at least 100 feet from all perennial streams, which would include most of the riparian sources of large wood to streams. Meleason et al. (2002) found that 90% of streamside large wood input originated from within 46 feet of streams when adjacent stands are 80 to 200 years of age and within 118 feet when adjacent stands are greater than 200 years of age. McDade et al. (1990) found that 90% of large wood recruitment from streamside sources occurs within 157 feet when adjacent stands are 80 to 200 years of age and 180 feet when adjacent stands are greater than 200 years of age. May and Gresswell (2003) found that 80% of large wood originated from trees that are rooted within 50 meters (164 feet) of the channel in colluvial streams and within 30 meters (98 feet) in alluvial channels.

Figure 255. Example of riparian management areas under all four alternatives

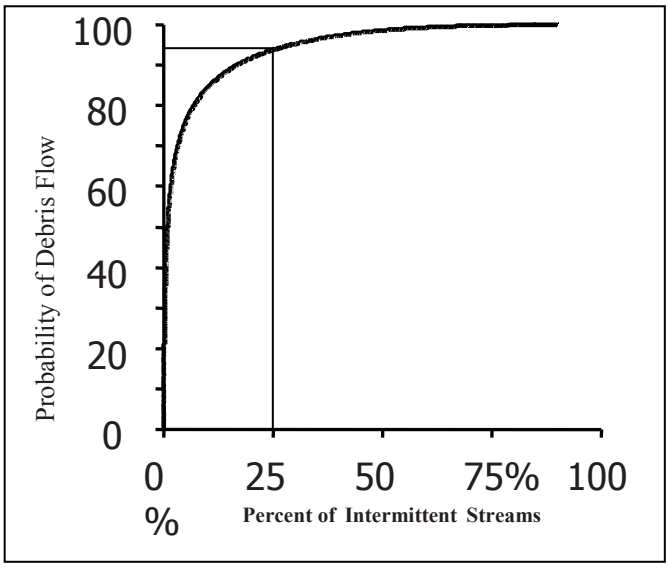


The widths of the riparian management areas also vary by alternative along headwater streams (non-fish-bearing intermittent channels).

Headwater streams differ in susceptibility to debris flows. The Coastal Landscape Analysis and Modeling Study (CLAMS), see *Figure 256 (Percent intermittent streams with highest probability of debris flow to fish-bearing stream channels)*

showed that a relatively small amount of intermittent channels deliver most of the large wood from these sources.

Figure 256. Percent intermittent streams with highest probability of debris flow to fish-bearing stream channels



Along intermittent streams, all four alternatives would incorporate some portion of large wood source areas into the riparian reserves or the riparian management areas. Alternative 3 would include the smallest proportion of large wood source areas along intermittent streams within riparian management areas, which explains why large wood contributions would be slightly lower in two of the five representative watersheds under Alternative 3.

Although Alternatives 2 and 3 would have similar riparian management areas along perennial streams, Alternative 2 would allocate larger riparian management areas on debris-flow prone intermittent streams and permit timber harvesting along other intermittent streams. The large wood contribution under Alternative 2 would be nearly the same as the No Action Alternative and Alternative 1 in two of the five watersheds, and nearly the same as Alternative 3 in all five representative watersheds. This is because there would be 100 foot riparian management areas under Alternative 2 along debris-flow prone intermittent channels having a high probability of delivering large wood to fish-bearing stream channels.

Reason 3. The abundance of structural stages within riparian management areas would change similarly over time under all four alternatives.

The contribution of large wood to streams would depend on the amount of mature&structurally complex forests within large wood source areas. Under all four alternatives, the amount of mature&structurally complex forests

would increase in the riparian reserves and the riparian management areas from 2006 to 2106. See the *Water* section in this chapter. As the amount of the mature&structurally complex forests increase in large wood source areas, the large wood contribution would also increase. The development of mature & structurally complex forests within the riparian management areas would be similar for all four alternatives. See the *Ecology* section in this chapter.

Fish Productivity

In all five representative watersheds, the relative potential of fish productivity for coho salmon, chinook salmon, and steelhead trout from BLM-administered lands would increase under all four alternatives between 2006 and 2106 to nearly the maximum potential. See *Table 210 (Relative potential of fish productivity index in 100 years compared to basin-wide maximum).*

Table 210. Relative potential of fish productivity index in 100 years compared to basin-wide maximum

Representative Watersheds	Fish Species	No Action Alt.	Alt. 1	Alt. 2	Alt. 3	No Harvesting Ref. Anal.	Maximum Potential
Upper Smith River	Coho	49	49	48	48	49	50
	Steelhead	53	53	51	51	53	53
	Chinook	48	48	48	47	48	49
Rogue River/ Horseshoe Bend	Coho	24	24	24	24	24	26
	Steelhead	29	29	29	29	29	32
	Chinook	18	18	18	18	18	20
Applegate River/ McKee Bridge	Coho	10	10	10	10	10	11
	Steelhead	11	11	11	11	11	13
	Chinook	5	5	5	5	5	6
Evans Creek	Coho	18	18	17	17	18	19
	Steelhead	21	21	19	19	21	22
	Chinook	15	15	14	14	14	16
Eagle Creek	Coho	10	10	10	10	10	11
	Steelhead	13	13	13	13	13	14
	Chinook	12	12	12	11	12	12

Note: The fish productivity index is estimated based on the surface area of the available stream habitat weighted by the intrinsic habitat potential value. The intrinsic habitat potential is based on topographical attributes of each stream reach including valley width, channel width, and channel gradient. This provides a comparison of the potential fish production between BLM and other land ownerships. As the proportion of the large wood contribution changes compared to the maximum potential large wood contribution, the fish productivity index would also change.

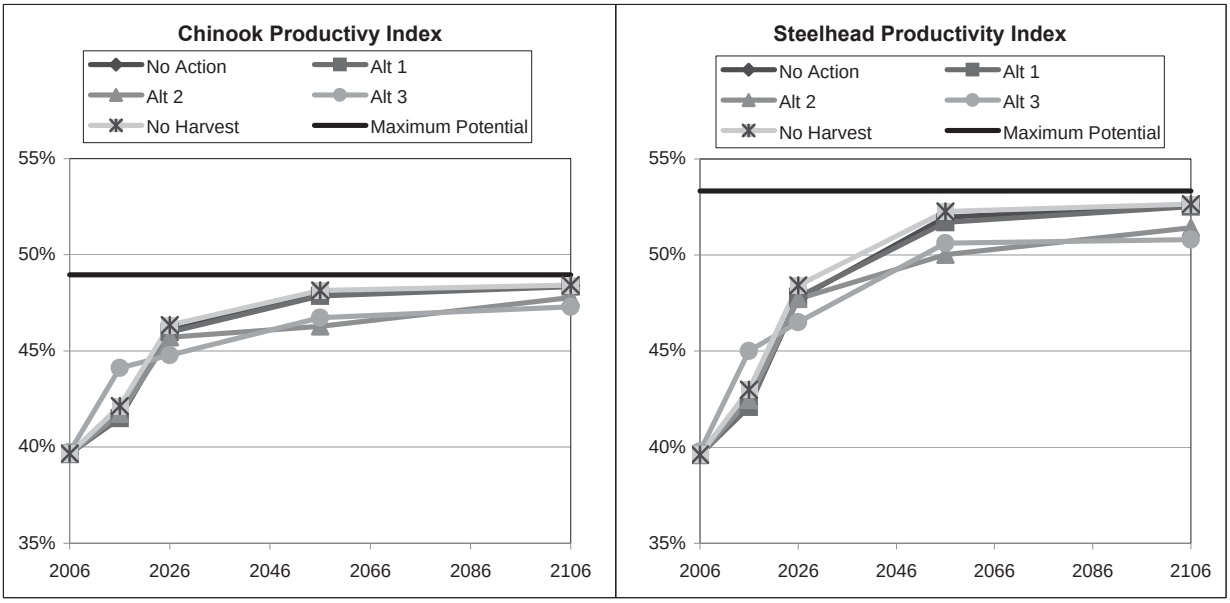
In the Rogue River/Horseshoe Bend and Applegate River/Mckee Bridge watersheds, there is no difference between all four alternatives in terms of the relative potential of fish productivity for coho salmon, chinook salmon, and steelhead trout.

In the other three representative watersheds, the relative potential of fish productivity for coho salmon, chinook salmon, and steelhead trout is the same under the No Action Alternative and Alternative 1, and slightly lower for some species under

Alternatives 2 and 3 (less than a 2% difference under Alternative 2 and 3 compared to the No Action Alternative).

For example, in the Upper Smith River, the relative proportion of the maximum potential watershed coho salmon productivity from BLM-administered lands would increase from the current level of 38% to 2106 levels of 49% under the No Action Alternative, Alternative 1, and the no harvesting reference analysis, 48% under Alternative 2, and 48% under Alternative 3. This trend for the three fish species is the same in the other four representative watersheds, and the difference in the proportion of the maximum watershed fish productivity from BLM-administered lands among the alternatives would be less than 2%. See *Figure 257 (Chinook salmon productivity index and steelhead trout productivity index for the Upper Smith River representative watershed).*

Figure 257. Chinook salmon productivity index and steelhead trout productivity index for the Upper Smith River representative watershed



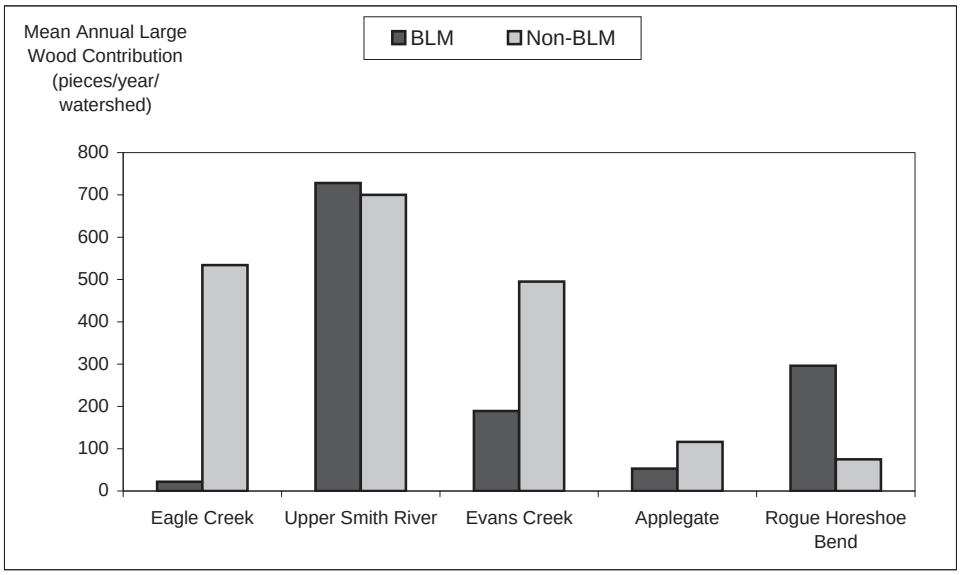
Although the proportion of the maximum large wood contribution would vary slightly among the alternatives in the Evans Creek representative watershed (14% difference among the alternatives) and the Rogue River/Horseshoe Bend representative watershed (7% difference among the alternatives), the differences among the alternatives in terms of fish productivity from the BLM-administered lands would be far smaller (less than 2%). The differences in the increase in large wood contribution in the Evans Creek and the Rogue River/Horseshoe Bend representative watersheds would have little effect on fish productivity because there are few high intrinsic potential streams on BLM-administered lands in those watersheds and the mature&structurally complex forest stands likely occur along the high intrinsic potential streams.

The effect of the four alternatives on fish productivity in the five representative watersheds would be influenced by the large wood contribution and the amount of high intrinsic potential streams on BLM-administered lands, as follows.

Reason 1. The maximum potential large wood contribution varies among watersheds.

In general, the potential for large wood to be delivered to a fish-bearing stream channel would vary among the watersheds. Some watersheds have a greater potential to deliver large wood to fish-bearing stream channels than others. See Figure 258 (*Maximum large wood contribution to fish bearing streams)* for how the maximum large wood contribution varies between the five representative watersheds.

Figure 258. Maximum large wood contribution to fish-bearing streams



The differences among watersheds, in general, explain why the maximum large wood contribution would vary greatly among the representative watersheds.

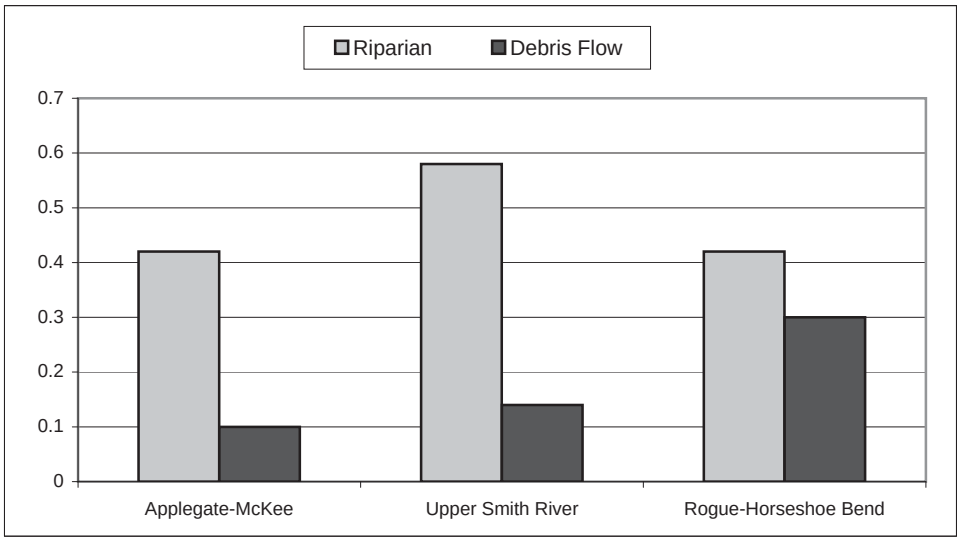
For example, the maximum large wood contribution from the BLM-administered lands in the Upper Smith River representative watershed (728 pieces per year) is more than twice that in the Rogue River/Horseshoe Bend representative watershed (296 pieces per year), even though the percentage of the BLM-administered land within the Upper Smith River representative watershed is about one-third less (59% and 93%, respectively). See the *Fish* section in *Chapter 3*.

Reason 2. The relative importance of each source area differs between watersheds.

The majority of large wood is delivered from riparian and flood plain source areas. All four alternatives include at least a 100 foot riparian management area around these large wood source riparian areas. The slight differences are a result of the differences in riparian management area widths along intermittent channels. Headwater streams differ in susceptibility to debris flows within watersheds and among watersheds. The rate and amount of wood recruited

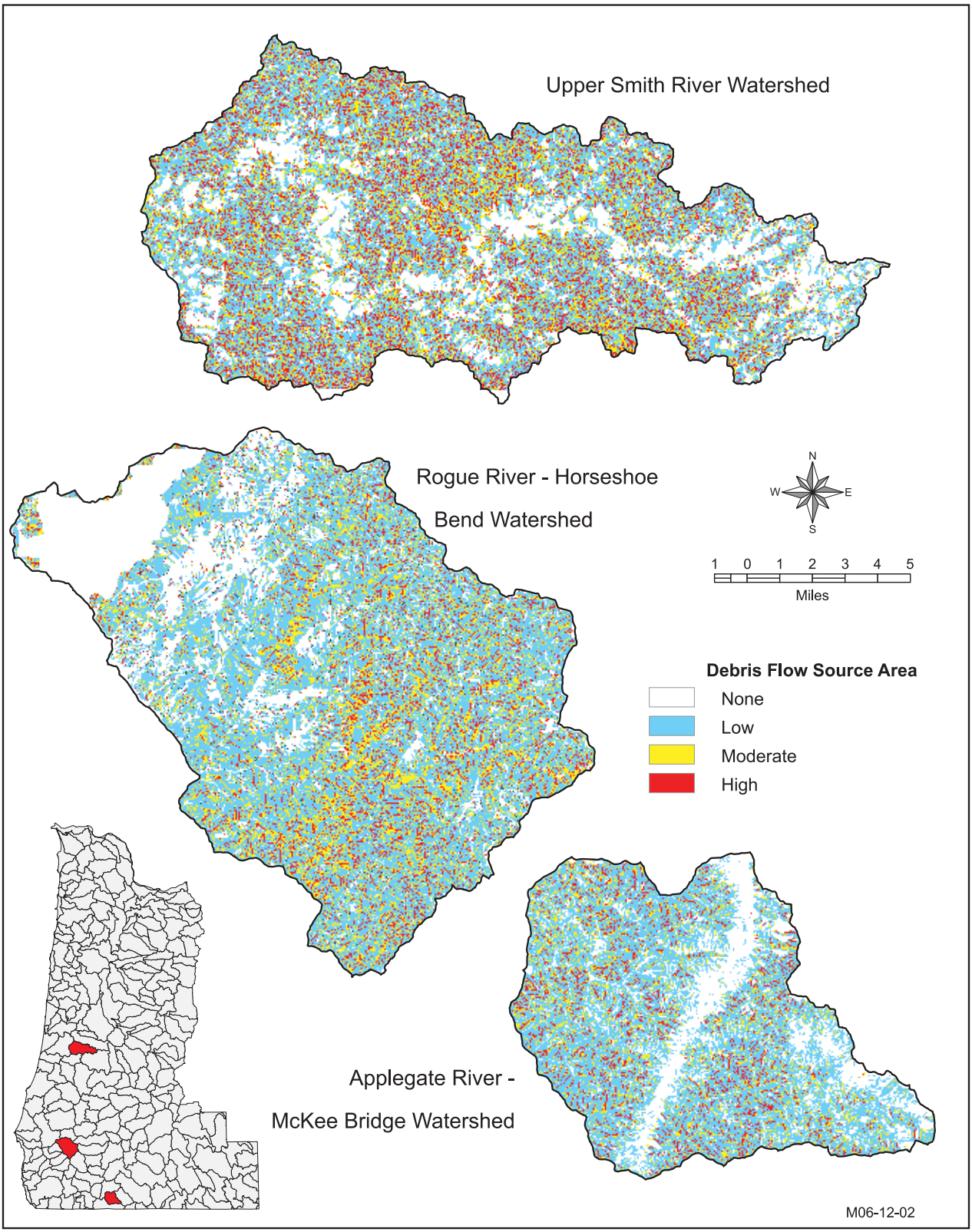
from these upslope debris-flow sources varies between watersheds. See *Figure 259 (Wood contribution by source)* and *Figure 260 (Debris flow probabilities between watersheds)*.

Figure 259. Wood contribution by source



Although the Rogue River/Horseshoe Bend representative watershed has a greater percentage of large wood coming from debris flow sources and a similar amount coming from riparian and floodplain sources as does the Upper Smith River representative watershed, it has a lower density of fish-bearing stream channels in the watershed on the BLM-administered lands. In these watersheds, the low density of fish-bearing streams suggests that there are some watersheds where timber harvesting would have a lesser effect on wood recruitment to fish-bearing channels. In the Upper Smith River representative watershed, the high density of fish-bearing channels suggests that timber harvesting has a greater potential to effect wood recruitment to fish-bearing streams.

Figure 260. Debris flow probabilities between watersheds



Reason 3. Increasing the large wood contribution along high intrinsic potential streams affects fish productivity more than increasing it along low intrinsic potential streams.

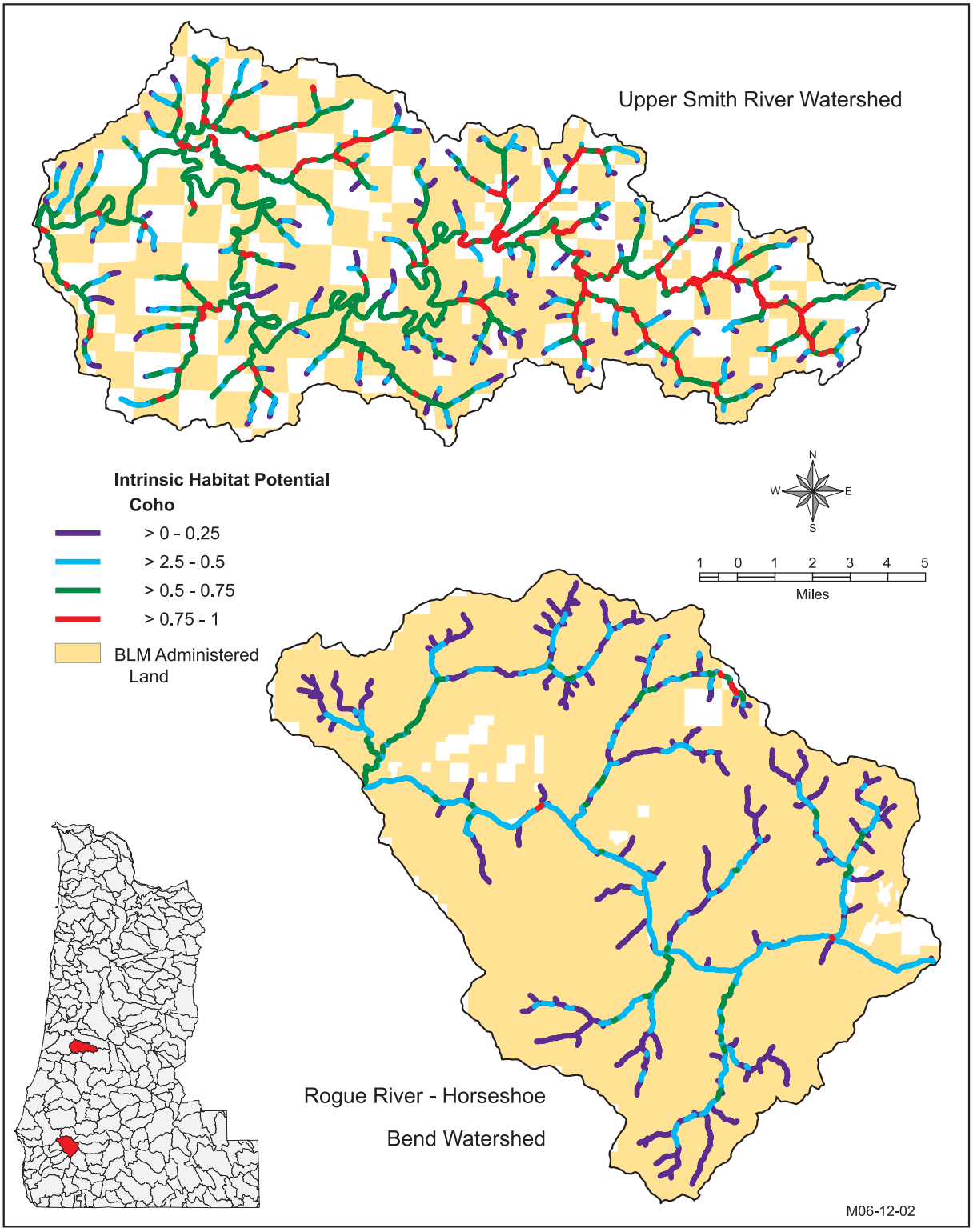
Fish productivity is largely dependant on the number of miles of high intrinsic potential streams within a watershed. The amount of high intrinsic potential streams varies among the watersheds. See *Figure 261 (Differences in the number of miles of high intrinsic potential streams between watersheds on BLM-administered lands)*.

In the Evans Creek representative watershed, the BLM-administered lands are 41% of the watershed, but would only affect approximately 16%, 19%, and 22% of the maximum potential productivity for the coho salmon, chinook salmon, and steelhead trout, respectively, because the majority of the high intrinsic potential stream habitat is on the non-BLM-administered lands.

In the Rogue River/Horseshoe Bend representative watershed, the BLM-administered land is 93% of the watershed, but there are very few high intrinsic potential stream channels, and most are on non-BLM-administered land.

In the Upper Smith River representative watershed, where there is a greater amount of BLM-administered land along high intrinsic potential stream channels than in the other representative watersheds, there would be a slightly greater difference (2%) among the alternatives in their effect on steelhead trout productivity compared to other representative watersheds.

Figure 261. Differences in the number of miles of high intrinsic potential streams between watersheds on BLM-administered lands

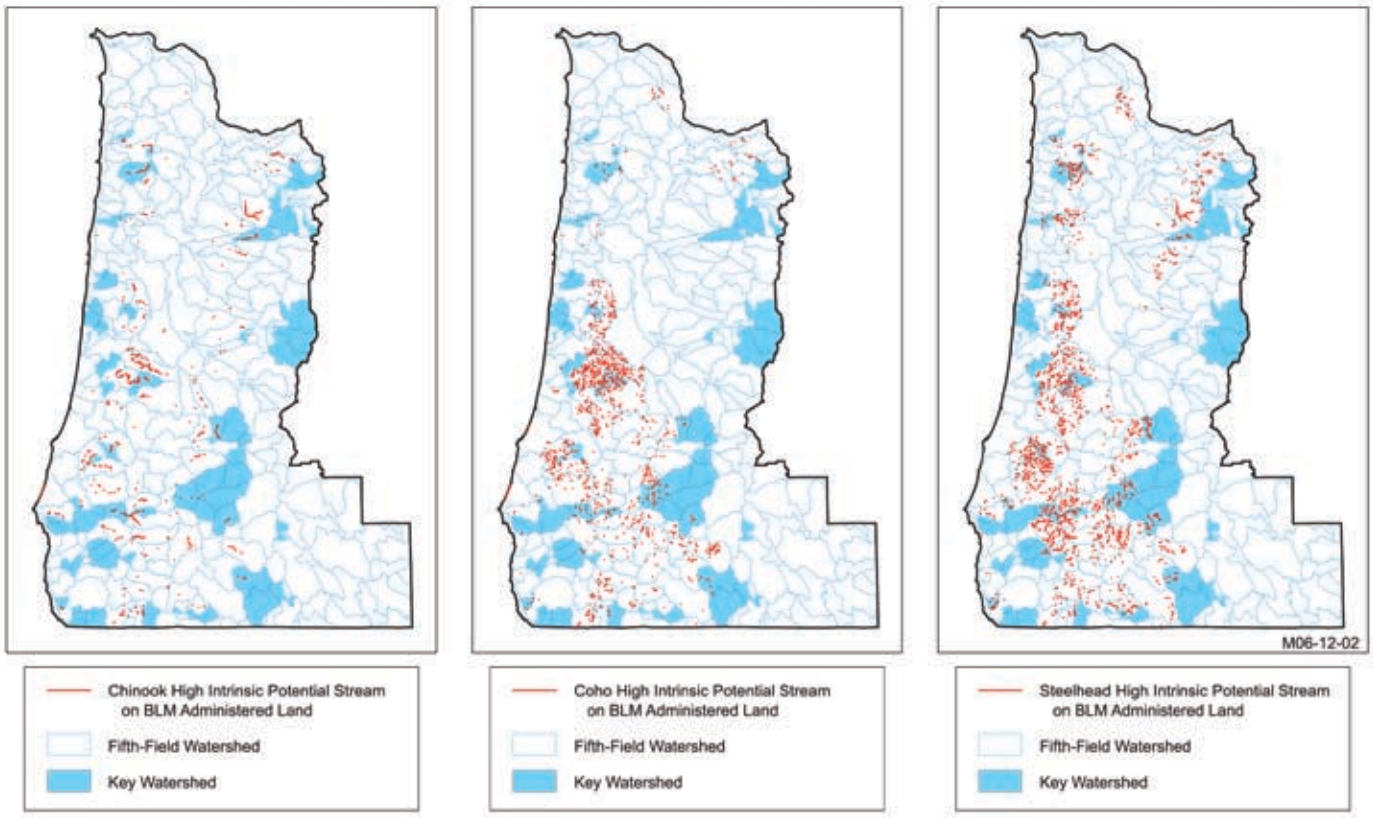


Instream Restoration

It is assumed that the annual instream restoration would be 11 miles under all four alternatives (based on the level of instream restoration that has occurred from 1995 to 2006), but would be applied in different areas. Under the No Action Alternative, key watersheds would continue to be high priority areas for instream restoration. Key watersheds do not always coincide with high intrinsic potential streams (see the *Fish* section in *Chapter 3*).

Figure 262 (Distribution of high intrinsic potential streams for chinook salmon, coho salmon, and steelhead trout within key watersheds of the planning area) shows that a relatively small portion of the high intrinsic potential streams occur within key watersheds.

Figure 262. Distribution of high intrinsic potential streams for chinook salmon, coho salmon, and steelhead trout within key watersheds of the planning area



Under the action alternatives, priority for instream restoration would be given to areas along high intrinsic potential streams. Because increasing the large wood in high intrinsic potential streams would be more effective in improving habitat complexity and fish productivity than increasing the large wood in other streams (see the *Fish* section in *Chapter 3*), instream restoration under the action alternatives would be more effective in improving fish productivity than under the No Action Alternative.

Nutrient Input

As noted in the *Fish* section of *Chapter 3*, the thresholds for the amount of organic input that are adequate to maintain food supplies for fish are unknown. All four alternatives would maintain nutrient input because all four alternatives would maintain some type of streamside vegetation.

Organic inputs under the No Action Alternative and Alternative 1 would be increasingly dominated by conifer needles, because the riparian reserves and the riparian management areas, which include the area along streams that would provide organic inputs, would develop into mature&structurally complex conifer forests over time (see the *Ecology* section in this chapter).

Under Alternatives 2 and 3, the organic inputs along perennial streams would be similar to the No Action Alternative and Alternative 1. However, along non-fish-bearing intermittent streams, some localized shifts in vegetation would occur because the riparian management areas would not include all of the areas that provide organic inputs to streams. Timber harvesting would alter the vegetation in these areas, which would create younger forest conditions with more shrub and hardwood organic input than the No Action Alternative or Alternative 1. This shift in stand ages and species composition would provide a variety of organic materials at varying rates, thereby adding to habitat heterogeneity. However, there is inadequate information to conclude that shifts in nutrient inputs would result in any difference in the effects of the alternatives on fish productivity.

Fine Sediment Delivery

As noted in the *Fish* section of *Chapter 3*, thresholds have not been established for the levels of sediment delivery that would cause impairment to fish. This analysis focuses on the management activities that would change the magnitude, timing, or duration of sediment transport and overwhelm the ability of fish to cope with or avoid the stress. This analysis assumes that every 1% increase in fine sediment from management activities would result in a 3.4% decrease in fish survival (see the *Fish* section in *Chapter 3*).

The proximity of ground disturbances to streams is an important factor for controlling sediment delivery. The potential for an increase of fine sediment delivery to fish-bearing stream channels could occur from soil disturbances from timber harvesting activities, road construction and use, culvert replacement, instream restoration activities, and grazing.

The potential for increased fine sediment delivery from timber harvesting activities would be greatest under Alternative 2. Over 10 years under Alternative 2, approximately 400 acres of regeneration timber harvesting would occur along non-debris-flow prone intermittent channels across the planning area (less than 0.5% of total BLM-intermittent stream miles). Although more harvesting would occur near the stream channel under Alternative 2 than in other alternatives, best management practices would reduce the amount of disturbances near stream channels. See the *Water* section in this chapter.

Fine sediment production would increase with road construction, use, maintenance, and decommissioning. Actions that expose the soil surface or disturb road or ditch surfaces would increase erosion potential. Once fine particles have been produced, they would be available for transport to streams where they could impact the quality of salmonid habitat (IMST 1999). Under all four alternatives, new roads would be located outside of a stream influence zone where possible, and these miles most likely would not deliver fine sediment to streams channels. See the *Water* section in this chapter. During the next 10 years under all four alternatives, the potential fine sediment delivery from new roads would be less than 1% of the fine sediment delivery from existing roads. Best management practices for road-related activities would also reduce the amount of fine sediment that is delivered to stream channels.

Under all four alternatives, the rate of susceptibility to shallow landsliding from timber harvesting and road construction over the next 10 years would not increase. This is because fragile soils susceptible to landsliding are either currently withdrawn under the timber productivity capability classification system as nonsuitable forest or would be withdrawn when identified with a project activity. See the *Water* section in this chapter.

The placement of culverts and instream structures could result in an increase in turbidity and potential downstream sediment delivery, and often would occur during low flow periods when fish are most vulnerable to fine sediment. Under all four alternatives, culvert replacements and other instream activities would cause short-term, localized increases in turbidity (less than eight hours and less than 300 feet). The increase in turbidity would not affect fish populations because:

- Best management practices, such as diverting water around a site, use of containment and filtering techniques (e.g., silt curtains), and limiting mechanized equipment along streambanks, would mitigate increases in turbidity.
- The majority of culverts that are barriers to anadromous salmonids have already been replaced on BLM-administered lands (see the *Fish* section in *Chapter 3*), so future culvert replacements would occur infrequently and the effects would be spread out over a large area.
- Fish have the ability to avoid short-term and localized turbidity. The amount of instream restoration activities and the best management practices applied to minimize increases in turbidity would be the same under all four alternatives.

Grazing in riparian areas can reduce and eliminate streambank vegetation and can increase sediment to stream channels. Within the planning area, sedimentation is a limiting factor for endangered Lost River and Shortnose suckers (USDI, USFWS 2003d). Under the three action alternatives, up to 29 reservoirs and 48 miles of fence would be constructed within the Klamath Falls Resource Area of the Lakeview District. These range improvements would be used to improve livestock distribution by shifting the grazing pressure from riparian and wetland areas to upland areas, and shift the grazing distribution on the upland areas (including those areas that are not currently used). These actions would be consistent with conservation measures of the recovery plan for the Lost

River and Shortnose suckers to fence portions of streams to reduce cattle-caused erosion and to replant streambanks with native vegetation (USDI, USFWS 2003d).

Even though there would be short-term (less than one year), localized increases in fine sediment delivery from culvert, grazing, and other management activities under all four alternatives, there would be less than a 1% increase in fine sediment compared to existing rates from road-related activities, which often accounts for the majority of sediment that is delivered to stream channels. See the *Water* section in this chapter.

Peak Flows

Peak flows would not increase in fifth-field watersheds under any of the alternatives to a level that would affect fish habitat, because they would not cause 5-year, 24-hour flow to occur at the 2-year, 24-hour interval. See the *Fish* section in *Chapter 3*.

One sixth-field subwatershed out of 635 would be susceptible to increases in peak flow in rain-dominated areas (where the 2-year, 24-hour bankfull channel forming peak flow is greater than the 5-year, 24-hour peak flow). For rain-on-snow-dominated areas, three sixth-field subwatersheds out of 471 would be susceptible to peak flow increases. See the *Water* section of this chapter.

In these four sixth-field watersheds, some intermediate streamflows may be elevated in the short term (a few hours to a few days), but this does not automatically imply adverse effects on stream morphology and fish habitat. Site-specific information regarding stream types and the resistance to the adjustment of bed and banks, as well as existing fisheries habitat information, would need to be analyzed during project implementation.

Stream Temperature

None of the alternatives would contribute to an increase in stream temperatures, except for the following temporary and localized exceptions. There are 31 miles of perennial streams on BLM-administered lands that are adjacent to the Coquille Forest (including 10 miles within the East Fork Coquille watershed and 20 miles within the Middle Fork Coquille Watershed). Under Alternatives 2 and 3, trees in the primary shade zone would be fully retained. However, the secondary shade zone would have varying amounts of tree retention. This would decrease effective shade by 10 to 20% and result in a probable temperature change of up to 1ºF per mile. See the *Water* section in this chapter. This increase in temperature would occur on a limited amount of stream miles relative to the entire planning area (less than 0.05%). However, streams in the Coquille basin are listed as temperature-limited by the Oregon Department of Environment Quality. In these areas, increases in stream temperature could cause stress to fish by limiting their ability to absorb oxygen at certain temperatures. Mitigation could be applied to eliminate these adverse effects and it is described in the *Water* section of this chapter.

Mitigation

To mitigate for the slightly reduced large wood contributions that would occur under Alternatives 2 and 3, apply the width of one site potential tree height to riparian management area along intermittent channels where the large wood contribution from BLM-administered lands would be delivered to a greater percentage of high intrinsic potential stream channels within the watershed.

Water

This analysis examines the peak water flow and water quality, which includes stream temperature and fine sediment that would result from the alternatives.

Other water quality parameters, including dissolved oxygen, bacteria, and heavy metals, were considered but eliminated from detailed consideration because their effects are site specific and have limited applicability to forest management. See the *Water* section of *Chapter 3*.

Key Points

- Within the rain-dominated hydroregion, and the rain-on-snow hydroregion, there would be four sixth-field subwatersheds susceptible to increased peak flows from timber management under all four alternatives.
- All four alternatives would maintain effective stream shade that would limit the increase of stream temperatures within the range of natural variability.
- Under all four alternatives, the existing road network's potential for fine sediment delivery to streams would far outweigh the slight potential for additional fine sediment delivery from new roads.
- Under all four alternatives, the most fragile soils that are susceptible to landsliding would be withdrawn.
- All the alternatives, which include the application of best management practices, would reduce contamination sources and improve water quality.

Peak Water Flow

Timber harvesting influences peak flows where a large proportion of the timber has been harvested in a watershed. The magnitude of the effect is scaled by the type of harvesting (thinning or regeneration harvesting), the amount and distribution of harvesting within watersheds, and the physical characteristics of the landscape. A stand establishment structural stage class of forest is used as a surrogate of open conditions where the majority of the basal area has been removed through timber harvesting. Acres of stand establishment forests are shown in *Table 211 (Projected acres of stand establishment forests on BLM-administered lands)*.

Table 211. Projected acres of stand establishment forests on BLM-administered lands

Alternatives	Stand Establishment Forests on BLM-Administered Lands									
	2006		2016		2026		2056		2106	
	acres	%	acres	%	acres	%	acres	%	acres	%
No Action Alternative	155,000	7	140,000	6	159,000	7	198,000	8	173,000	7
Alternative 1	155,000	7	161,000	7	213,000	9	305,000	13	228,000	10
Alternative 2	155,000	7	213,000	9	295,000	12	431,000	18	319,000	13
Alternative 3	155,000	7	195,000	8	274,000	12	417,000	17	450,000	19

Note: Stand establishment acres are shown as a % of BLM-administered lands and includes roads and nonforest. Regeneration harvesting that results in forest in the stand establishment classification contains varying amounts of green tree retention (legacies) under the alternatives. Only stand establishment acres without legacies was used in calculating rain-on-snow peak flows (see the *Water* section in *Chapter 3*).

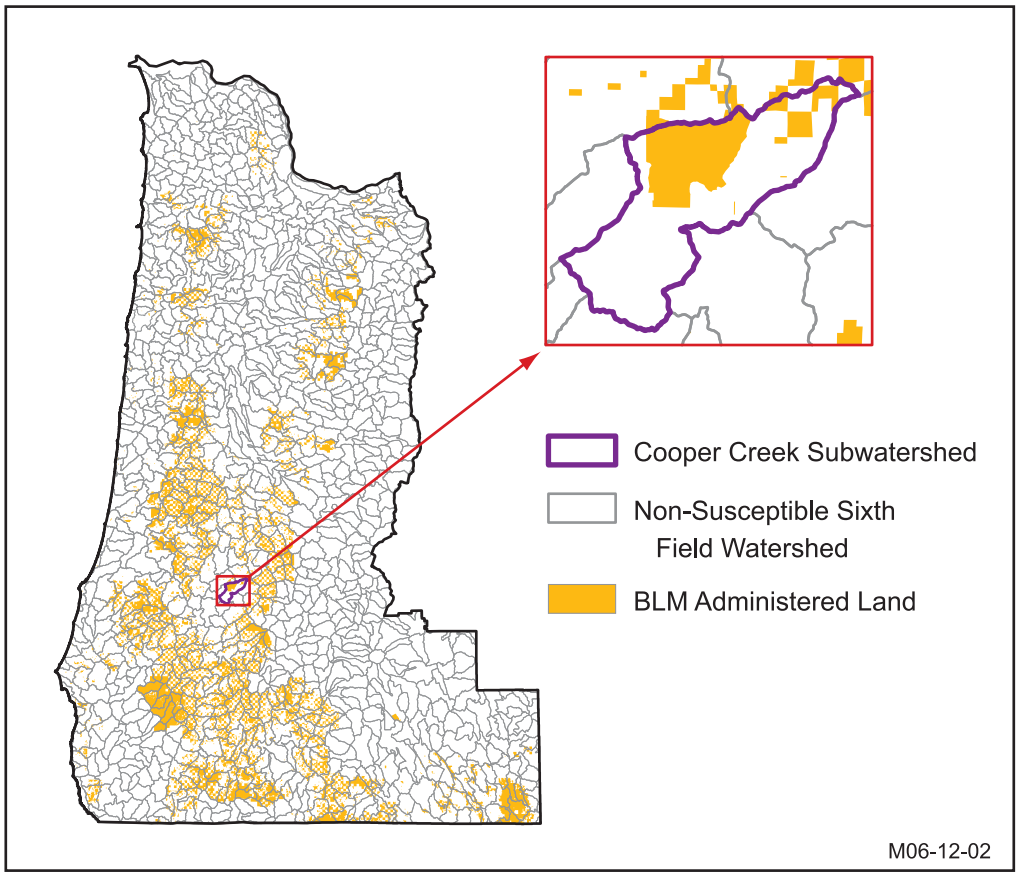
The results of modeling to determine the effects of timber harvesting on peak flows in rain-dominated subwatersheds are shown in Figure 263 (Susceptible rain-dominated subwatershed). Also see Appendix I. Water. Considering BLM-administered lands, a single sixth-field subwatershed out of 635 (less than 1%) would be susceptible to peak flow increases because the stand establishment structural age class would exceed 40% of the subwatershed over all time periods under all four alternatives. Two additional sixth-field subwatersheds would be susceptible when considering management activity on all lands.

There was no difference in the results for the potential increases in peak flows in rain-dominated subwatersheds for the reference analyses (the no harvesting reference analysis and the intensive management of most commercial timber lands) for timber production that were also examined.

Forest patch size, pattern, and age are important factors in the accumulation, redistribution, melting, and ablation of snow in the rain-on-snow hydroregion.

Within rain-on-snow elevations, a sufficient proportion of watershed acreage must consist of recent regeneration harvests in order to detect a vegetative-related peak flow effect significant enough to increase flooding or alter the geomorphology of streams. The low amount and scattered pattern of BLM-administered lands within most watersheds makes it difficult to determine a BLM-caused rain-on-snow peak flow signal. Furthermore, the changes in water balance due to vegetative management is relatively small and is dwarfed by the inner-annual stream flow variability that have formed the dominant stream channel characteristics (Grant et al. 2007, in review).

Figure 263. Susceptible rain-dominated subwatershed



The results of modeling to determine the effects of timber harvesting on peak flows in rain-on-snow-dominated subwatersheds are shown in *Figure 264 (Susceptible rain-on-snow-dominated sixth-field subwatersheds)*. See *Appendix I. Water* and the *Water* section in *Chapter 3*. Considering that the BLM-administered lands are intermingled with other ownerships, three sixth-field subwatersheds out of 248 (1%) would be susceptible to peak flow increase over all time periods for all four alternatives. One additional sixth-field subwatershed would be susceptible when considering management activity in the subwatersheds without BLM-administered lands.

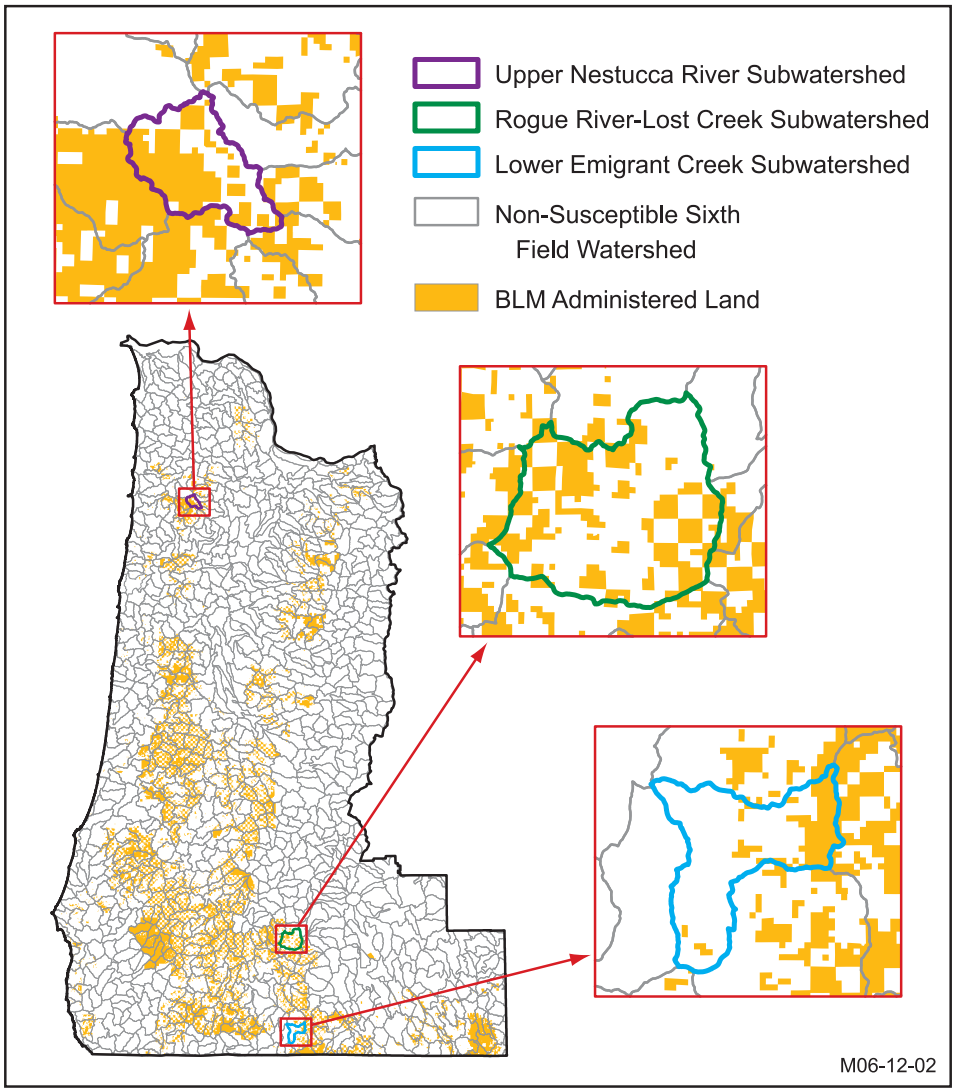
Potential increases in peak flows for rain-on-snow-dominated subwatersheds for the reference analyses (the no harvesting reference analysis and the intensive management of most commercial timber lands) for timber production were also examined. There was no change for the no harvesting reference analysis and one additional subwatershed found to be susceptible in the 2026 and 2056 time periods for the intensive management of most commercial timber lands reference analysis.

In rain-on-snow-dominated sixth-field subwatersheds, the alternatives are more sensitive to extremes in environmental conditions than to the BLM's management activity. If daily average air temperatures and wind speeds are changed from average conditions (exceeded 50% of the time) to where they are exceeded less than 2% of the time, then 4 to 10 of the sixth-field subwatersheds out of 248 (up to 4%) with various levels of BLM

ownership would be susceptible to peak flow increases. This involves approximately 78,000 acres (3%) of BLM-administered lands within the planning area. Alternatives 1 and 2 involve slightly more affected sixth-field subwatersheds during the 2026 and 2056 and 2106 time periods, while there was no difference in the No Action Alternative and Alternative 3. Alternative 3 would have fewer regeneration harvest areas and therefore fewer stand establishment areas without legacy. When considering all lands, 13 sixth-field subwatersheds out of 248 (5%) would be susceptible to peak flow increases.

For susceptible sixth-field subwatersheds, intermediate streamflows, which may be elevated in the short term (a few hours to a few days) do not automatically imply adverse effects on stream morphology, or aquatic or benthic resources. Site-specific information regarding stream types and the resistance to the adjustment of bed and banks, as well as existing fisheries habitat information, would need to be analyzed. Furthermore, the downstream routing of streamflows, including the degree of tributary basin convergence and synchronicity of tributary watersheds would also need to be analyzed.

Figure 264. Susceptible rain-on-snow-dominated sixth-field subwatersheds



Note: Peak flow susceptibility for sixth-field watersheds where the 2-year, 24-hour bankfull channel forming peak flow is greater than the 5-year, 24-hour peak flow. Includes the current rate of harvesting on private land from the 1996 IVMP satellite imagery, applied to all time periods.

Roads that extend the stream network influence the advances in the timing of water runoff or increases in peak flow (Wemple 1994; Jones and Grant 1996; and Grant et al. in review). New road construction can extend the stream drainage network with roadside ditches that channel runoff and contribute to peak flows. Few studies evaluate the degree that roadside ditches increase stream flow. See the *Water* section in *Chapter 3*.

Under all four alternatives, the new roads constructed for timber harvesting would extend the stream network by less than 0.1% of the BLM's total stream miles in the affected watersheds. This inconsequential stream lengthening would have no effect on the timing of runoff.

Water Quality

Shade

Solar radiation is the most important source of radiant energy that affects stream temperature (Brown 1969; Beschta 1997). Brown recognized that it was the loss of riparian vegetation, and not timber harvesting that affected solar radiation that fall on a stream (Brown and Krygier 1970). The forest canopy that is nearest a stream blocks the majority of the solar radiation from reaching the stream.

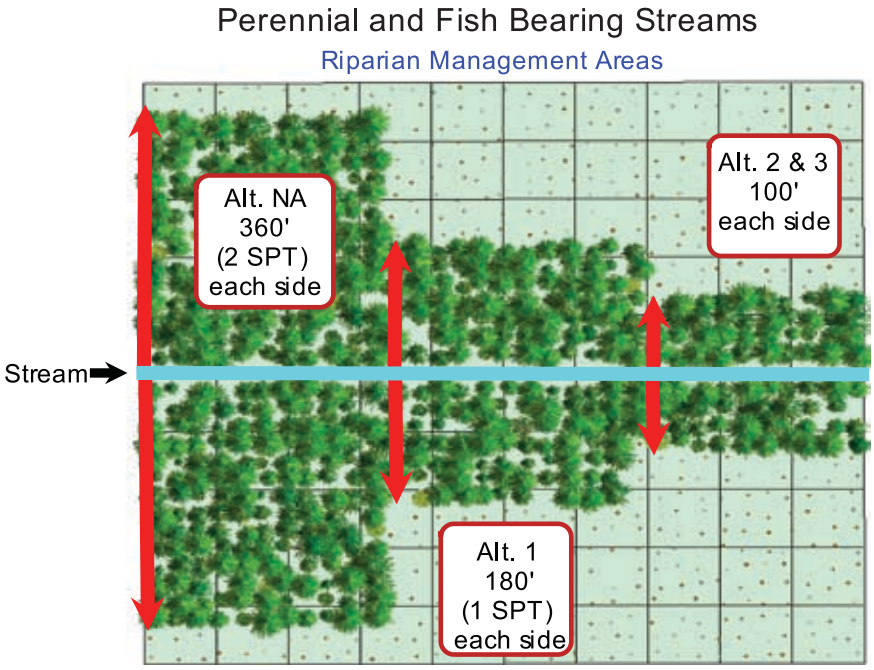
- For most circumstances, the first 12 to 60 feet along each side of streams shades the primary midday solar radiation.
- For mornings and afternoons, when the sun is at lower angles, a secondary zone up to 100 feet provides additional blocking of solar radiation.

At least 80% effective shade is met at 100 feet distance from streams. There is only marginal improvement (less than 5%) in the shading ability of wider areas. Approximately 80% effective shade corresponds to less than 0.2ºF change in stream temperature per mile of stream. This is considered to be within the range of natural variability. See the *Water* section in *Chapter 3*.

Slope steepness, stream orientation, stream width, overhanging vegetation, and undercut banks, as well as forest tree height, spacing and crown form, can either increase or reduce shade or affect shade quality. See the *Water* section in *Chapter 3*.

See *Figure 265 (Riparian management areas for permanently flowing streams)* for the width of the riparian reserves or the riparian management areas along permanently flowing streams under the alternatives.

Figure 265. Riparian management areas for permanently flowing streams



Note: SPT [Site Potential Tree] example shown for mid-range of conifer forest site productivity [site class III]

No Action Alternative

Under the No Action Alternative, the width of the riparian reserves would be one site potential tree height along each side of permanently flowing non-fish-bearing streams, and two site potential tree heights along each side of permanently flowing fish-bearing streams.

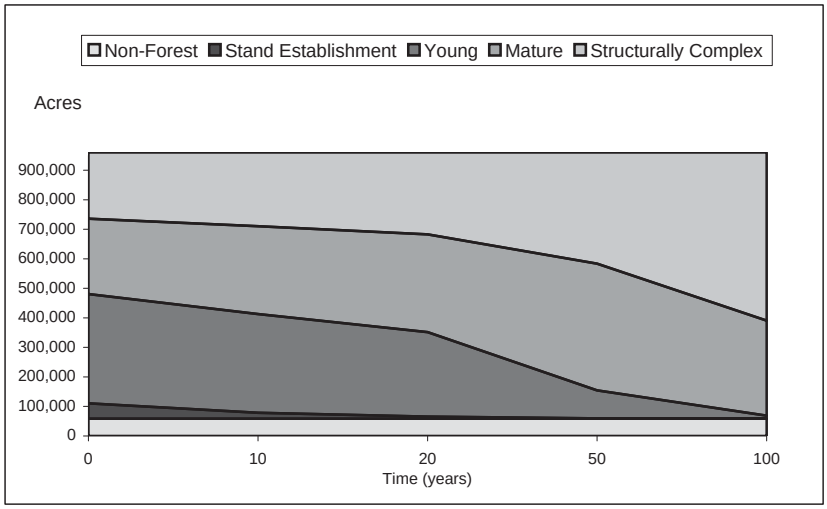
Under the No Action Alternative, most riparian reserves (with the exceptions that are noted below) along permanently flowing non-fishing-bearing and fish-bearing streams would fully retain the shade that is necessary to block sunlight from reaching the streams and increasing their temperature. The exceptions are:

- The riparian reserves fully occupy the primary and secondary shade zones. See the *Water* section in *Chapter 3* for definitions of the primary and secondary shade zones.
- The riparian reserves are in excess of what is needed to maintain 80% effective shade (100 feet). This includes up to 66% of the riparian reserve area (or approximately 314,500 acres) in excess of the needs for the 80% effective shade level. The gain from these additional acres of riparian reserve corresponds to less than 0.2ºF change in stream temperature per mile of stream, which is considered to be within the range of natural variability. See the *Water* section in *Chapter 3*.

See *Figure 266 (Structural stage classes of the riparian reserves under the No Action Alternative)* for the distribution of acres by structural stage class

within the riparian reserves. The preponderance of acres within the young high-density and mature forest structural stage classes indicates that the riparian areas already have tree heights and crown areas that would provide effective shading. See the *Water* section in *Chapter 3*. There would be a gradual decline of stand establishment and young forest structural stage classes over time. This would result in riparian forest structure that would improve shade quality as more acres move into the mature and structurally complex classes.

Figure 266. Structural stage classes of the riparian reserves under the No Action Alternative



Under the No Action Alternative, forest thinning and other practices would occur in the riparian reserves for the purpose of promoting the development of mature and structurally complex forests. In the short term (10 to 40 years), localized water temperatures would increase from 0.2 to 1ºF, depending on the extent of the area of such actions. However, these activities would be widely spaced within and between watersheds. The pattern and intensity of site-level forest treatments would not produce shade loss and corresponding temperature gain that exceeds the range of natural variability or reasonable measurement error of temperature monitoring instruments. In the long term, these practices would promote the development of mature forests, which result in greater proportions of shade.

Under the No Action Alternative, salvaging for safety or operational reasons in riparian reserves would have no effect on shade loss because it would be limited to incidental trees, which would be similar to random tree mortality.

Alternative 1

Under Alternative 1, the width of the riparian management areas would be a one site potential tree height along each side of permanently flowing streams.

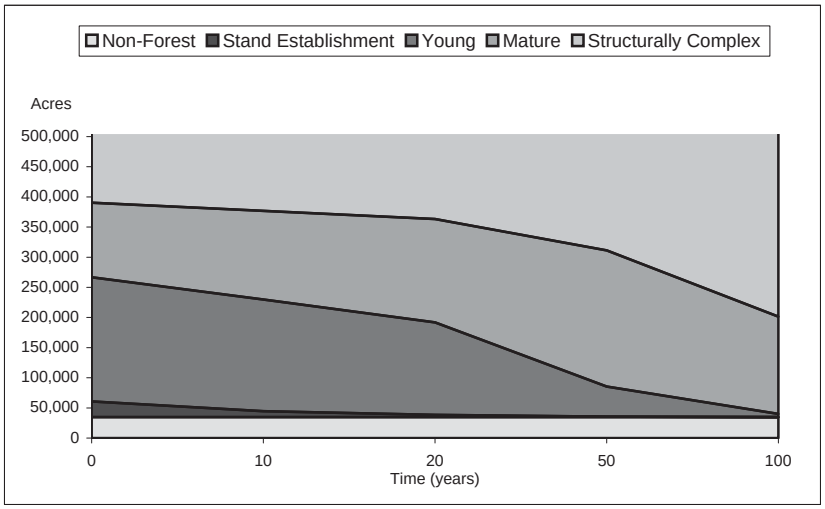
Under Alternative 1, most riparian management areas (with the exceptions that are noted below) along permanently flowing streams would fully retain the shade that is necessary to block sunlight from reaching the streams and

increasing their temperature. This would be true in both the short and long terms. The exceptions are:

- The riparian management areas fully occupy the primary and secondary shade zones. See the *Water* section in *Chapter 3* for definitions of the primary and secondary shade zones.
- The riparian management areas are in excess of what is needed to maintain 80% effective shade (100 feet). This includes up to 32% of the riparian management area (or approximately 75,700 acres) in excess of the needs for the 80% effective shade level. The gain from these additional acres of riparian management area corresponds to less than 0.2ºF change in stream temperature per mile of stream, which is considered to be within the range of natural variability. See the Water section in Chapter 3.

See *Figure 267* (*Riparian management area structural stage classes under Alternative 1)* for the distribution of acres by structural stage class within the riparian management areas. The preponderance of acres within the young high-density and mature forest structural stage classes indicate that the riparian areas already have tree heights and crown areas that would provide effective shading. There would be a gradual decline of stand establishment and young forest structural stage classes over time. This would result in riparian forest structure that would improve shade quality as more acres move into the mature and structurally complex classes.

Figure 267. Structural stage classes of the riparian reserves under Alternative 1



Under Alternative 1, thinning and other practices would occur for the purpose of promoting the development of mature and structurally complex forests. Some short term shade loss could occur. In the short term (10 to 40 years), localized water temperatures would increase from 0.2 to 1°F, depending on the extent of the area of such actions. However, these activities would be widely spaced within and between watersheds. The pattern and intensity of site-level forest treatments would not produce shade loss and corresponding temperature gain that exceeds the range of natural variability or reasonable measurement error of temperature monitoring instruments. In the long term, these practices would promote the development of mature forests, which would result in greater proportions of shade.

Under Alternative 1, salvaging for safety or operational reasons in the riparian management areas would have no effect because it would be limited to incidental trees, which would be similar to random tree mortality.

Alternatives 2 and 3

Under Alternatives 2 and 3, the riparian management areas would feature a primary and secondary shade zones along each side of permanently flowing fish-bearing streams, and along each side of permanently flowing non-fish-bearing streams.

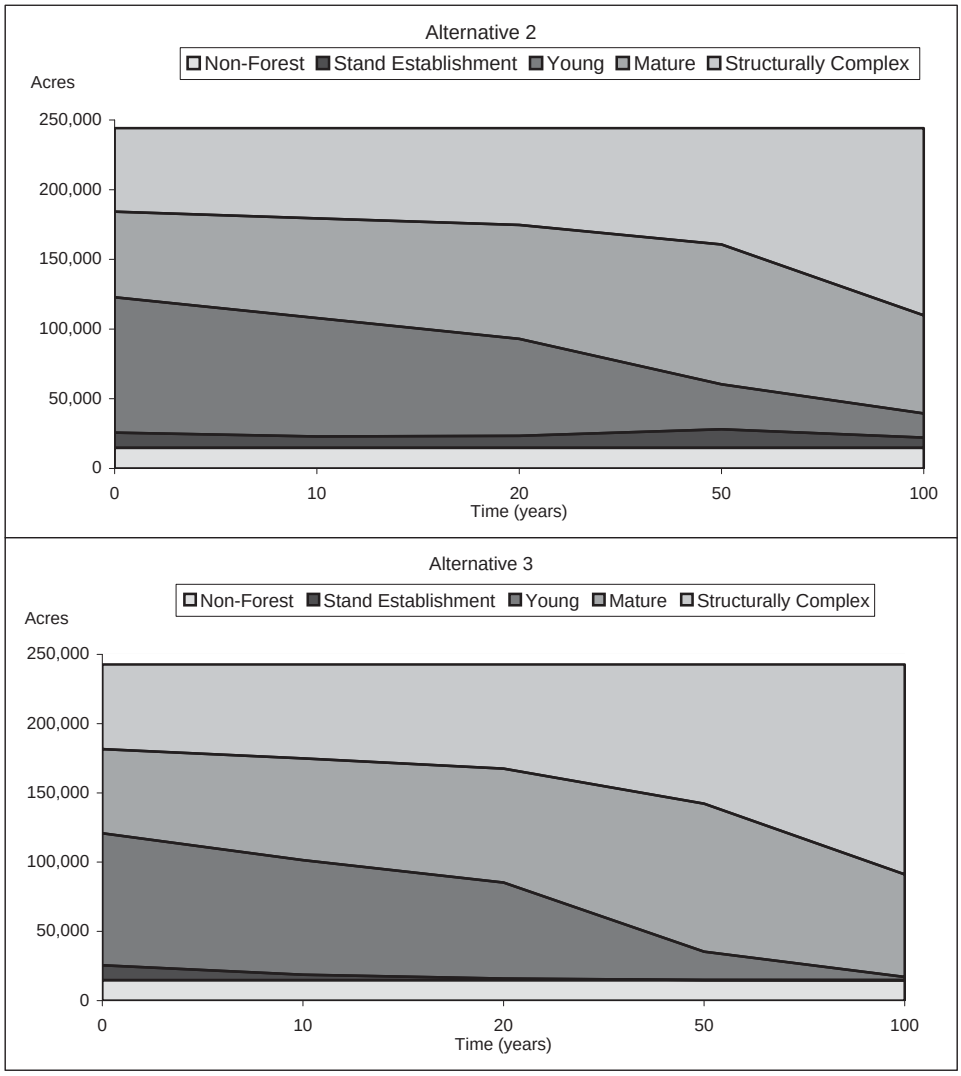
Under Alternatives 2 and 3, the riparian management areas (with the exception that is noted below) along permanently flowing non-fishing-bearing and fish-bearing streams would fully retain the shade that is necessary to block sunlight from reaching the streams and increasing their temperature. The exception is: The riparian management areas would fully occupy the primary and secondary shade zones. See the *Water* section in *Chapter 3* for definitions of the primary and secondary shade zones.

Under Alternatives 2 and 3, trees within the primary shade zone would be retained. In the short term, thinning and other practices would occur for the

purpose of promoting the development of mature and structurally complex forests within the secondary shade zone. Thinning would maintain at least 50% of this canopy cover after harvesting. In the short and long terms, this combination of shade zones would maintain at least 80% of the effective shade. This level corresponds to less than 0.2ºF change in stream temperature per mile of stream, which is considered to be within the range of natural variability. See the *Water* section in *Chapter 3*.

See *Figures 268 (Structural stage classes of the riparian reserves under Alternatives 2 and 3)* for the distribution of acres by structural stage class within the riparian management areas. The preponderance of acres within the young high-density and mature forest structural stage classes indicate that the riparian areas already have tree heights and crown areas that would provide effective shading. There would be a gradual decline of stand establishment and young forest structural stage classes over time. This would result in riparian forest structure that would improve shade quality as more acres move into the mature and structurally complex classes.

Figure 268. Structural stage classes of the riparian reserves under Alternatives 2 and 3

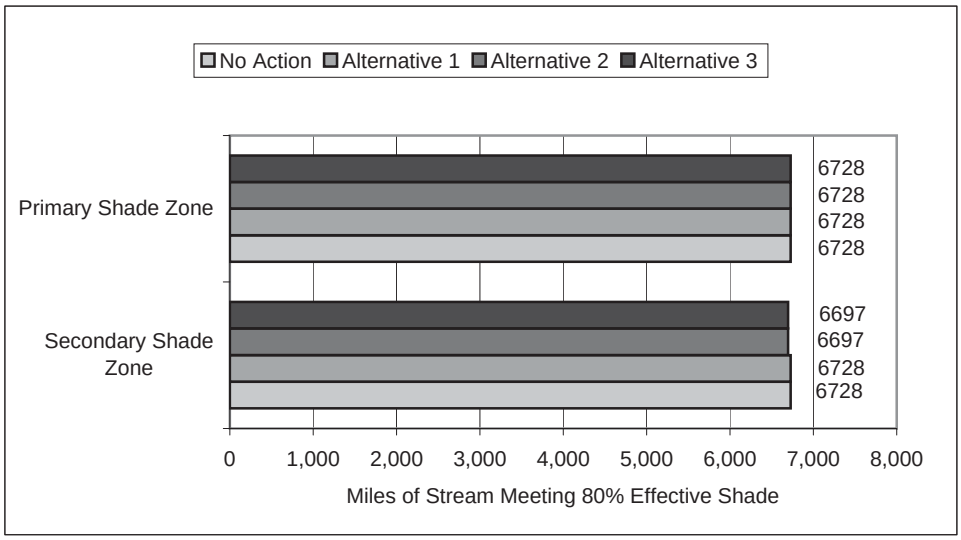


Under Alternatives 2 and 3, salvage for safety or operational reasons would have no effect because it would be limited to incidental trees, which would be similar to random tree mortality.

There are 31 miles of perennial streams on BLM-administered lands adjacent to the Coquille Forest, which include 10 miles within the East Fork Coquille watershed and 20 miles within the Middle Fork Coquille Watershed. Under Alternatives 2 and 3, trees in the primary shade zone would be fully retained. The secondary shade zone, however, would have varying amounts of tree retention. This would decrease the effective shade by 10 to 20% and result in a probable temperature change of up to 1ºF per mile. This would be outside the range of natural variability. See the *Water* section in *Chapter 3*. The East Fork of the Coquille River and the Middle Fork of the Coquille River are listed for the water quality parameter of temperature. The Oregon Department of Environmental Quality is scheduled to complete a total maximum daily loads (TMDL) in 2007.

See *Figure 269 (Number of miles along streams that are maintaining 80% effective shade within the primary and secondary shade zones)* for the minimal difference between the alternatives when considering the retention of effective shade along streams. Under Alternatives 2 and 3 there would be 31 miles of stream that would not maintain effective shade in the secondary shade zone.

Figure 269. Number of miles along streams that are maintaining 80% effective shade within the primary and secondary shade zones



Certain assumptions were used in analyzing the effects on stream temperature caused by the alternatives. They include:

- Treatments within the primary and secondary shade zones within the riparian management areas for all four alternatives would normally be well distributed in such a way that no more than 5% of the riparian areas along perennial streams would be treated within a watershed in any 10 year period.
- Within the riparian management areas under the No Action Alternative, Alternative 1, and the secondary shade zone under Alternatives 2 and 3, no more than one half of the riparian areas that are providing shade to perennial streams would be thinned, because of the physical limitations in the ability to harvest these areas.
- The overhanging vegetation that provides stream shade is decreased when floods cause bank undercutting that results in the subsequent falling of trees. Under Alternatives 2 and 3, the retention of trees in the primary shade zone would result in a high density of trees adjacent to streams, which would lessen the loss of stream shading.

Riparian-Wetlands on East-Side Management Lands

The Medford District and Klamath Falls Resource Area contain rangeland riparian-wetland systems, such as streams, marshes, wet meadows, and spring/seep areas occur. These riparian-wetland habitats may include shade producing woody vegetation such as willows and cottonwoods, or pinyon-juniper woodlands. Other riparian systems do not have the potential for woody vegetation and are dominated by grasses or shrubs and provide limited shade. A full discussion of these riparian systems is contained in the Klamath Falls Resource Area Resource Management Plan and Environmental Impact Statement (1994). This environmental impact statement is incorporated by reference.

The BLM expresses the status of riparian-wetland areas in terms of properly functioning condition and ecological status. Functioning condition is an important measure of the health of riparian-wetland conditions. Riparian management is designed to improve properly functioning condition (see the *Water* section in *Chapter 2*)

To limit solar radiation exposure during the summer months, under all alternatives, riparian-wetland communities would be managed for an upward trend, where ecologically appropriate. Depending on vegetation species height, density, width and physical aspects of the riparian-wetland area, a wide range of effective shade levels would result. For stream systems, width and depth, bank stability, and frequency of floodplain inundation would be related to the vegetative condition to determine an upward trend.

Mitigation

Mitigation could be applied to maintain 80% of the effective shade in the secondary shade zone on BLM-administered lands adjacent to the Coquille Forest. This would consist of managing the BLM-administered lands adjacent to the Coquille Forest to retain at least 50% of the canopy cover in the secondary shade zone (60 to 100 feet from stream) after harvesting.

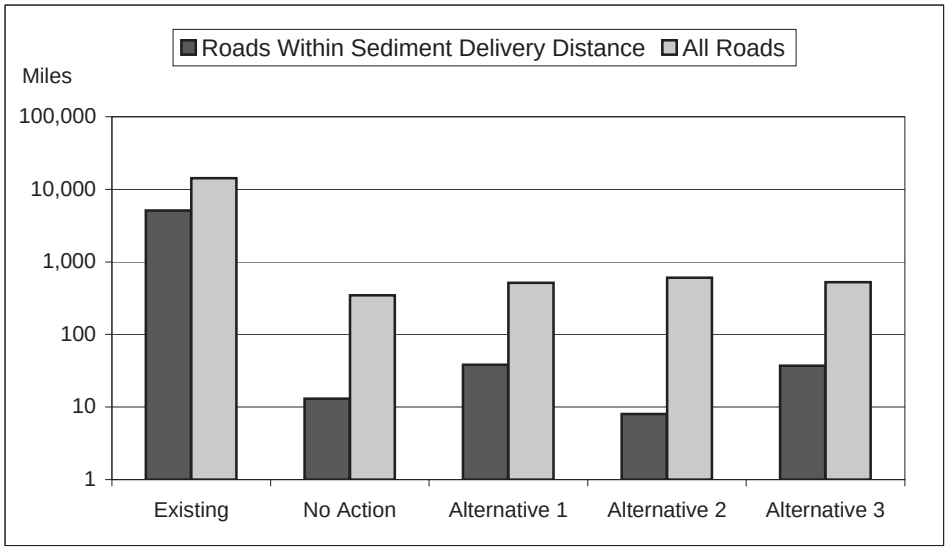
Fine Sediment Delivery

The delivery and routing of fine sediment is a natural part of stream systems. There is a wide variability in the natural rates of fine sediment production, which varies from 34 to 344 tons per square mile per year for undisturbed mountainous basins (Reid 1981). The principal sources of fine sediment are landslides, debris flows, bank erosion, and trees toppled by wind and animal burrows. See the *Water* section in *Chapter 3*.

Overland flow is seldom observed in the Pacific Northwest because forest soils have high infiltration capacities. Roads, however, shed more water overland because their hardened surfaces have low infiltration capacities. Therefore, roads that are within a delivery distance to streams become the primary sites in the

Pacific Northwest for mobilizing chronic fine sediment to those streams. See the *Water* section in *Chapter 3*. See *Figure 270 (Projected new permanent BLM road miles contributing to fine sediment delivery)* for a comparison of existing roads to the new roads that would be constructed under the alternatives. Note that the graph uses a logarithmic scale.

Figure 270. Projected new permanent BLM road miles contributing to fine sediment delivery



Under all four alternatives, new roads would be located outside of stream influence zones, where possible, and therefore would most likely would not deliver fine sediment to streams channels. See the *Water* section in *Chapter 3*. During the next 10 years under all four alternatives, roads outside of stream influence zones would average 90% of the total new road construction.

See *Table 212 (Potential delivery of fine sediment by roads under the alternatives)* for the results for road segments that could contribute to fine sediment delivery over the next 10 years under each alternative. The current condition is shown for comparison.

Table 212. Potential delivery of fine sediment by new roads constructed by 2016 under the alternatives

Current Condition and Condition under the Alternatives by 2016	Roads Within Fine Sediment Delivery Distance (miles[2])		Potential Fine Sediment Delivery (tons/year[3])		Watershed Average Potential Fine Sediment Delivery (tons/sq. mile/year [3])	
Current Condition						
Existing Roads[1]	BLM	Other	BLM	Other	BLM	Other
Natural	1,738	15,874	23,050	233,054	0.86	8.75
Aggregate	2,590	22,938	28,938	30,765	1.09	1.15
Paved	767	2,436	8,277	33,807	0.31	1.27
Totals	5,096	21,249	60,265	297,626	2.26	11.17
No Action Alternative						
New Roads (by 2016)[4]						
Natural	5.5		154		<0.01	
Aggregate	7.4		202		<0.01	
Paved	0.0		0		0	
Totals	12.9		356		0.01	
Alternative 1						
New Roads (by 2016)[4]						
Natural	9.6		251		0.01	
Aggregate	28.8		705		0.03	
Paved	0		0		0	
Totals	38.4		956		0.04	
Alternative 2						
New Roads (by 2016) [4]						
Natural	2.9		87		<0.01	
Aggregate	5.4		112		<0.01	
Paved	0		0.		0	
Totals	8.3		199		<0.01	
Alternative 3						
New Roads(by 2016) [4]						
Natural	10.4		282		0.01	
Aggregate	26.9		624		0.02	
Paved	0		0		00	
Totals	37.3		906		0.03	

[1]The BLM includes the BLM-controlled roads and the private roads within the planning area from BLM GIS GTRN (roads) coverage.
[2]Delivery distances include the road segments within 200 feet of stream channels, where ditchflow carrying fine sediment could enter streams.
[3]The calculations for these planning criteria estimates were calculated by surface type for each fifth-field watershed and summed for the planning area.
[4]New roads include BLM new roads only. Information is not available to predict the number of miles of new roads on other lands.

Under the No Action Alternative, there would be 12.9 miles of permanent new roads constructed with natural or aggregate surfaces within a sediment delivery distance over the next 10 years. These new roads would occur in 25% of the 185 fifth-field watersheds where the BLM has ownership. No permanent paved roads, however, are planned.

Under Alternative 1, there would be 38.4 miles of permanent new roads constructed with natural or aggregate surfaces within a sediment delivery distance over the next 10 years. These new roads would occur in 34% of the 185

fifth-field watersheds where the BLM has ownership. No permanent paved roads, however, are planned.

Under Alternative 2, there would be 8.3 miles of permanent new roads constructed with natural or aggregate surfaces within a sediment delivery distance over the next 10 years. These new roads would occur in 12% of the 185 fifth-field watersheds where the BLM has ownership. No permanent paved roads, however, are planned.

Under Alternative 3, there would be 37.3 miles of permanent new roads constructed with natural or aggregate surfaces within a sediment delivery distance over the next 10 years. These new roads would occur in 29% of the 185 fifth-field watersheds where the BLM has ownership. No permanent paved roads, however, are planned.

Under all four alternatives over the next 10 years, the potential fine sediment delivery from new permanent roads would be less than 1,000 tons per year, which is 0.3% of the 358,000 tons per year of sediment delivery from existing roads.

When averaging the watersheds for the next 10 years, the potential fine sediment delivery from new permanent roads would be 0.03 tons per square mi per year, which is less than 1% of the 13.43 tons per square mi per year of sediment delivery from all existing roads.

Alternatives 1 and 3 would have potential fine sediment yield that are similar, while the No Action Alternative and Alternative 2 would be slightly lower, because fewer roads within a sediment delivery distance of streams would be constructed. Under all four alternatives, 66 to 88% of fifth-field watersheds with BLM-administered lands are not projected to have new BLM permanent roads constructed within a sediment delivery distance of streams.

Under all four alternatives, best management practices would be applied (see *Appendix I. Water*) and are assumed to maintain or improve water quality. The best management practices include methods that limit the delivery of sediment to streams. These practices are applied during such management activities as timber harvesting, road maintenance and construction, road decommissioning, energy and mineral development, and fuel treatments.

Some of the best management practices that are related to roads include:

- Reducing the number of new road and reducing the stream fine sediment delivery points.
- Any new stream crossings would have sufficient cross drains commensurate with road slopes.
- Road systems improvements would reduce the flow of concentrated water and entrainment of fine sediment in roadside ditches by increasing drainage relief.

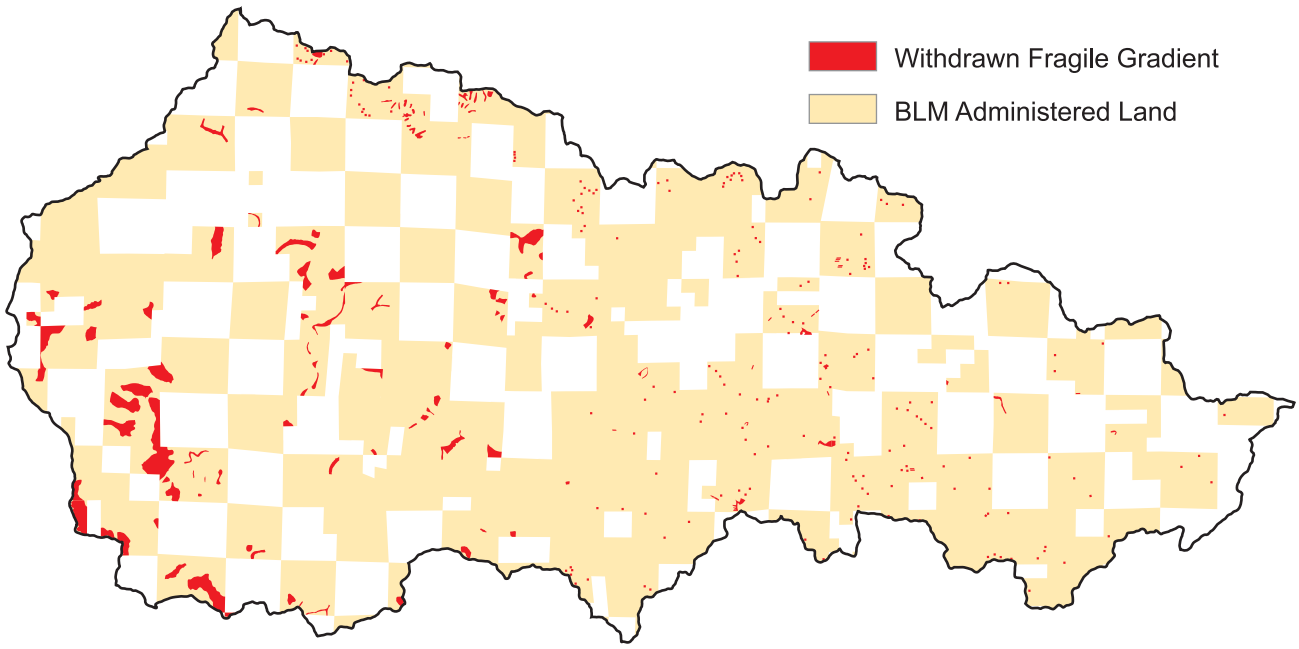
- Road restoration actions where roads are permanently decommissioned would disconnect road flow paths from streams.

Under all four alternatives, it is assumed that the decommissioning of existing roads would be completed within streamside areas in the same proportion as other roads. It is assumed that 550 miles of roads would be decommissioned in the next 10 years based on the level of activity in the last decade. *Table 212* shows that 5,096 miles (36%) of the BLM's roads occur within a sediment delivery distance out of the 14,273 miles (see the *Water* section of *Chapter 3*) of BLM or BLM-controlled roads. On a proportional basis, it is estimated that 200 miles of streamside roads would be substantially improved or decommissioned.

Over the next 10 years, it is estimated that approximately 8 to 38 miles of new permanent roads would be constructed that would be within a sediment delivery distance. Given the projections for both new roads and decommissioned roads within a sediment delivery distance of streams, there would be a net decrease of approximately 160 to 190 miles of roads contributing fine sediment to stream channels.

Over 89,937 acres of fragile BLM-administered lands within the planning area (3.5% of the BLM-administered lands) have been permanently withdrawn from forest management under the timber productivity capability classification (TPCC) system due to landsliding concerns. This includes very steep slopes, skeletal soils and rock outcrops, waterlogged soils, or other fragile landforms. See *Figure 271 (Timber productivity capability classification withdrawals within the Upper Smith River representative watershed).*

Figure 271. Timber productivity capability classification withdrawals within the Upper Smith River representative watershed



Under all four alternatives, the rate of susceptibility to shallow landsliding from timber harvests and road construction over the next 10 years would not increase. This is because fragile soils that are susceptible to landsliding are either currently withdrawn or would be withdrawn under the timber productivity capability classification system when identified during field work that is associated with site-specific project planning. This would include areas in all land use allocations. All four alternatives would include best management practices for road construction, which include the avoidance of headwalls, old slump benches, weak geologic bedding planes, seeps, and steep channel-adjacent side slopes.

Under all four alternatives, broadcast burning for site preparation after harvesting would involve higher fuel loadings, longer duration, and higher intensity fires compared to underburning in a thinned stand. Approximately 50% of the regeneration harvest units would be broadcast burned. There are intervening riparian management areas between regeneration harvest units and stream channels under all four alternatives, except for a portion of the intermittent stream channels under Alternative 2. Unburned areas close to streams within riparian management areas would act as an effective filter strip and prevent sediment delivery. See the *Water* section of *Chapter 3*. Under Alternative 2, approximately 200 acres per year of broadcast burning would occur along 33 miles (less than 0.5% of the total BLM intermittent stream miles) of nondebris flow non-fish-bearing intermittent stream channels. There would be widely distributed short-term sediment delivery for up to one year while new groundcover vegetation is being established.

Fine sediment from short-term soil loss would be delivered to streams when burning within riparian areas to reduce fuel hazard loadings or for restoration purposes. The amount of fine sediment delivery would depend on the residual vegetation, organic material and duff, soil organic matter, site roughness, soil type, and slope steepness. Fuel prescriptions would require low-intensity, short-duration burns and only where fuel loads are light (up to 12 tons per acre) under favorable moisture and weather conditions. Residual vegetation, unburned debris, and surface duff would be retained with an objective that no more than 5% of bare soil would be exposed where soil material could be detached. This residual groundcover would effectively trap and retard the movement of fine sediment toward stream channels. Additional best management practices would be applied within and between watersheds including the limiting of fire ignition within riparian management areas and distributing treatment areas. Fine sediment inputs to stream channels would last for no more than one year due to rapid establishment of grasses, forbs, and shrubs.

Under all four alternatives, there would be 77 acres in the open off-highway vehicle use designation. This is within the Heceta Dunes Area of Critical Environmental Concern. This area contains windblown shifting sand with no watercourses involved. Therefore, no impact to the water resource is expected. Under the three action alternatives, the number of areas that are open to off-highway vehicle use

would decrease by 330,000 acres. Under the three action alternatives, 2.4 million acres (93%) of BLM-administrated lands within the planning area would be designated as limited to designated roads and trails for off-highway vehicle use. This is an increase from 1.1 million acres under the No Action Alternative. Limiting off-highway vehicle use to designated roads and trails would have a benefit to the maintenance of water quality by controlling open area disturbances in erodible soils, and near or within stream channels or waterbodies.

The grazing of cattle along rangeland streams would contribute contaminants to water (fine sediment and bacteria) and elevate stream temperatures. The standards for rangeland health (1997), particularly standard II (for riparian area function) and standard IV (for water quality) would be achieved at the earliest possible date, or when permits or leases are renewed.

Under all four alternatives, the general guidelines for grazing management and best management practices for water quality would be expected to meet the proper functioning condition of streams and water quality standards in the long term. These measures would include:

- Providing adequate cover and plant community structure to promote stream bank stability, debris and fine sediment capture, and floodwater energy dissipation in riparian areas.
- Maintaining or restoring plant communities to promote photosynthesis throughout the growing season.
- Completing range improvements including riparian pasture fencing, development of off-stream watering, and the relocation of animal holding facilities away from riparian areas (see the *Grazing* section in this chapter).

There are 80 source water watersheds within the planning area. The potential contaminant sources that would impact the surface water have been identified as part of the Oregon Department of Environmental Quality Source Water Assessments. See the *Water* section of *Chapter 3*. Potential water quality impairment sources under all four alternatives would include: regeneration harvest units, road and stream crossings, river recreation, transmission lines, grazing animals, and quarry operations.

Under all four alternatives, the riparian reserves or riparian management areas would be established and best management practices (see *Appendix I. Water*) would be applied during management activities. These land use allocations and best management practices would maintain or improve water quality in source water watersheds.

Fire and Fuels

This analysis examines how the alternatives would affect fire severity and fire hazard on all BLM-administered lands; and fire resiliency in the Medford District and Klamath Falls Resource Area.

Key Points

- In the Salem, Eugene, Coos Bay, and Roseburg Districts, compared to the current condition, all alternatives would reduce the fire hazard and would reduce the acres of high severity fire when wildfires occur.
- In the Medford District, compared to the current condition, all alternatives would reduce the fire hazard and would decrease the acres of high severity fire when wildfires occur. The No Action alternative would result in the largest decrease and Alternative 2 would result in the smallest decrease.
- In the Klamath Falls Resource Area, compared to the current condition, the No Action Alternative and Alternative 3 would reduce the fire hazard and the acres of high severity fire when wildfires occur. Alternatives 1 and 2 would increase the fire hazard and would increase the acres of high severity fire when wildfires occur.
- In the Medford District and Klamath Falls Resource Area, the No Action Alternative and Alternative 3 would increase fire resiliency from current conditions. Alternatives 1 and 2 would decrease fire resiliency.
- In the Medford District and Klamath Falls Resource Area, the No Action Alternative, Alternative 1, and Alternative 2 would create stand establishment and young stands consisting of even-aged plantations, which would be highly susceptible to stand-replacing crown fires. Alternative 3 would reduce crown fire hazard.

Under all alternatives, fuels treatments to reduce fire hazard in areas other than timber sale units would occur on approximately 110,000 acres per decade. The majority of these treatments will occur in the Medford District and Klamath Falls Resource Area.

The analysis of fire and fuels divides the planning area into two areas:

- The Salem, Eugene, Coos Bay, and Roseburg districts (the North), which generally have a low frequency/high severity fire regime; and
- The Medford District and Klamath Falls Resource Area (the South), which generally have a high frequency/low severity fire regime.

Fire severity and hazard are of particular concern in the Wildland Urban Interface. The Wildland Urban Interface constitutes the majority of BLM-administered acres in most of the planning area, and the trends described here would be reflected within the Wildland Urban Interface.

Fire severity, hazard, and resiliency can generally be equated to broad descriptions of vegetation conditions. This analysis uses the standard 13 fuel models (Andersen 1982), which are assigned to the forest structural stage classifications. However, fire severity, hazard, and resiliency are also influenced by site-specific or stand-specific factors, which are evaluated qualitatively in this analysis. Environmental conditions such as temperature, wind, and relative humidity can cause extreme variations in fire behavior within the fuel models. See the *Fire* section of *Chapter 3* for additional discussion of weather, risk, hazard and ignition patterns and how they contribute to fire hazard and severity.

Fire severity is a function of both ground and surface fuel loading. As a young forest develops into a mature forest, the fire severity drops from high to low. As a mature forest develops into a structurally complex forest, fire severity changes to a mixed severity rating, as both ground fuels and surface fuels increase. Very heavy amounts of ground and surface fuels increase the probability of a crown fire, which would occur under extreme conditions (weather that exceeds the 90th percentile). Weather factors that influence fire behavior are temperature, relative humidity, and wind speed. On a 10-year average, extreme fire weather conditions occur:

- 0-2 days a year in coastal areas,
- 2 to 11 days in the Willamette Valley and the Central Cascades, and
- Greater than 11 days in the south. (ODF Hazard and Risk Assessment 2005).

Under moderate and extreme conditions, the primary source of high severity fire would be in the stand establishment and young forest structural stage classifications that consist of even aged plantations. Under extreme conditions, the structurally complex forest structural stage classification would also burn with high severity.

In the stand establishment and young forest structural stage classifications in the North, slash levels created by timber harvest have a strong influence on fire behavior. In the stand establishment and young forest structural stage classifications in the South, live vegetation has more of an influence on fire behavior.

Slash levels would be highly variable, depending on site-specific conditions such as:

- pre-harvest stand condition and composition,
- harvesting methods,
- timber merchantability standards, and
- market prices.

Post-harvest slash treatment can greatly reduce slash levels. Because slash levels cannot be predicted at this scale of analysis, the effect of slash on fire severity and hazard is evaluated qualitatively.

For analysis purposes, it is assumed that in the North, approximately half of the acreage within regeneration harvest units would receive slash treatment, and thinning units would not receive slash treatment. For analysis purposes, it is projected that 90% of harvest units would receive some form of slash treatment in the south. The remaining 10% would not have enough slash to require treatment. The assignment of structural stages to fire severity and hazard levels reflects the severity and hazard of surface fires. At this scale of analysis, it is not possible to categorize the structural stages by crown fire hazard, or otherwise quantitatively evaluate crown fire hazard. The hazard of crown fire depends in large part on site-specific stand conditions such as height to live crown and canopy density which cannot be modeled at this scale of analysis. Therefore, the analysis qualitatively evaluates crown fire hazard based on the amount and types of stand treatments and the expected stand conditions that would result from treatment.

Fire resiliency depends in part on some of the same site-specific factors as crown fire hazard. However, surface fuels and the presence of large trees also affect fire resiliency, and these factors

can be reflected in assignment of structural stages to fire resiliency levels as shown in *Table 213* (*Principles of fire resiliency*) and *Table 214* (*Fire severity, hazard, and resiliency by forest structural stage classifications*).

Table 213. Principles of fire resiliency

Structure Class	Principle	Effect	Advantage	Concern
Young & stand establishment with legacy	Large legacy trees reduce probability of mortality to stand	Low crown bulk density in overstory	Separation of crown between legacy and Young & stand est. Reduces crown fire potential in legacy	Surface wind may increase and surface fuels may be drier
Mature	Low surface fuels High height to live crown	Reduced flame length. Requires longer flame length to initiate torching	Control easier Less torching	Surface disturbance is less with fire than with other techniques
Mature, structurally complex	Large trees	Thicker bark and taller crowns	Increases probability of trees surviving	May accumulate heavy ground and surface fuels

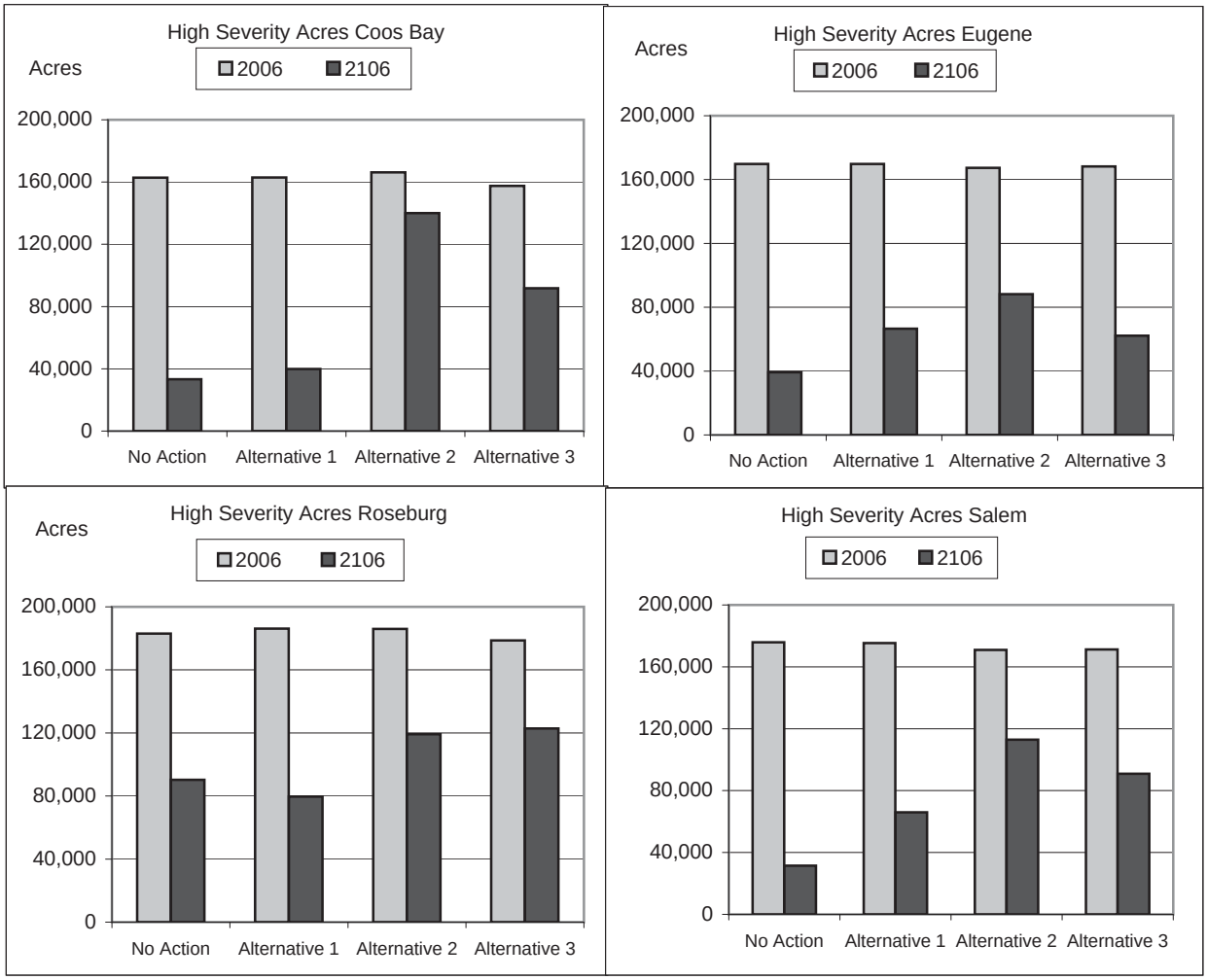
Table 214. Fire severity, hazard, and resiliency by forest structural stage classifications

Structure class	Severity	Hazard	Resiliency
Stand Establishment without Structural Legacies; and Young without Structural Legacies	High	High	Low
Stand Establishment with Structural Legacies; and Young with Structural Legacies	High	High	Moderate
Mature	Moderate	Moderate	Moderate
Structurally complex	Mixed	Moderate	Moderate

Fire Severity and Hazard in the North

Over the next 100 years, all alternatives would reduce fire severity and hazard in the North, because all alternatives would reduce the combined abundance of the stand establishment and young forest structural stage classifications. The reductions in acres susceptible to high severity fire during wildfires and reduction of fire hazard would vary among districts. The No Action Alternative and Alternative 1 would result in the largest decrease and Alternative 2 would result in the smallest decrease as shown in *Figure 272* (*High fire severity for northern districts by alternative).*

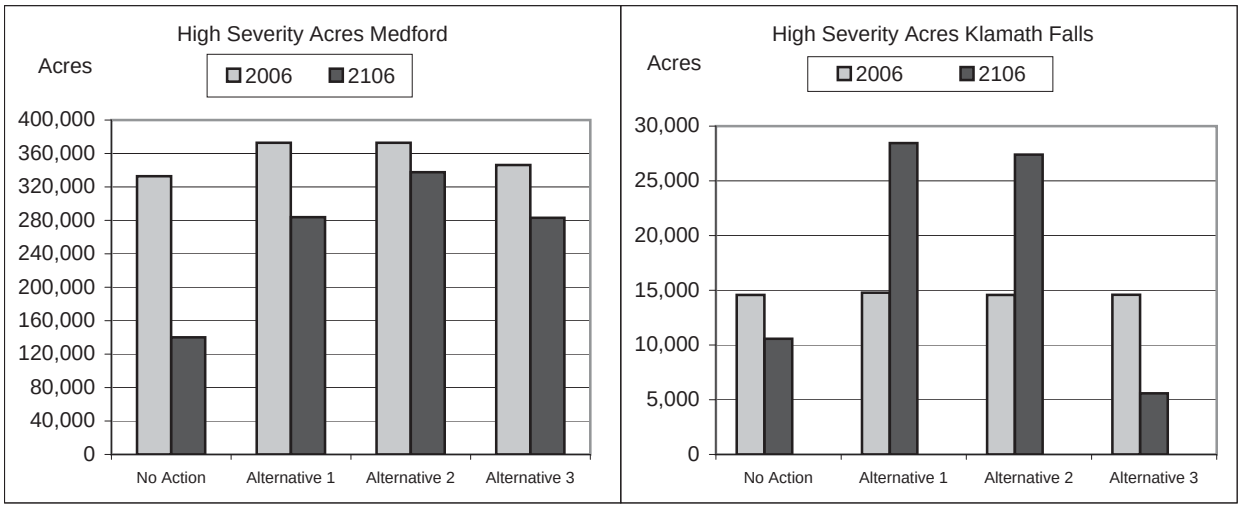
Figure 272. High fire severity for northern districts by alternative



Fire Severity, Hazard, and Resiliency in the South

Over the next 100 years, fire severity and hazard would decrease in the Medford District under all alternatives, but the amount of decrease would vary widely among the alternatives. The amount of decrease is relative to the reduction in acreage of the stand establishment and young forest structural stage classifications compared to the current condition. The No Action Alternative would result in the most decrease, reducing the acres of high severity fire when wildfires occur and fire hazard to less than half of the current condition in 100 years. Alternative 2 would have the least decrease, maintaining the acres of high severity fire when wildfires occur and fire hazard at only slightly less than the current condition. See *Figure 273* (*High fire severity for southern districts by alternative*).

Figure 273. High fire severity for southern districts by alternative.



Fire severity and hazard would increase in the Klamath Fall Resource Area under Alternatives 1 and 2, and would decrease under both the No Action Alternative and Alternative 3. As in the Medford District, the change in fire severity and hazard would be generally consistent with the change in the acreage of the various structural stages. Under Alternative 3, the application of repeated partial harvests would create a large number of acres in the stand establishment forest structural stage classification in the Klamath Falls Resource Area. In the Klamath Falls Resource Area, it is common practice to manage understory vegetation with every entry thus eliminating dense buildups of ladder fuels normally associated with even aged plantations. This modification of fuel levels will reduce the likelihood of high severity fires under Alternative 3.

The following assumptions were used in projecting fire resiliency and fire severity under Alternative 3 in the Medford District and Klamath Falls Resource Area:

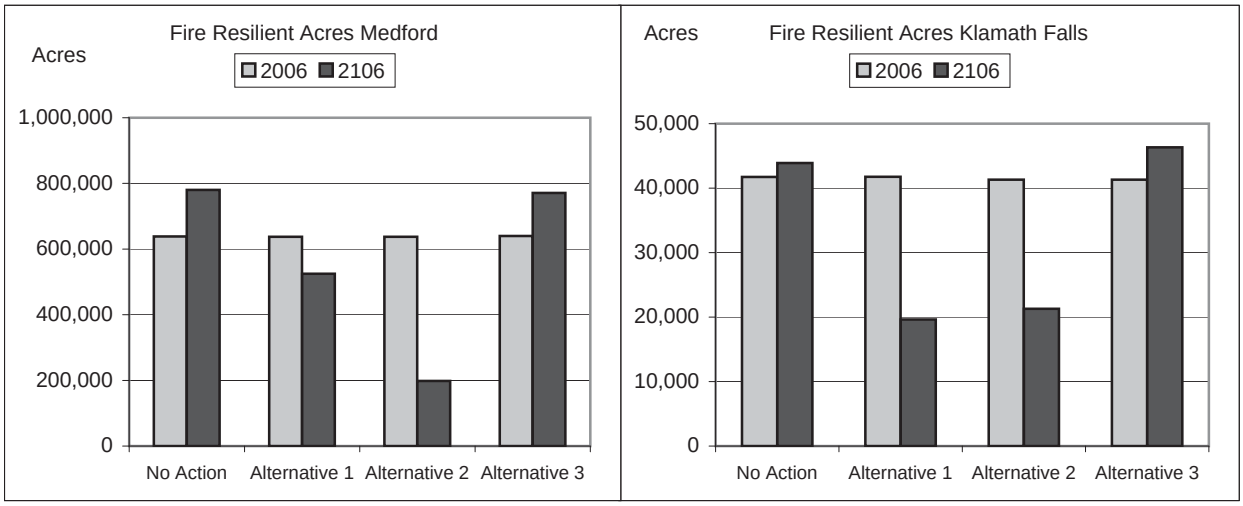
- Thinning or partial harvest would occur across all structure stage classifications
- Small patches of group selection would occur that would not retain legacy trees

- Legacy trees would be retained under a variable spacing and not clustered around the edges of regeneration units
- Legacy trees will be a minimum of 16 inches in diameter
- There will be a vertical separation between the canopies of the legacy trees and the understory of the stand establishment and young forest structural stage classifications.
- Understory thinning would occur
- Surface fuels would be treated whenever a management action occurs that would increase existing surface fuel loads

Although surface fire hazard can be quantified through an analysis of the change in the amount of acres in the structural stage classifications, such a quantified comparison of crown fire hazard is not possible. Although the crown fire hazard cannot be analyzed quantitatively, there would be differences between the alternatives. The stand establishment and young forests created under the No Action Alternative, Alternative 1, and Alternative 2 would consist of even-aged plantations, which would be highly susceptible to stand-replacing crown fires. This would maintain or increase the crown fire hazard in the South. While Alternative 3 would also create stand establishment and young forests, there would be less crown fire hazard as a result of the use of partial harvest or uneven-aged management. Alternative 3 would increase the tree height to live crown ratio, create multiple-storied canopies with gaps, reduce canopy bulk density, and treat both surface and ladder fuels. All of these actions would decrease fire severity and increase fire resiliency. Any increase in wind or reduction of fuel moistures created by opening the canopy in the partial harvests would likely be offset by a reduction in fire severity and an increase in fire resiliency (Agee and Skinner, 2005). As a result, Alternative 3 would be the only alternative that would reduce crown fire hazard.

In both the Medford District and Klamath Falls Resource Area, the No Action Alternative and Alternative 3 would increase the acreage of fire resilient forest from current conditions, because they would create forests with structural legacies. See *Figure 274* (*Fire resiliency by district by alternative*).

Figure 274. Fire resiliency by district by alternative



There is no threshold for the number of green trees needed to be retained during timber harvesting to create a fire resilient stand. In general, enough green trees need to be retained to materially alter the drying conditions of the stands. The greater the canopy retained, the less influence wind has on surface fire. This in turn reduces flame length which can lead to a reduction in mortality. (Fire Behavior Field Reference Guide: NFES 2224). The cover above ground fuels is assigned to one of the following categories: fully sheltered, partially sheltered, and unsheltered. A wind reduction factor is assigned to each category:

> ***Fully sheltered fuels*** are defined as: fuel sheltered beneath standing timber on flat or gentle slopes or near the base of a mountain with steep slopes. Fully sheltered is subdivided into dense and open stands. Dense stands receive a wind reduction factor of 0.1 to reduce 20 ft wind speeds. Open stands receive a wind reduction factor of 0.2.
>
> ***Partially sheltered fuels*** are defined as: Fuels beneath patchy timber where it is not well sheltered, fuel beneath standing timber at midslope or higher with a wind blowing directly at the slope. Partially sheltered fuels receive a wind reduction factor of 0.3.
>
> ***Unsheltered fuels*** are defined as fuels that are directly exposed to the wind – no overstory or sparse overstory, fuel beneath timber near clearing or clearcuts. The wind reduction factor ranges from 0.4 to 0.6 for these fuels.

Frequent surface fires tend to favor the largest trees with the thickest bark (Hessburg et al. 2005). Large diameter trees (greater than 16 inches in diameter) have greater resistance to mortality from bole and crown scorch. The information in *Table 215* (*Probability of mortality by tree diameter in an extreme event*) was generated using the mortality module from the Behave Plus model under extreme burning conditions. This table shows expected mortality during a wildfire by diameter class and species. A lower probability of mortality equates to greater fire resiliency. Although this table does not address the

number of trees needed to create a fire resilient stand, it gives an indication of the size and species of trees that need to be retained.

Table 215. Probability of mortality by tree diameter in an extreme fire event

Medford, Douglas fir			Klamath Falls, Ponderosa		
	Tree Diameter in inches	**Probability of Mortality**		**Tree Diameter in inches**	**Probability of Mortality**
	10	71		10	25
	15	49		15	12
	20	34		20	7
	25	24		25	4
	30	18		30	3
	35	15		35	2
	40	13		40	2

Alternatives 1 and 2 would decrease the acres of fire resilient forest from current conditions, because they would create forests without green tree structural legacies which have lower fire resiliency compared to forests with such structural legacies.

Although the No Action Alternative would increase the acres of fire resilient forest similar to Alternative 3, other aspects of fire resiliency would differ from Alternative 3. Similarly to Alternatives 1 and 2, the No Action Alternative (similar to Alternatives 1 and 2) would create stand establishment and young forests, consisting of even-aged plantations, that would be highly susceptible to stand-replacing crown fires.

The increased crown fire hazard under the No Action Alternative would partially offset the increase in fire resiliency from the retention of green tree structural legacies. The increased crown fire hazard under Alternatives 1 and 2 would exacerbate the reduction in fire resiliency (resulting from stand establishment and young forests that lack green tree structural legacies). Alternative 2 would have the greatest reduction in fire resiliency by creating the largest number of acres of forest without such green tree structural legacies combined with high crown fire hazard.

Mitigation

The following mitigation measures could be used to increase fire resilience and reduce crown fire hazard under Alternatives 1 and 2:

- Increase initial plantation spacing to reduce the need to thin and reduce the amount of slash that would require fuels treatment.
- Treat surface fuels whenever management actions (such as thinning) would increase existing surface fuel loads

Air

This analysis examines the affects of prescribed burning and wildfire on air quality that would result from the alternatives.

Key Points
Under all four alternatives, prescribed burning would be accomplished under the Oregon Smoke Management Plan to protect air quality, Class 1 visibility areas, and air quality maintenance areas.

Prescribed burning for the purpose of hazardous fuels treatments and site preparation is the only management action under the alternatives that would have a notable effect on air quality. This effect would be largely at the local level because prescribed burning would be implemented in accordance with the Oregon Smoke Management Plan. The Oregon Smoke Management Plan minimizes smoke impacts on local communities and directs smoke away from designated areas. See the *Air* section in *Chapter 3*.

The amount of acres that are burned by prescription for the purpose of hazardous fuels treatment (not due to timber harvesting) would not vary by alternative, therefore emissions production from this source would remain constant across all four alternatives. Emissions predictions are based on the number of acres treated and the tons of slash per acre. It is estimated that:

- The Medford District and the Klamath Falls Resource Area of the Lakeview District would produce 3,257 tons of PM10 material per year.
- Hazardous fuels treatments in Salem, Eugene, Roseburg, and Coos Bay districts would have minimal effects on air quality.

The amount of emissions from slash treatments after timber harvesting activities do vary by alternative. See *Table 216 (Prescribed burning emissions from timber harvesting activities in the northern and southern BLM districts within the planning area)* for the PM10 emissions under the alternatives.

Table 216. Prescribed burning emissions from timber harvesting activities in the northern and southern BLM districts within the planning area

BLM Districts	PM10 Emissions (tons/year)			
	No Action Alternative	Alternative 1	Alternative 2	Alternative 3
Northern (Salem, Eugene, Roseburg, and Coos Bay)	3,443	4,090	7,414	3,979
Southern (Medford and the Klamath Falls Resource Area of the Lakeview District)	2,004	3,094	3,137	3,138

Under the No Action Alternative, the PM10 emissions from postharvesting prescribed burning in the northern districts would be 3,443 tons per year, while the emissions in southern districts would be 2,004 tons per year

Under Alternative 1, the PM10 emissions from postharvesting prescribed burning in the northern districts would increase by 647 tons per year over the No Action Alternative, while the emissions in the southern districts would increase by 1,090 tons per year over the No Action Alternative.

Under Alternative 2, the PM10 emissions from postharvesting prescribed burning in northern districts would increase by 3,971 tons per year over the No Action Alternative, while the emissions in the southern districts would increase by 1,133 tons per year over the No Action Alternative.

Under Alternative 3, the PM10 emissions from postharvest prescribed burning in the northern districts would increase by 450 tons per year over the No Action Alternative, while the emissions in southern districts would increase by 1,134 tons per year over the No Action Alternative.

The prediction of the amount of emissions from future wildfires is speculative. A broad generalization can be made, however, that wildfire emissions are roughly double those from the fires of prescribed burns (Huff 1995). The emissions from recent large wildfires in southwest Oregon in 2002 are discussed in the Timbered Rock environmental impact statement. The Timbered Rock fire resulted in 12,000 tons of PM10 emissions. The discussion of wildfire emissions in the Timbered Rock environmental impact statement is incorporated by reference (USDI, BLM 2004b pp. 3-168 through 3-171).

Although the prediction of the location and magnitude of wildfires is speculative, the amount of wildfire emissions that has occurred over the past 10 years provides a reasonable index of what could occur in the future. Because wildfires and prescribed burns do not usually occur at the same time, there would be no cumulative effect of the emissions from these two sources.

The health effects of smoke vary from the irritation of the eyes and respiratory tract to more serious disorders, including asthma, bronchitis, reduced lung function and premature death. Studies have found that fine particulate matter is linked (alone or with other pollutants) to a number of significant respiratory- and cardiovascular-related effects, including increased mortality and the aggravation of existing respiratory and cardiovascular diseases (Therriault 2001).

In addition, airborne particles are respiratory irritants, and laboratory studies (Therriault 2001) show that high concentrations of particulate matter cause persistent coughing, phlegm, wheezing, and physical discomfort in breathing. Particulate matter can also alter the body's immune system and affect the removal of foreign materials, such as pollen and bacteria, from the lungs (Therriault 2001).

The health threat from lower levels of carbon monoxide is the most serious effect for those who suffer from cardiovascular disease. At higher levels, carbon monoxide exposure can cause headaches, dizziness, visual impairment, reduced work capacity, and reduced manual dexterity. At even higher levels (seldom associated solely with wildfires), carbon monoxide can be deadly (Therriault 2001). People exposed to toxic air pollutants at sufficient concentrations and durations may have an increased chance of cancer or other serious health problems. However, in general, it is believed that the long-term risk from toxic air pollutants from the smoke of wildfires and prescribed burns is very low (Therriault 2001).

Recreation

This analysis examines the recreational demand and the quality of visitor experiences under each alternative as measured by the availability of recreational developments, recreational management areas, off-highway vehicle designations, and the variety of recreational settings.

Key Points

- All action alternatives would meet projected recreational demand and improve the quality of visitor experiences.
- The redesignation of off-highway vehicle areas under all action alternatives would improve off-highway vehicle opportunities, public safety, and visitor experiences compared to the No Action Alternative.
- In the Medford District, the addition of 10 off-highway vehicle emphasis areas under Alternative 2 would improve off-highway vehicle opportunities and would result in fewer visitor conflicts, thereby improving the quality of experiences for all visitors compared to the other alternatives.
- All action alternatives would continue to maintain a mix of recreation settings that provide a variety of opportunities and experiences for visitors.

All action alternatives would carry forward 206 existing recreation developments on BLM-administered lands, except for two day-use areas in the Coos Bay District that would be discontinued due to insufficient local demand. However, two new environmental education areas would be established in the Coos Bay District (see the *Recreation* section in *Chapter 2*).

Under all action alternatives, there would be no new recreation developments under any of the action alternatives. Existing developments would continue to support the increasing level of recreation use on BLM-administered lands. This is because visitors are not solely dependent on recreation developments for their recreation pursuits. For example, dispersed recreation uses (e.g., hunting, fishing, and sightseeing) do not require recreation developments.

It is, however, probable that visitors would experience localized crowding at certain existing recreation developments as demand for these sites increases. Although potential recreation developments are not included in the analysis of effects (since there is no certainty of their future development), a list of potential sites, trails, and byways is included under all action alternatives (see the *Recreation* section in *Chapter 2*). Future overcrowding could be offset by developing potential recreation sites.

Under all action alternatives, four new special recreation management areas would be designated and two existing special recreation management areas would be consolidated. In addition, the boundaries of nine special recreation management areas would be adjusted. As a result, there would be 31 special recreation management areas on BLM-administered lands in the planning area, for a total of 308,800 acres. This is an increase of 150,800 acres from the No Action Alternative. A majority of this change in acreage is a result of designating the Gerber Special Recreation Management Area (104,400 acres) in the Klamath Falls Resource Area and Tioga Special Recreation Management Area (34,000 acres) in the Coos Bay District. See the *Recreation* section in *Chapter 2* for information about individual recreation management areas for each BLM district by alternative.

The Row River Trail in the Eugene District is the only special recreation management area that would result in a measurable reduction in acreage under all action alternatives. This area would be reduced from 15,100 acres to 170 acres in order to focus recreation management on the trail corridor itself, rather than the entire Row River fifth-field watershed, as established under the No Action Alternative. Since intensive recreation management only occurs within the trail corridor, there would be no loss of existing opportunities or experiences for visitors.

Under all action alternatives, the overall increase in the number and total acres of special recreation management areas would improve the BLM's ability to provide quality visitor experiences. This is because special recreation management areas, by definition, are designed to provide specific recreation opportunities, experiences, and benefits to visitors. *See Appendix J. Recreation* for the planning frameworks that are designed to enhance the quality of visitor experiences within these special recreation management areas.

Under all action alternatives, 2.4 million acres (93%) of BLM-administered lands in the planning area would be designated as limited-to-designated-roads-and-trails for off-highway vehicle use. This is an increase from 1.1 million acres under the No Action Alternative. For the action alternatives, this change would reduce the amount of area open to off-highway vehicle use from 330,000 acres to 77 acres, and reduce the amount of area designated as limited-to-existing-roads-and-trails from 950,000 acres to 0 acres.

Under all action alternatives, there would also be an increase of 14,200 acres (less than 1% of the total land base) in areas that are closed to off-highway vehicle use compared to the No Action Alternative. This would bring the total amount of closed area to 98,800 acres. A majority of this increase in acreage is the result of closing off-highway vehicle use in three elk emphasis areas (the Bull Run Watershed Management Unit and the Mt. Hood Corridor in the Salem District, and the North Bank Habitat Management Unit in the Roseburg District). This small increase in closed area would not measurably affect off-highway vehicle opportunities when considering the overall planning area. It would, however, result in a loss of site-specific off-highway vehicle opportunities, while improving nonmotorized recreational experiences in these areas.

An improvement in nonmotorized recreational experiences is based on the assumption that motorized and nonmotorized activities have limited compatibility. This is especially true when high levels of both types of use are confined to the same area. For example, motorcycle riders and horseback riders using a narrow, single-track trail would likely result in visitor conflicts and safety concerns. Spatial segregation of these activities would reduce encounters, thereby improving the overall experience for visitors. This is also true of areas that are managed specifically for off-highway vehicle opportunities (e.g., designated trail systems and off-highway vehicle emphasis areas), which would also result in fewer visitor conflicts by deemphasizing nonmotorized recreation activities in these areas.

Under the action alternatives, a reduction of 330,000 acres of open areas would not result in a substantial loss of off-highway vehicle opportunities. This is because a majority of the open areas are located on steep, densely-forested terrain, which is not conducive to cross-country motor vehicle travel. (Only 7% of these lands are classified as nonforest habitat.) For this reason, off-highway vehicle use is primarily limited to existing roads and trails in these areas. These existing routes would continue to be available to off-highway vehicle use until route

designations are completed through subsequent transportation management plans. Some of these roads and trails would eventually be closed to off-highway vehicle use if warranted for resource or social concerns.

Under all action alternatives, the limited-to-designated-roads-and-trails off-highway vehicle area designation would increase off-highway vehicle opportunities and public safety and decrease visitor conflicts compared to the No Action Alternative. This would result from an increase in on-site management controls and other off-highway vehicle related developments that are associated with this designation type (e.g., improved signing, construction of parking areas with off-loading ramps, placement of stream crossing structures, and trail construction and maintenance based on standards for off-highway vehicle use).

Improving off-highway vehicle management under all action alternatives would primarily be accomplished through subsequent route designations, which would identify specific roads and trails to provide off-highway vehicle opportunities for the public. These routes would be improved or expanded to enhance visitor experiences or to meet increasing demand. Routes that are not designed or suitable for off-highway vehicle use (or are only compatible for certain types of motor vehicles) would be closed or restricted in order to reduce visitor conflicts and improve public safety.

Appendix J, Recreation includes interim off-highway vehicle management guidelines for the districts. They provide the basis for managing off-highway vehicle use until subsequent transportation management plans are completed.

Under the No Action Alternative, there are three off-highway vehicle emphasis areas in the Salem, Eugene, and Roseburg districts, totaling 34,200 acres. Under all action alternatives, these existing emphasis areas would be carried forward with some acreage adjustments.

In addition, under all action alternatives, a new off-highway vehicle emphasis area (Blue Ridge) would be designated in the Coos Bay District, for a total of 1,600 acres. This area currently provides a multiple-use, off-highway vehicle trail system for the public. The new emphasis area designation would improve the BLM's management of the area for off-highway vehicle use. This would result from an increase in off-highway vehicle related developments and management presence which would better accommodate off-highway vehicle riders.

Under all action alternatives, these small changes in off-highway vehicle emphasis areas in the BLM districts would not appreciably increase off-highway vehicle opportunities when considering the entire planning area, but it would improve local opportunities near Coos Bay and Eugene compared to the No Action Alternative.

Off-highway vehicle emphasis areas would only vary by action alternatives on the Medford District. Under the No Action Alternative, there are three existing off-highway vehicle emphasis areas on this district, totaling 25,600 acres. Under Alternative 1 and 3, none of these would be designated. Under Alternatives 2, all existing emphasis areas would be carried forward with some acreage adjustments and ten new ones would be designated.

Alternatives 1 and 3 would result in a mix of outcomes in the Medford District. Since off-highway vehicle emphasis areas neither allow nor prevent off-highway vehicle use of a particular area (that is only determined through the broader off-highway vehicle area designations of

open, limited, and closed), eliminating emphasis areas would simply diminish the BLM's more concentrated off-highway vehicle management approach of these areas. As a result, visitor conflicts and safety concerns would increase due to a lack of on-site management controls. Off-highway vehicle riders who prefer a more structured recreation experience (i.e., designed trails and other amenities) would be displaced to other areas that offer such an experience.

As with most recreation developments, information that is disseminated to the public about their presence typically result in higher levels of use. The loss of existing off-highway vehicle emphasis area designations under Alternatives 1 and 3 would likely reduce public awareness of these areas, leading to a gradual reduction in off-highway vehicle use over time.

Under Alternative 2, a total of 13 off-highway vehicle emphasis areas would be designated in the Medford District, for a total of 105,800 acres. This would result in a four-fold increase in acres of off-highway vehicle emphasis areas as compared to the No Action Alternative. All of these areas are currently receiving moderate to high levels of off-highway vehicle use. However, 10 of these areas are undeveloped and have limited management presence under the No Action Alternative.

By designating these areas as off-highway vehicle emphasis areas, there would eventually be an improvement in off-highway vehicle opportunities that would result from an increase in developments. This would result in more concentrated levels of off-highway vehicle use within these areas and likely cause a reduction in dispersed off-highway vehicle use on other Medford District BLM lands. It is assumed that dispersed off-highway vehicle use would decrease because riders would be attracted to greater opportunities within these developed emphasis areas.

Alternative 2 would result in a loss of nonmotorized recreation opportunities in the Medford District due to the larger portion of land that would be designated specifically for motorized recreation use (12% of the district's total land base). Since off-highway vehicle emphasis areas are specially managed to accommodate motorized recreational activities, visitors seeking nonmotorized forms of recreation would be dissuaded from using these areas. If they did engage in nonmotorized activities within these emphasis areas, the quality of their experiences would be diminished as a result of the limited compatibility of their activity with off-highway vehicle riders. In general, however, off-highway vehicle emphasis areas help segregate these user groups, resulting in an overall improvement in the quality of experiences for all visitors.

If management actions change the remoteness and naturalness aspects of the recreation setting of areas, then those actions can cause corresponding changes in the public use of those areas. This is because certain settings are more conducive to certain types of recreation activities and preferred by visitors who engage in them (see the *Recreation* section in *Chapter 3*). Since recreation use occurs on the BLM-administered lands that are managed for timber production, modifying these recreation setting characteristics could improve or diminish the BLM's ability to provide opportunities that contribute to meeting recreation demand and quality recreation experiences.

Visitors engage in a wide variety of recreation activities on BLM-administered lands, each with a unique combination of recreation setting preferences. See the *Recreation* section in *Chapter 3* for an illustration of the diversity of settings preferred by each activity.

These setting preferences are based on a combination of physical, administrative, and social setting characteristics. When these primary setting characteristics are combined together, they

establish the overall recreation setting of an area. However, this analysis only considers the physical setting characteristics of remoteness and naturalness, because they provide the most direct measure of timber management effects under each alternative.

The effects of future management actions on the levels of recreation demand are projected through 2016. A 10-year period is used because a reasonably accurate projection of road construction and recreation demand beyond 10 years is not possible. For recreation demand, this is due to the continually changing variables that influence outdoor recreation trends, such as regional demographics and new technologies.

Timber management actions that require new road construction do affect the level of remoteness of an area. Increasing the amount or improving the type of access into an area can lead to higher levels of certain types of use. Such changes can also displace certain types of visitors who preferred the area before access was modified. This dynamic relationship between recreation settings, recreation demand, and the distribution of recreation demand is the basis for analyzing the effects of alternatives (Clark and Stankey 1979).

The total amount of roads (including new road construction that would be projected to occur under the alternatives over the next 10 years) is used to classify levels of remoteness. This is done by buffering the different road types that occur on BLM-administered lands. *Table 217* (*Acres of remoteness levels by alternative)* shows the results of this classification process by alternative. This analysis does not consider the proximity of non-BLM roads located on adjacent lands, since they do not aid in the comparison of alternatives.

Table 217. Acres of remoteness levels by alternative

Alternative	Remoteness Level				
	Primitive (acres)	Back Country (acres)	Middle Country (acres)	Front Country (acres)	Rural (acres)
No Action Alt	8,000	463,000	1,735,000	279,000	70,000
Alternative 1	14,000	461,000	1,731,000	279,000	70,000
Alternative 2	13,000	455,000	1,739,000	279,000	70,000
Alternative 3	13,000	447,000	1,746,000	279,000	70,000

Under all four alternatives, the front country and rural settings are static. This is because new road construction for timber harvesting under each alternative would only require additional local and resource roads (often referred to as logging roads). These road types would be developed within the middle country setting or further into the back country or primitive settings. These settings vary by less than 0.5% each under all action alternatives. Because of the extensive road network that already exists on BLM-administered lands, new road construction under all four alternatives would not measurably change these existing levels of remoteness.

Under all four alternatives, there would be no effect to the variety of recreational opportunities that exist on BLM-administered lands when considering remoteness levels. As a result, the majority of BLM-admiistered lands (82%) would continue to be located within a quarter mile of

roads, which are more conducive to motorized forms of recreation. Under all four alternatives, 18% of BLM-administered lands would continue to be within the primitive and back country settings, which are favored by those seeking nonmotorized recreational opportunities.

As with remoteness, timber management activities affect the naturalness aspects of the recreation setting (i.e., forest stand structure and age). This in turn affects where visitors recreate based on their setting preferences.

The amount of timber harvest by type and acres that would occur over the next 10 years is used to classify degrees of naturalness along the continuum of recreation settings from primitive to rural. This analysis is based on forest stand types that are characteristic of these areas. For example, timber harvest that involves thinning dense, young stands would shift the naturalness of an area from the front country to the middle country setting. In contrast, the regeneration harvesting of older stands would modify the naturalness of an area from primitive to rural. These changes influence the distribution of recreation demand for visitors who prefer these different settings.

The scale of this analysis is at the forest stand level, which varies greatly across BLM-administered lands. In fact, within a one-square-mile block of ownership, there can be more than a dozen different stand types. This results in an equal number of recreation settings, some of which can be relatively small and disjointed. For example, small patches of old forest scattered throughout young, even-aged stands can result in the primitive setting being obscured by a more predominate front country setting.

The intermixing of setting types affects visitor experiences depending on their individual preferences. Since setting preferences are subjective and vary from one person to the next, this interrelationship is not considered in the analysis. Rather, all forest stands on BLM-administered lands within the planning area are analyzed to calculate the total number of acres within each setting type.

This analysis does not consider nonforested lands or BLM-administered lands occupied by existing roads, since the naturalness of these areas are not affected by timber harvesting. Nonforest habitat and roads account for approximately 4% and 3% respectively of the BLM's total land base.

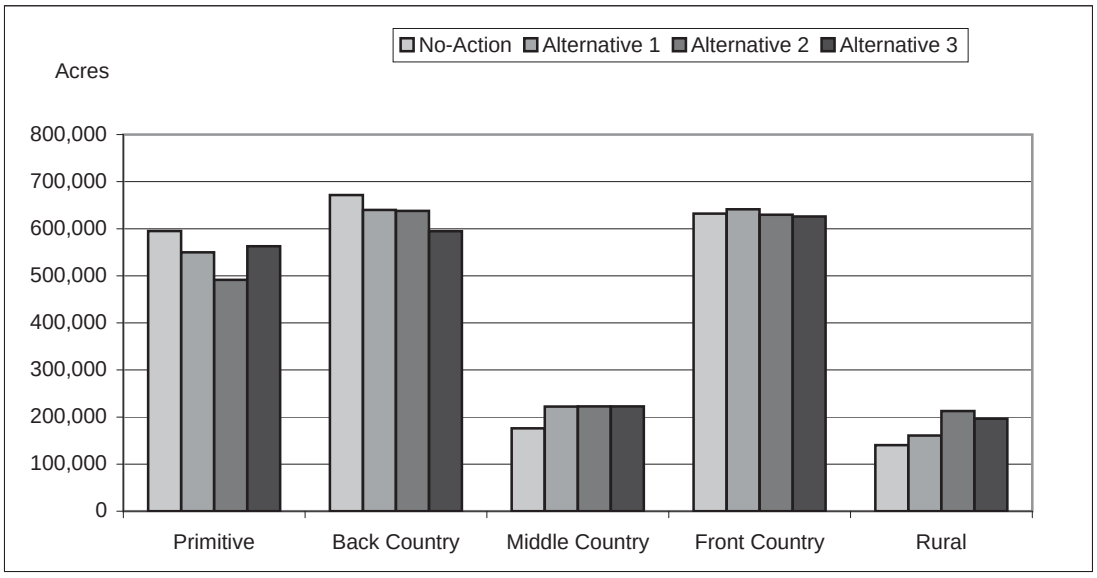
See the *Recreation* section of *Chapter 3* for a series of stand visualizations that illustrate these individual setting types.

Table 218 (*Acres of naturalness levels projected for the year 2016 by alternative*) and *Figure 275* (*Acres of naturalness levels for the year 2016 by alternative*) show the naturalness component of the recreation setting by alternative.

Table 218. Acres of naturalness levels projected for the year 2016 by alternative

Alternative	Naturalness Levels				
	Primitive (acres)	Back Country (acres)	Middle Country (acres)	Front Country (acres)	Rural (acres)
No Action Alt	595,000	671,000	176,000	632,000	140,000
Alternative 1	550,000	640,000	222,000	641,000	161,000
Alternative 2	491,000	638,000	223,000	630,000	213,000
Alternative 3	563,000	595,000	223,000	626,000	196,000

Figure 275. Acres of naturalness levels for the year 2016 by alternative

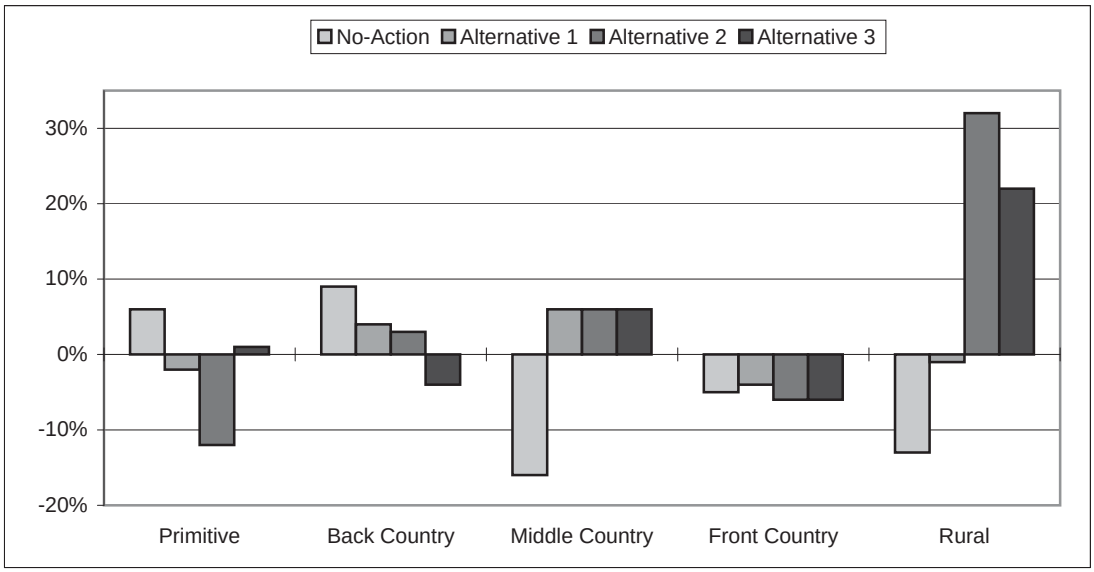


When considering the entire land base, all four alternatives would have a relatively minor effect on naturalness settings by the year 2016. This is largely due to the short duration for which timber harvest practices would modify forest stands under each alternative. As a result, all four alternatives would continue to maintain a mix of naturalness settings that provide a variety of recreational opportunities and experiences for visitors.

The alternatives would have some minor effects on visitor use patterns when comparing visitors' setting preferences for different recreational activities (see *Recreation* section of *Chapter 3*) with changes to individual naturalness settings. This analysis assumes that visitor preferences for naturalness would be similar to their overall recreation setting preferences, which includes physical, administrative, and social setting characteristics.

Figure 276 (*Percent change in naturalness settings by the year 2016 under each alternative*) illustrates changes to individual naturalness settings by alternative when using the existing condition for the year 2006 as the baseline.

Figure 276. Percent change in naturalness settings by the year 2016 under each alternative



All four alternatives would have relatively minor affects to existing levels of the primitive and back country settings.

- Existing levels of these settings account for 25% and 28%, respectively, of all BLM-administered lands in the planning area.
- Due to their large proportion of the entire land base, small changes to these settings under all four alternatives would not substantially diminish or improve recreational opportunities within these areas.
- The greatest levels of recreational use that occur within these settings are from nonmotorized activities, such as hiking, horseback riding, hunting, and fishing. High levels of use from off-highway vehicles, wildlife viewing, camping, and picnicking also occur within the back country setting. Visitors seeking these activities may experience localized changes within these settings, but visitor use patterns associated with these activities would not be affected when considering the entire land base.

All Action Alternatives would increase the middle country setting by 6%; the No Action Alternative would decrease it by 16%.

- The highest percentage of almost every recreational activity occurs within this setting, which is likely due to a combination of both naturalness and remoteness characteristics.
- Middle country provides the highest level of naturalness within close proximity to roads, which is preferred by visitors who are seeking nature-based experiences that are easily accessible.

- When considering the BLM's entire land base in the planning area, 68% is classified as middle country based on remoteness levels. However, only 9% is classified as middle country when considering naturalness.
- All Action Alternatives would increase the proportion of middle country (based on naturalness levels) compared to the No Action Alternative, thereby improving recreational opportunities and experiences for visitors who prefer this setting.

All four alternatives would slightly reduce the front country setting by no more than 6%.

- When considering the BLM's entire land base in the planning area, 31% is classified as front country (based on existing naturalness levels), which is proportionally more than all of the other settings.
- Due to its extensiveness throughout the planning area, small reductions under each of the alternatives would not affect recreational use that occurs within this setting type.

Alternatives 2 and 3 would increase the rural setting by 32% and 22% respectively.

- Although these increases appear to be considerable, the rural setting only accounts for 5% of the BLM's total land base.
- The naturalness aspect of this setting is classified as a substantially modified environment, which (from a forestry standpoint) is typical of an area following a regeneration harvest.
- These areas are generally not conducive to recreational use; however, high levels of recreation use occur within this setting. This is likely due to the experiences derived from improved access, amenities, and social interactions within developed recreation sites, which are also located within the overall rural setting. These experiences are generally more important to visitors in the rural setting than those derived from the physical aspects of the environment.
- Since only 5% of the BLM's lands are classified as rural when considering naturalness levels, increasing the amount of this setting by as much as 32% would not noticeably affect overall recreational opportunities and experiences for visitors.
- Substantially modifying the natural setting of certain areas would have a localized effect on visitors who prefer to recreate in those areas. As a result, some localized displacement of visitors would occur. This effect would be greatest under Alternative 2.

Although some localized effects would occur within each of these settings, none of the changes would be measurable enough to influence visitor use patterns that are associated with any single recreation activity within the planning area. As a result, all action alternatives would continue to maintain a mix of naturalness settings that provide a variety of recreational opportunities and experiences for visitors.

Wilderness Characteristics

This analysis examines the wilderness characteristics of the BLM-administered lands based on the timber harvesting treatments under each alternative.

Key Points
Alternative 1 would maintain wilderness characteristics on the greatest percentage of BLM-administered lands compared to the other action alternatives. Alternative 3 would have the highest degree of long-term impacts compared to all other alternatives.

The identification of BLM-administered lands with wilderness characteristics is the result of an evaluation of 146 public wilderness proposals received during scoping. Nine areas (26,123 acres) contain the following wilderness characteristics: sufficient size, naturalness, and either outstanding opportunities for solitude or outstanding opportunities for primitive and unconfined recreation (See the *Recreation* section in *Chapter 3* and *Appendix J, Recreation*).

Under all action alternatives, the BLM districts would apply special management to maintain the wilderness characteristics on five of these nine units. See *Table 219* (*Special management to maintain wilderness characteristics under all action alternatives*) for a summary of this management direction by district.

Table 219. Special management to maintain wilderness characteristics under all action alternatives

BLM District	Unit Name	Acres	Special management to maintain wilderness characteristics
Coos Bay	Wasson Creek	3,408	Yes
Salem	Bull of the Woods/ Opal Creek Additions	3,203	Yes
	South Fork Clackamas River	919	Yes
	Salmon Huckleberry Additions	637	Yes
	Mount Hebo	81	Yes
Medford	Berry Creek	6,433	No
	Whiskey Creek	5,667	No
	Wellington Mountain	5,659	No
Roseburg	Williams Creek	116	No

Except for designated wilderness areas and wilderness study areas, the BLM-administered lands with wilderness characteristics are not identified in the existing RMPs. Because of this, the effects of the No Action Alternative on these lands are considered without the application of special management to maintain their identified wilderness characteristics.

Under all action alternatives, the special management to maintain wilderness characteristics would not apply to portions of these units that occur on O&C lands suitable for permanent timber production. For analytical purposes, it is assumed that these portions would eventually

be regeneration harvested unless they have been removed from the harvest land base for other purposes (e.g., critical habitat for threatened and endangered species or wild and scenic river corridors). Regeneration timber harvest would result in a loss of wilderness characteristics. Under all action alternatives, special management would exclude regeneration harvest on only those public domain lands and portions of O&C lands not suitable for permanent timber production on the five units that would receive special management.

Of the total amount of the lands with identified wilderness characteristics, the portion that would be in the harvest land base varies when applying special management on select units and other protections as defined by each alternative. *Table 220* (*BLM-administered lands with wilderness characteristics in the harvest land base by alternative*) shows the amount of lands with wilderness characteristics that would be in the harvest land base by alternative.

Table 220. BLM-administered lands with wilderness characteristics in the harvest land base by alternative

Unit Name	Total Acres	Harvest Land Base by Alternative (acres)			
		No Action Alt	Alt 1	Alt 2	Alt 3
Wasson Creek	3,408	0	0	1,989	2,154
Bull of the Woods	3,203	144	239	634	641
South Fork Clackamas River	919	246	363	389	388
Salmon Huckleberry Additions	637	88	121	144	141
Mount Hebo	81	0	0	17	19
Berry Creek	6,433	563	1,658	3,512	3,465
Whiskey Creek	5,667	2,074	1,949	0	2,701
Wellington Mountain	5,659	1,680	2,185	2,258	2,311
Williams Creek	116	22	54	54	54
Totals	**26,123**	**4,817**	**6,569**	**8,997**	**11,874**
Percentage of Total acres	***100%***	***18%***	***25%***	***34%***	***46%***

Timber harvest that is associated with late successional management areas and riparian management areas would also have an effect on the lands that have wilderness characteristics. Limited timber harvest to promote the development of structurally complex forests and to protect streams would occur within these land use allocations and would only slightly diminish naturalness if no new road construction is necessary. This effect (of slightly diminished naturalness) would occur initially after treatment, but the long-term implications of such practices would eventually result in a higher degree of naturalness.

Opportunities for solitude and primitive, unconfined recreation would also be diminished within late successional management areas and riparian management areas due to the visible evidence of limited timber harvesting. Ultimately, to retain these wilderness characteristics, the “imprint of man’s work [should be] substantially unnoticed,” as defined by the Wilderness Act of 1964. Even with the limited timber harvest associated with late successional management areas and riparian management areas, this would not be entirely possible to achieve. For example, evidence of thinning operations includes slash piles, yarding corridors, and stumps, which can take decades to become indiscernible.

Because of these effects to wilderness characteristics, special management of select units would exclude limited timber harvesting within these management areas on public domain lands and portions of O&C lands not suitable for permanent timber production. *Table 221* (*BLM-administered lands with wilderness characteristics in late successional management areas and riparian management areas by alternative*) shows the proportion of each unit of BLM-administered land with wilderness characteristics that contain late successional and riparian management areas by alternative.

Table 221. BLM-administered lands with wilderness characteristics in late successional management areas and riparian management areas by alternative

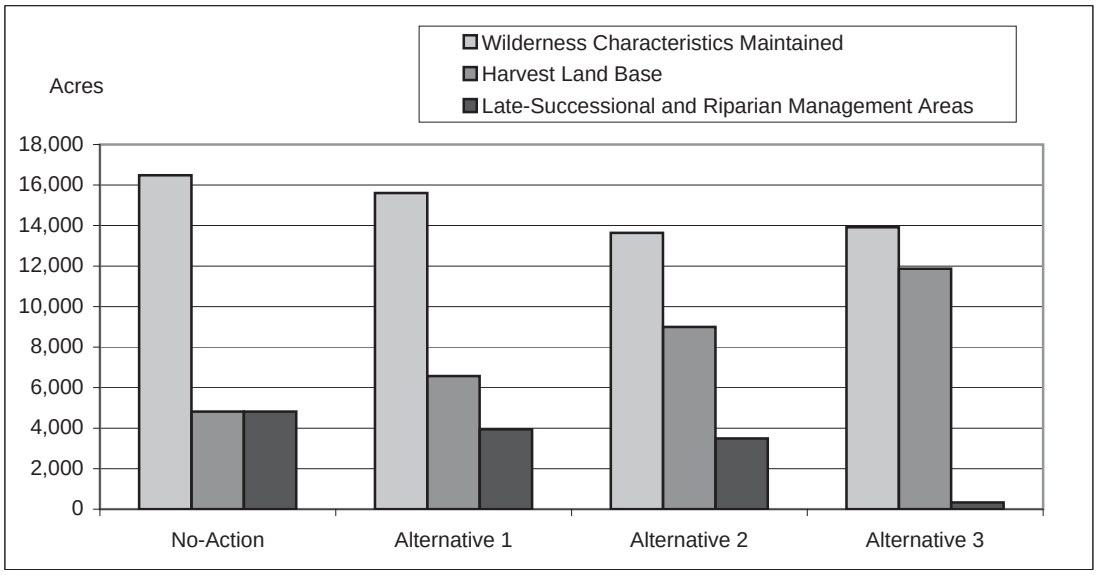
Unit Name	Total Acres	Late-Successional and Riparian management areas by Alternative (acres)			
		No Action Alt	Alt 1	Alt 2	Alt 3
Wasson Creek	3,408	106	106	442	10
Bull of the Woods	3,203	414	430	127	38
South Fork Clackamas River	919	134	118	64	42
Salmon Huckleberry Additions	637	69	9	2	2
Mount Hebo	81	63	19	5	0
Berry Creek	6,433	1,342	1,902	170	29
Whiskey Creek	5,667	2,198	1,052	2,350	138
Wellington Mountain	5,659	495	308	329	72
Williams Creek	116	0	0	0	0
Total Acres	**26,123**	**4,821**	**3,944**	**3,489**	**331**
Percentage of Total Acres	***100%***	***18%***	***15%***	***13%***	***1%***

See *Table 222* (*BLM-administered lands with wilderness characteristics maintained by alternative*) and *Figure 277* (*Acres of BLM-administered lands with wilderness characteristics maintained by alternative*) for the amount of lands with wilderness characteristics that would be maintained when excluding those portions in the harvest land base, late successional management areas, or riparian management areas by alternative.

Table 222. BLM-administered lands with wilderness characteristics maintained by alternative

Unit Name	Total Acres	Wilderness Characteristics Maintained (acres)			
		No Action Alt	Alt 1	Alt 2	Alt 3
Wasson Creek	3,408	3,302	3,302	977	1,244
Bull of the Woods	3,203	2,645	2,534	2,442	2,524
South Fork Clackamas River	919	539	438	466	489
Salmon Huckleberry Additions	637	480	507	491	494
Mount Hebo	81	18	62	59	62
Berry Creek	6,433	4,528	2,873	2,751	2,939
Whiskey Creek	5,667	1,395	2,666	3,317	2,828
Wellington Mountain	5,659	3,484	3,166	3,072	3,276
Williams Creek	116	94	62	62	62
Total Acres	**26,123**	**16,485**	**15,610**	**13,637**	**13,918**
Percentage of Total Acres	***100%***	***63%***	***60%***	***52%***	***53%***

Figure 277. Acres of BLM-administered lands with wilderness characteristics maintained by alternative



Alternative 1 would maintain wilderness characteristics on the greatest portion of lands compared to the other action alternatives. However, all action alternatives would maintain fewer acres with wilderness characteristics than the No Action Alternative. Alternative 1 would maintain only 3% less than the No Action Alternative. Alternatives 2 and 3 would maintain 11% and 10 % less respectively. Alternative 3 would have the highest degree of long-term impacts (46%) resulting from regeneration harvesting compared to all other alternatives.

Under all action alternatives, special management of the five selected units would protect these lands from all other discretionary management actions (e.g., recreation developments, road building). However, special management would not protect these areas from nondiscretionary actions, such as road construction associated with reciprocal right-of-way agreements or mining

unless the area is withdrawn from mineral entry. Since there is no certainty of these potential actions, it is not possible to reasonably foresee their effects.

Mitigation

Project design features, such as helicopter yarding and flush-cutting stumps at ground level would lessen the short-term effects of limited timber harvesting in late successional management areas and riparian management areas that overlap lands with wilderness characteristics.

Visual Resources

This analysis examines the maintenance of the visual resource quality of the BLM-administered lands under each alternative.

Key Points
Alternative 1 would maintain existing visual resource quality on the greatest portion of BLM-administered lands in the planning area compared to the other action alternatives.

Visual resource quality is determined through the visual resource inventory process, which is based on a combination of scenic quality, sensitivity levels, and distance zones. The results of this inventory process classified all BLM-administered lands in the planning area as class I, II, III, or IV. Class I areas have the highest level of visual resource quality, while class IV areas have the lowest level (see the *Recreation* section of *Chapter 3*).

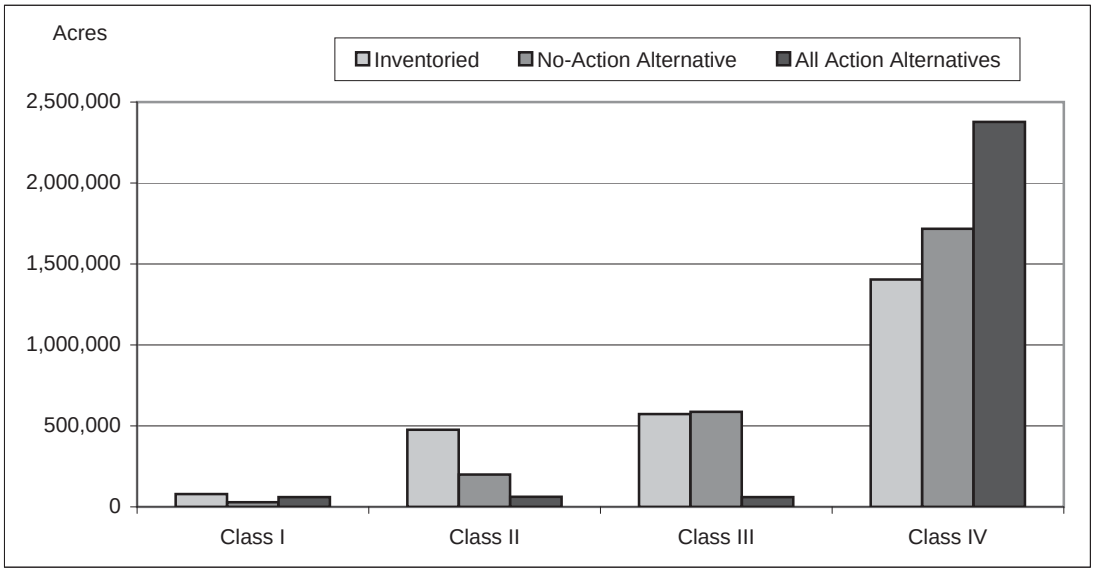
The BLM also designates visual resource management classes through the land use planning process and these classes also range from class I to IV. Class I areas are managed to preserve visual resource quality and class IV areas allow for major modifications. Except for Class I areas, management classes can vary from the original inventory classes to be consistent with resource management plan goals and objectives (see the *Visual Resources* section of *Chapter 2*).

It is assumed that a visual resource management class that matches the inventory class of an area would not diminish its existing visual resource quality. For example, an area inventoried and designated as class IV would not degrade its existing visual resource quality. Conversely, an area with a lower inventory class rating that has a higher management classification would reduce its visual resource quality. For instance, an area inventoried as class II but managed as class IV would allow for a major modification of the area's high level of scenic quality. *Table 223* (*Visual resource inventory classes and management classes by alternative*) and *Figure 278* (*Visual resource inventory and management classes in acres by alternative)* show the relationship between visual resource inventory and management classes by alternative.

Table 223. Visual resource inventory classes and management classes by alternative

Visual Resource Classes	Inventoried (acres)	No Action Alternative (acres)	All Action Alternatives (acres)
Class I	79,000	29,000	60,000
Class II	477,000	199,000	62,000
Class III	573,000	587,000	61,000
Class IV	1,404,000	1,717,000	2,377,000

Figure 278. Visual resource inventory and management classes in acres by alternative



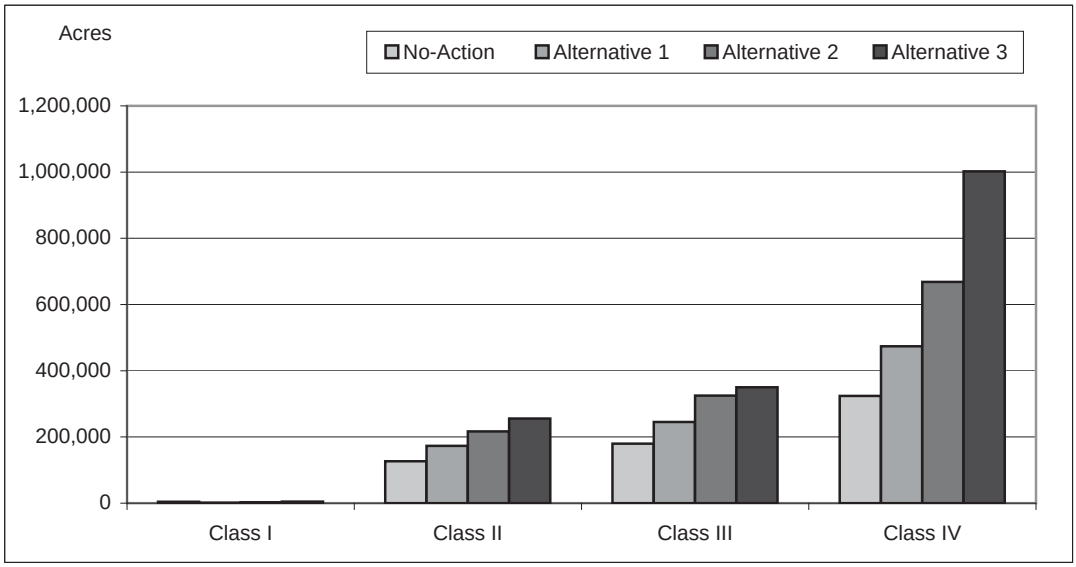
The relationship between inventory and management classes can not be used exclusively to analyze the effects of alternatives on visual resource quality. Effects are dependant upon the level and type of surface disturbing activities that would occur under each alternative. It is assumed that major modifications of visual resource quality would take place on forest lands that are in the harvest land base (i.e., where regeneration harvests would occur). Therefore, the amount of harvest land base within each visual resource inventory class is used to determine the degree to which existing visual resource quality would be affected under each alternative. See *Table 224* (*Harvest land base within each visual resource inventory class by alternative*) and *Figure 279* (*Harvest land base acres within visual resource inventory classes by alternative)* for the amount of BLM-administered lands by inventory class in the harvest land base by alternative.

Table 224. Harvest land base within each visual resource inventory class by alternative

Visual Resource Inventory Classes	Harvest Land Base by Alternative (acres)			
	No Action Alt	Alt 1	Alt 2	Alt 3
Class I*	4,000	1,000	3,000	5,000
Class II	127,000	173,000	217,000	256,000
Class III	180,000	245,000	325,000	350,000
Class IV	324,000	474,000	668,000	1,002,000

*Some harvest land base acres overlap class I areas. This is due to mapping errors associated with the original inventory, which does not align exactly with congressional and administrative areas that are designated as class I.

Figure 279. Harvest land base acres within visual resource inventory classes by alternative



Existing visual resource quality on BLM-administered lands inventoried as class I would be maintained under all alternatives. Class I is unique from the other inventory classes, because it is assigned to areas where a management decision has been made to preserve a natural landscape (see the *Visual Resources* section of *Chapter 3*). Because of this, no timber harvest would occur within these areas. All four alternatives would protect existing visual resource quality on lands inventoried and managed as class I.

The existing visual resource quality on BLM-administered lands inventoried as class IV would also be maintained under all four alternatives. Major modifications that would occur within the harvest land base portions of these areas would not diminish their existing visual resource quality. Areas inventoried as class IV have low scenic quality; have low sensitivity levels (based on indicators of public concern); or they are seldom seen (based on the relative visibility from travel routes or observation points). Because of these factors, regeneration harvest practices are compatible in areas inventoried as class IV.

Areas inventoried as class II and III have higher degrees of scenic quality and sensitivity levels and are typically more visible to the public than areas inventoried as class IV. Because of this, regeneration harvests would diminish existing visual resource quality within these areas. *Table 225* (*Percentage of existing visual resource quality maintained by alternative within areas inventoried as class II and III)* shows the percentage of these inventory classes that would be maintained under each alternative based on the portion of these areas that are not within the harvest land base.

Table 225. Percentage of existing visual resource quality maintained by alternative within areas inventoried as class II and III

Visual Resource Inventory Classes	Percent Maintained by Alternative			
	No Action Alt	Alt 1	Alt 2	Alt 3
Class II	73%	64%	55%	46%
Class III	69%	57%	43%	39%

All action alternatives would maintain less existing visual resource quality within areas inventoried as class II and III compared to the No Action Alternative. Alternative 1 maintains the highest portion of existing visual resource quality within these areas compared to the other action alternatives. *Figure 280* (*Visual resource inventory class II areas maintained by alternative*) shows the proportion of areas inventoried as class II that would be maintained or in the harvest land base by alternative. *Figure 281* (*Visual resource inventory class III areas maintained by alternative*) shows the proportion of areas inventoried as class III that would be maintained or in the harvest land base by alternative.

Figure 280. Visual resource inventory class II areas maintained by alternative

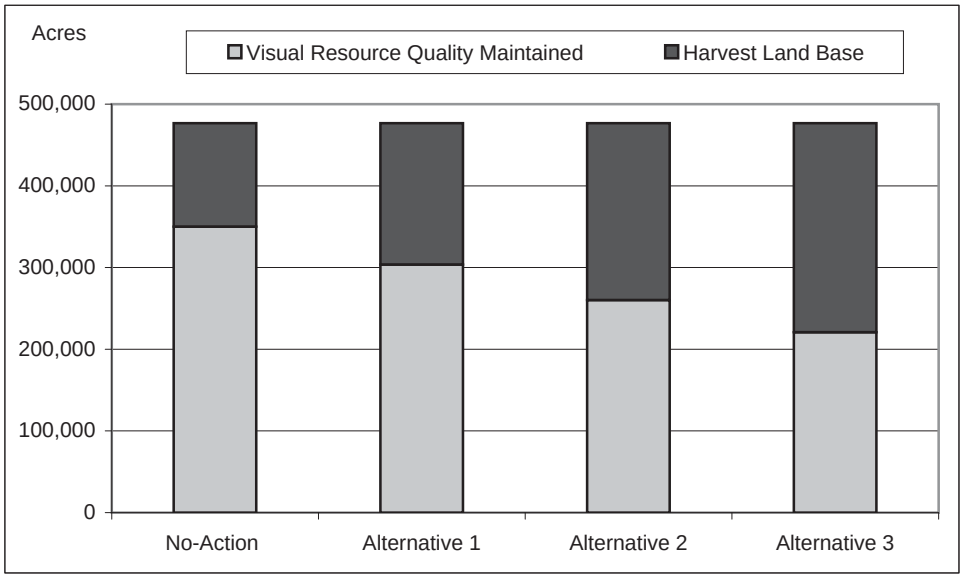
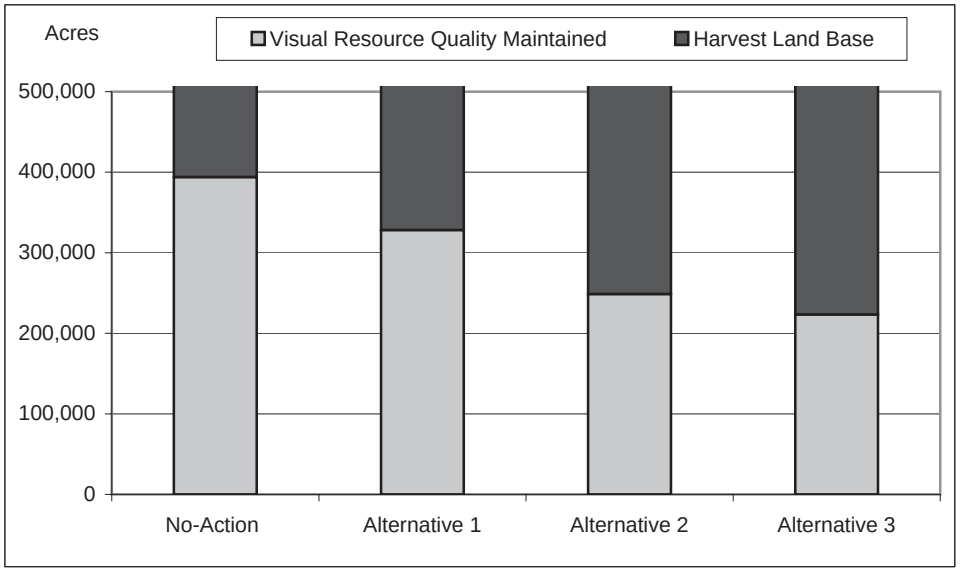


Figure 281. Visual resource inventory class III areas maintained by alternative



National Landscape Conservation System

This analysis examines the protection of the National Landscape Conservation System lands under each alternative.

Key Points
All alternatives would continue to protect all National Landscape Conservation System designations.

The BLM manages the following National Landscape Conservation System designations within the planning area: 1 national monument, 12 wild and scenic river segments, 2 wilderness areas, 5 wilderness study areas, 1 national scenic trail, and 1 outstanding natural area. The BLM also manages portions of the Mount Hood Corridor and the Bull Run Watershed Management Unit, along with 110 eligible and suitable wild and scenic river segments, which are related to, but not part of, the National Landscape Conservation System. See *Chapter 2* for a list of these individual designations in the planning area.

All of these designations are withdrawn from timber harvest with the exception of designated, suitable, and eligible wild and scenic rivers that are classified as scenic or recreational. Therefore, only the wild and scenic rivers classified as scenic or recreational are considered in the analysis.

Under all four alternatives, limited timber harvesting would be allowed within designated, suitable, and eligible wild and scenic river corridors that are classified as scenic or recreational. Harvesting would be done in a manner that would not impair their free-flowing character, classification, or identified outstandingly remarkable values. There are 86 of these river segments on BLM-administered lands in the planning area, totaling 73,338 acres.

These river segments have different combinations of outstandingly remarkable values that overlay site-specific conditions, each of which requires unique management considerations to guarantee their protection. Because of this, all wild and scenic river corridors would not be included in the harvest land base under all four alternatives.

Under all four alternatives, limited timber harvest would be allowed if designed to have either a positive or neutral effect on a river segment's classification and outstandingly remarkable values. This would result in the protection of all designated, suitable, and eligible wild and scenic rivers under all four alternatives.

Soils

This analysis examines the effects of forest management activities on soil productivity that would result from the alternatives.

Key Points
Soil productivity would be maintained or improved under all four alternatives.

The same or improved practices that were used from 1995 to 2006 under the current RMP (the No Action Alternative) would be used under all alternatives to improve or maintain soil productivity. It is reasonable to assume that these practices would be implemented under all alternatives because the management objective for soils under all action alternatives is the same.

Timber harvest activities can cause soil compaction, displacement and erosion. The duration and extent of soil disturbance depends on numerous factors including: soil characteristics, harvest method, amount of area in yarding trails, topography, skill of the individual equipment operators, and the application of amelioration practices.

In general, soil compaction that reduces water infiltration rates and large pore space for gas and water movement constitutes detrimental soil disturbance and can last many years (Froehlich and McNabb 1984; Cafferata 1992). Soil compaction reduces tree growth, but the relationship between compaction and tree growth is complex. For example, Miller, et al (1996) found early growth reductions of seedlings planted on compacted skid trails compared to uncompacted locations, but growth of most seedlings on compacted locations caught up to uncompacted locations after eight years. For most soils and climates, soil compaction and displacement will reduce tree growth, but the magnitude and duration of this reduction is difficult to predict (Miller et al. 1996).

The extent of existing compaction caused by past timber harvest on BLM-administered lands is not known. Under all four alternatives, when these areas of existing compaction are encountered during future management actions, amelioration of soil compaction would be implemented if needed to improve or maintain soil productivity.

Ground-based yarding equipment, such as rubber tired and tracked skidders, can compact forest soils. Highly mechanized ground-based logging systems (e.g., harvester/forwarders, feller bunchers, shovels) have become more prevalent recently in timber harvests on BLM-administered lands. However, even with these systems, "… research and monitoring confirmed that despite their unique design and use, highly mechanized systems … for logging younger and smaller timber have the potential to produce significant soil compaction" (Adams, 2005).

Under all alternatives, skyline and helicopter logging systems would generally be used on slopes over 35%. These harvest methods decrease log contact with soils compared to ground-based systems by partially or fully suspending the logs over the soils. The more a log is suspended during yarding, the less the soil is affected.

The area of residual detrimental soil disturbance within a timber harvest area remaining after all activities including amelioration would vary by logging method as follows:

- ground–based 15%
- skyline 3%
- helicopter 1%.

The amount of acres that would be harvested by each logging method varies by alternative. However, under all alternatives, when the total acres of residual detrimental soil disturbance is compared to total acres harvested for each alternative, the residual detrimental soil disturbance would be about 5%.

Table 226 (*Residual detrimental soil disturbance compared to total acres harvested*) shows the total acres harvested and the predicted acres that would remain in a detrimental condition after timber harvest and amelioration.

Table 226. Residual detrimental soil disturbance compared to total acres harvested

	No Action Alt	Alt 1	Alt 2	Alt 3
Total Acres Harvested	160,500	204,000	220,100	288,800
Total Detrimental Soil Disturbance	8,400	10,700	10,800	15,300

Under all alternatives, permanent roads and landings would be constructed as part of forest management activities and would be compacted to increase the bearing strength of the soil in order to hold the weight of trucks and equipment. Some research suggests that the growth of roadside trees may benefit from the increased light and moisture and reduced competition (Miller, et al, 1989). Whether this increased growth makes up for the loss of timber production on a permanent road or landing is not known.

For this analysis, temporary roads and landings would not affect overall soil productivity, because associated compaction would be ameliorated.

New permanent roads and landings would be built under all four alternatives. Decommissioning of permanent roads and landings no longer needed for forest management would also occur. The net effect of road building versus road decommissioning results in a less than 1% increase over current road and landing acreage in Alternatives 2 and 3 and a net decrease in acres in the No Action Alternative and Alternative 1.

Prescribed fire can cause detrimental soil disturbance if the temperature and duration of a fire heats the soil at depth, such that there is a breakdown in soil structure and decrease in soil productivity. The deeper the burn, the more likely soil productivity would be impaired.

Under all four alternatives, site preparation after timber harvest would include pile and burn (either by machine or hand) or broadcast burning. Burning piles would be more likely to create the higher temperatures that last longer then broadcast burning, increasing consumption of organic matter and volatilization of nutrients. Broadcast burns for slash disposal and hazardous

fuels treatment would generally have lower temperatures and shorter duration such that surface soils and organic matter would be left mostly intact.

Both pile and burn and broadcast burning for site preparation has been implemented on BLM-administered lands since 1995 with practices and techniques designed to lessen the duration and temperature of fire. The annual amount of site preparation prescribed burning would vary from 4,800 under the No Action Alternative to 10,900 acres under Alternative 2. Under all alternatives, overall soil productivity would be maintained because severe depth of burning would be highly localized and small in area extent.

Little is known about the long term effects of mechanically treating vegetation for site preparation or fuels reduction on soils. However, machines that reduce vegetation into small pieces have the potential to compact soils (Bennett and Fitzgerald). The effects of mechanically treating vegetation would be similar to timber harvest activities due to repeated trips over the same site. Soil nitrogen would be tied up and unavailable for plant growth due to the high carbon-nitrogen ratio until the woody material decomposes. Some research suggests that if the resulting mulch layer exceeds three inches following mastication biological damage from soil heating can occur if the mulch is burned. "Field projections indicate that up to one-fourth of treated areas with dense premastication of vegetation would surpass lethal soil temperatures during a surface wildfire." (Busse et al. 2005). However, the mechanical treatment of hazardous fuels reduces the risk soil damage caused by uncharacteristic wildfire. It is projected that in the northern districts, approximately half of the acreage within regeneration harvest units would receive slash treatment, and thinning units would not receive slash treatment. It is projected that 90% of harvest units would receive some form of slash treatment in the southern districts. The remaining 10% would not have enough slash to require treatment.

Uncharacteristic wildfire damages soils. Regardless of whether the ignition source is natural or human caused, when soil heating occurs such that there is a breakdown in soil structure, reduction or loss of organic matter and microbial species, water repellency, and surface runoff, soil functions are impaired and soil productivity can be decreased (Neary et al. 2005). All alternatives would treat hazardous fuels using mechanical means. The methods and techniques used would be consistent with past practices and would maintain or improve soil productivity by decreasing the effects of uncharacteristic wildfire.

Livestock cause compaction and displacement of soils where there is a concentration of animals. Livestock also exacerbate erosion if bare ground is present due to the churning action of their hooves. This hoof action can compact biological crusts which play a role in nitrogen fixation and soil stabilization. This would typically be localized and occur around water sources, salt licks and on the trails leading to these areas.

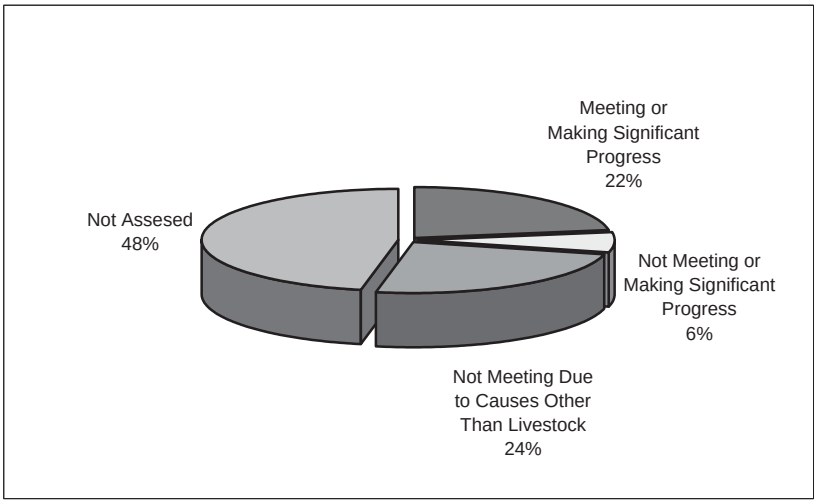
A BLM assessment of rangelands to determine which grazing allotments meet rangeland health standards is anticipated to be completed by 2009. The rangeland health standards incorporate soil parameters that contribute to rangeland health. These include qualitative indicators for soil/site stability, hydrologic function, and biotic integrity (Pellant, et al). If rangeland health standards are met it is assumed that soil productivity is maintained.

Out of the approximately 560,000 acres currently available for grazing in the planning area about 53% has been assessed so far. *Figure 282* (*Acres available for grazing*) shows the acres available for grazing and if they are meeting standards or making progress towards meeting the standards. There are 7 allotments representing 36,000 acres in the Klamath Falls Resource Area (approximately 6% of the acreage available for grazing) that have not met or made significant

progress towards the rangeland health standards due to livestock concerns. Actions were taken to ensure significant progress.

Under all four alternatives, where rangeland health standards are not being met, grazing management practices would be modified in order to meet the standards.

Figure 282. Acres available for grazing



Exposed compacted soil surfaces reduce the infiltration of rain water and snowmelt. A long, straight length of compacted soils such as that which occurs with off-highway vehicle use is conducive to the overland flow of water. When channelized, overland flow occurs, rills and gullies are formed and subsequent sediment delivery to streams can occur when close enough to a water body. Currently there are small localized areas in the planning area where this has occurred due to off-highway vehicle use.

Under the Action Alternatives, there would be a reduction of 330,000 acres of area open to off-highway vehicle use. A majority of these open areas are located on steep, densely-forested terrain. This terrain is not conducive to cross-country motor vehicle travel, so off-highway vehicle use is primarily limited to existing roads and trails in these areas. In the action alternatives, off-highway vehicle use is predominantly limited to designated roads and trails. Under all alternatives, it is assumed that off highway vehicle use would not cause additional erosion beyond that caused by other vehicular travel (as describe in the *Water* section of this chapter).

Mass soil movement, including landslides, slumps, and debris flows, are natural geologic processes in western Oregon. Depending on geology and soils, the risk of slope failure changes from site to site across the planning area. Factors that contribute to slope instability include steep slopes (greater than 65%), low soil strength, declining root strength, shallow soil depths, and high frequency, duration, and intensity of precipitation. Management actions can also contribute to slope failure through timber harvest and new road construction. Sites that have a high risk of mass movement are identified under the Timber Production Capability Classification (TPCC) system and withdrawn from timber management. Although high risk areas are withdrawn from timber management to avoid slope failures, areas that are judged to be of lower risk have occasionally failed in the past.

Grazing

This analysis examines the livestock grazing authorizations and the forage production in the Coos Bay and Medford districts, and the Klamath Falls Resource Area in the Lakeview District that would result under the alternatives.

Key Points

- Under all action alternatives, there would be a decrease in livestock grazing authorizations. However this would not change the current level of grazing since the decrease would represent allotments that are currently vacant except in the Coos Bay District.
- Under all Alternatives there would be an increase in forage production on the west side of the Klamath Falls Resource Area and in the Medford District. The increase would be the highest under the No Action Alternative. Under all action alternatives, the increase would be the highest under Alternative 3.
- Under all Alternatives, the quantity of forage production in eastern Klamath Falls would not change substantially.

Livestock grazing authorizations are assessed through changes in acres available for grazing including number of allotments, animal unit months, and permittees/lessees.

As shown in *Table 227* (*Livestock grazing authorizations by district and by alternative*) all of the components of livestock grazing authorizations would either remain the same or decrease under the action alternatives.

Under the action alternatives, the amount of public land available for livestock grazing through the issuance of a grazing lease would decrease from 560,000 acres (22% of the planning area) to 418,500 acres (16% of the planning area).

Table 227. Livestock Grazing Authorizations by District and by Alternative

Grazing	Medford		Coos Bay		Klamath Falls		Total	
	No Action	Action Alts	No Action	Action Alts	No Action	Action Alts	No Action	Action Alts
Allotments	95	55	0	0	96	95	191	150
Leases	0	0	4	0	0	0	4	0
Public Land (Acres)	352,000	217,000	16	0	208,000	202,000	560,000	419,000
Active AUMs	13,416	11,118	23	0	13,401	13,381	26,840	24,499
Permittees/ Lessees	59	59	3	0	92	92	154	151

In the Medford District and Klamath Falls Resource Area, the decrease represents allotments (in whole or in part) that are vacant and not currently grazed. This decrease would not reduce the number of allotments that have an active permit or lease.

In the Coos Bay District, four active grazing leases with three lessees covering 16 acres and 23 Animal Unit Months (0.08% of the total Animal Unit Months authorized in the planning area) would be discontinued. See *Figure 283* (*Change in animal unit month by alternative*) and *Figure 284* (*Change in the number of allotments by alternative*) for a summary.

Figure 283. Change in animal unit months by alternative

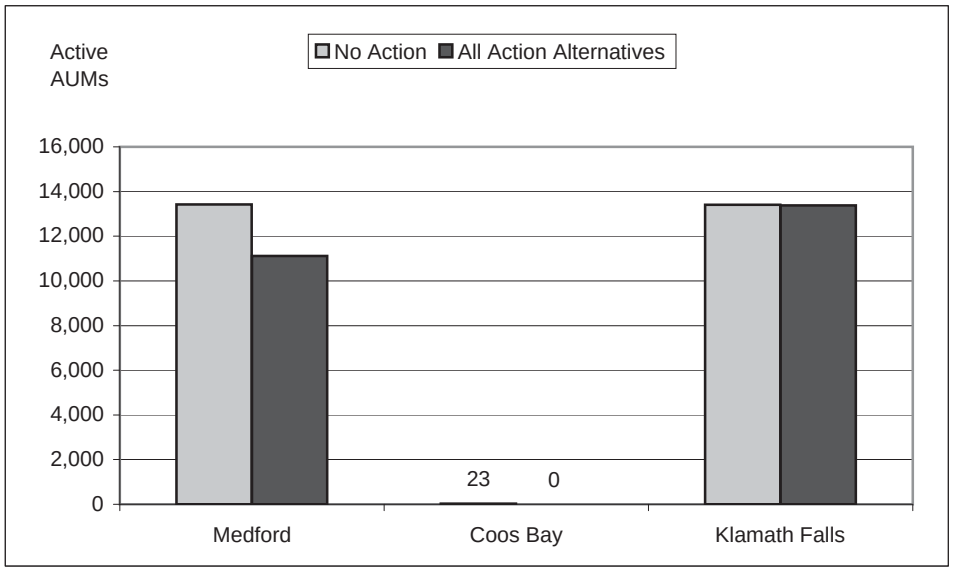
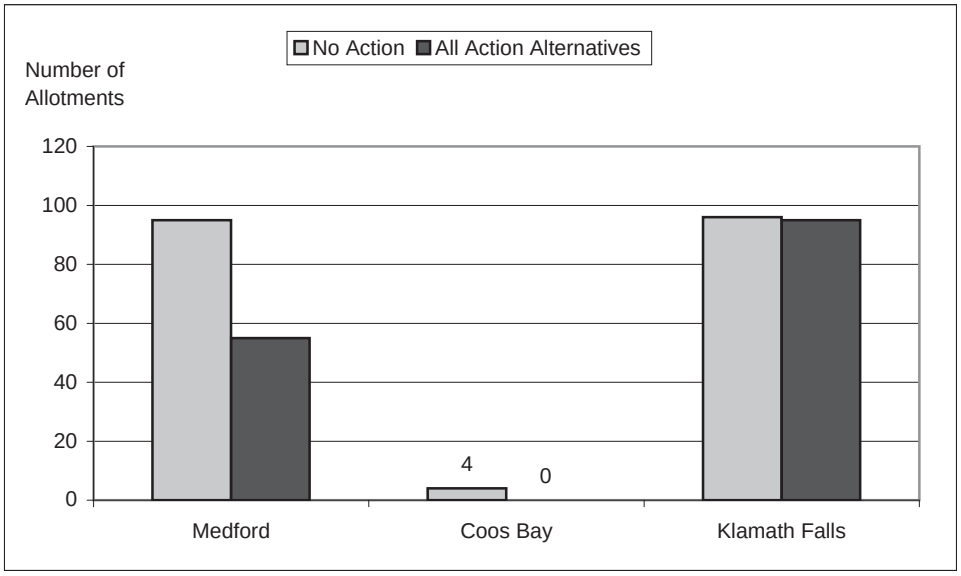


Figure 284. Change in the number of allotments by alternative



The levels of livestock grazing on U.S. Forest Service and BLM-administered lands covered by the Northwest Forest Plan have decreased since the early 1990's with some allotments vacant since the 1970's. Under all four Alternatives, the quantity of forage production on the west side of Klamath Falls Resource Area and the Medford District would increase; however, the demand for grazing on the BLM (representing 14% of the acres of U.S. Forest Service and BLM-administered lands) lands is expected to continue to decline.

Management actions that are needed to achieve the Standards for Rangeland Health for Oregon and Washington, resource management objectives, or other allotment-specific objectives would require adjustments in livestock numbers, season of use, or animal unit months, construction of range improvements or implementation of intensive grazing systems. In the Medford District, no allotments have required management actions to meet rangeland health standards since 1999. Adjustments in the next three years in the Medford District would be higher than the last eight years because 58% of the allotments (representing 66% of the acres) have not been assessed. In the Klamath Falls Resource Area, seven allotments covering 36,369 acres have required management actions to meet rangeland health standards since 1999. Adjustment in the next three years in the Klamath Falls Resource Area would be lower than the last eight years because more than 85% of the acres (representing 60% of the allotments) have been assessed.

Forage production is affected by changes to vegetation. Changes to vegetation can occur due to range improvements, fuels treatments, timber harvest, and management of areas of critical environmental concern.

Forage and water availability is generally adequate for livestock; however, there are opportunities to improve livestock distribution to restore riparian and upland vegetation, provide additional water sources, and protect riparian areas. Under the action alternatives, the construction of range improvements would be used to improve livestock distribution by:

- Shifting grazing pressure from riparian/wetlands to uplands, and
- Shifting grazing distribution within the uplands including areas that are not currently used.

The construction of range improvements that would occur under the alternatives is shown in *Table 228 (Range improvement construction by district and by alternative).*

Under all action alternatives, the construction of range improvements that would occur under the alternatives in the Medford District would occur at approximately the same rate as those constructed 1996-2006 (see the *Grazing* section of *Chapter 3*).

Under all action alternatives, the rate of range improvement construction that would occur in the Klamath Falls Resource Area would increase by 245% over the next 10 years as compared to the rate constructed during the period of 1996-2006. There would be up to 29 reservoirs and 48 miles of fence constructed under the action alternatives within the Klamath Falls Resource Area. See *Chapter 2* and *Appendix L, Grazing*.

Table 228. Range Improvement Construction by District and by Alternative

Range Improvement	Medford		Coos Bay		Klamath Falls		Total	
	No Action	Action Alts	No Action	Action Alts	No Action	Action Alts	No Action	Action Alts
Livestock Fences Constructed (units/miles)	18 (5 miles)	18 (5 miles)	0	0	11 (19 miles)	27 (48 miles)	29 (24 miles)	45 (53 miles)
Reservoirs or Springs Constructed/ Developed (units)	6	6	0	0	3	29	9	35

Under all alternatives, the management actions that provide for the site-specific protection or restoration of habitat would exclude access (through fencing) to certain traditional watering or foraging areas. Exclusion of these areas from grazing would be so limited in number and so scattered geographically that they would not limit watering or foraging areas.

Under all alternatives, the quantity of forage production in the Medford District and the western part of the Klamath Falls Resource Area would not substantially change as a result of fuels treatments because there would be minimal fuels treatment (10,000 acres/year within the wildland urban interface) outside of timber harvests.

Under all Alternatives, the quantity of forage production in the eastern part of the Klamath Falls Resource Area would not substantially change as a result of fuels treatments because the number of acres treated (1-2 % per year) would be inconsequential and scattered geographically.

Under all alternatives, where fuels treatments would occur:

- In the short term (0-5 years), closures would rest these areas after fuels treatments if soil and vegetation are no longer capable of supporting grazing.
- In the long term (5+ years), treatments would result in increased forage production and enhanced vigor of vegetation.

Off-highway vehicle use affects livestock grazing through disturbance or harassment to livestock and the type and access that permittees/lessees use to manage livestock or conduct range improvement maintenance (see the *Grazing* section of *Chapter 3*).

Under the action alternatives, all areas currently designated as open to off-highway vehicle use would be redesignated as limited in the Medford District and Klamath Falls Resource Area. This would decrease disturbance or harassment to livestock resulting from off-highway vehicle use. There would be no substantial effect to livestock operators in the type and availability of access because forested terrain and steep slopes limit the capability of off-highway vehicle use to move livestock or conduct range improvement maintenance.

Under all alternatives, the designation of off-highway vehicle emphasis areas would not affect livestock grazing because off-highway vehicle use would be concentrated within the emphasis area and livestock would avoid these areas.

Timber management actions affect forage production through changes to vegetation structural stages. Timber harvest that results in the stand establishment forest structural stage classification would increase the amount of grasses and grass-like species that serve as forage (see the *Grazing* section of *Chapter 3*). The young forest structural stage classification would provide the least amount of forage.

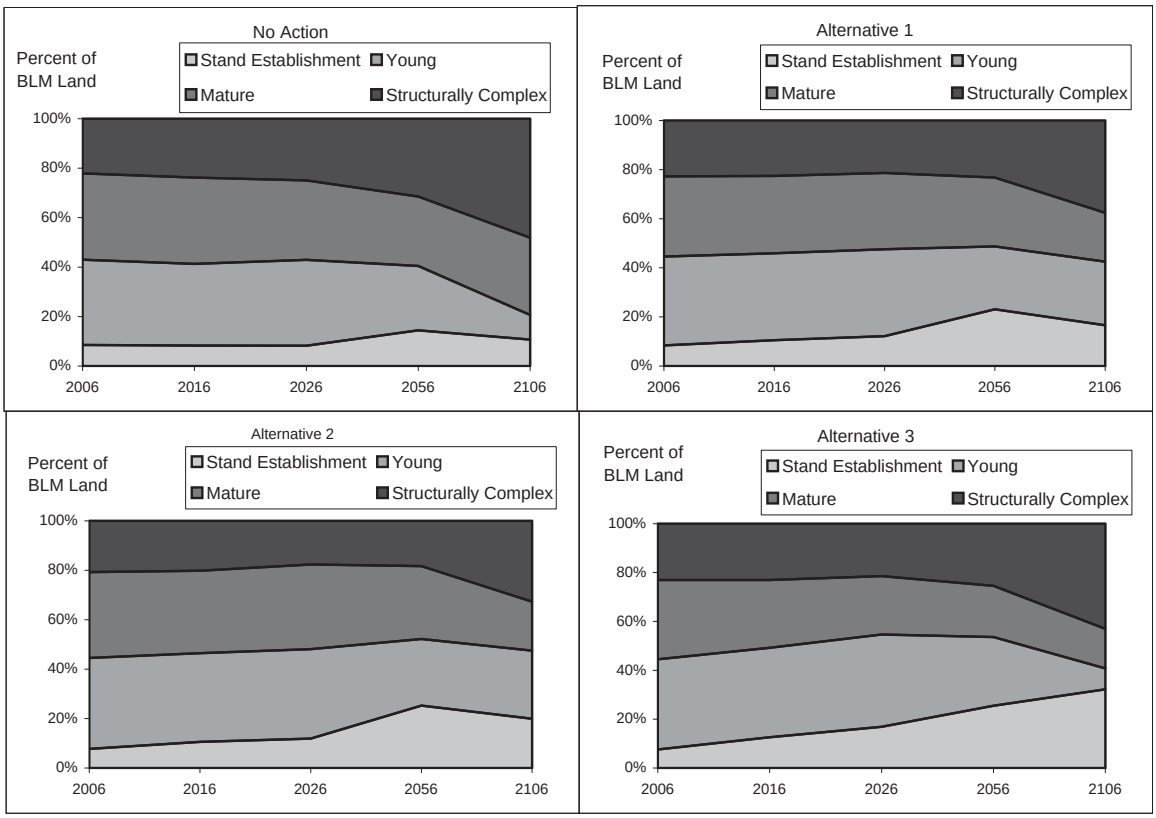
As shown in *Figure 285* (*Changes in structural stage abundance within lands allocated for grazing*), under the No Action Alternative, the amount of the stand establishment forest structural stage classification within grazing areas would increase from 30,000 acres to 37,600 acres over the next 100 years.

Under Alternative 1, the amount of the stand establishment forest structural stage classification within grazing areas would increase from 20,000 acres to 39,500 acres over the next 100 years.

Under Alternative 2, the amount of the stand establishment forest structural stage classification within grazing areas would increase from 18,400 acres to 47,400 acres over the next 100 years.

Under Alternative 3, the amount of rhe stand establishment forest structural stage classification within grazing areas would increase from 18,000acres to 76,500 acres over the next 100 years.

Figure 285. Changes in structural stage abundance within lands allocated for grazing

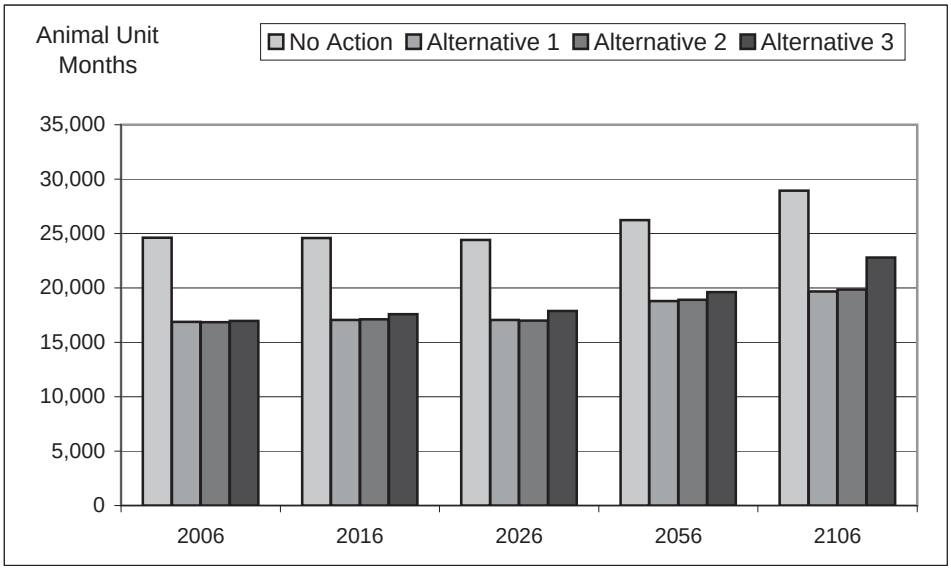


Under all action alternatives, the increase of the stand establishment forest structural stage classification and the decrease in the young forest structural stage classification would result in a corresponding increase in livestock forage production. This increase would be the highest under the No Action Alternative. This is because the lands allocated for grazing are higher under the No Action Alternative. For the action alternatives, the increase would be the highest under Alternative 3, as shown in *Table 229* (*Changes in livestock forage production by alternative*) and *Figure 286* (*Changes in livestock Forage Production by Alternative).*

Table 229. Changes in Livestock Forage Production by Alternative

Year	Forage Production (animal unit months)			
	No Action	Alternative 1	Alternative 2	Alternative 3
2006	24,620	16,972	16,972	16,972
2016	24,582	17,059	17,127	17,601
2026	24,400	17,066	17,006	17,892
2056	26,223	18,802	18,920	19,616
2106	28,950	19,673	19,867	22,805

Figure 286. Changes in Forage Production by Alternative



Management of areas of critical environmental concern affects forage production by applying site-specific protection (exclosures) or management actions (i.e. season of use restrictions).

Under all alternatives, the designation of areas of critical environmental concern would not affect livestock grazing. Even though areas designated as areas of critical environmental concern would decrease under all action alternatives, forage production would not be affected because site-specific protection (exclosures) or management actions (i.e. season of use) would not change in these areas. This is because site-specific protection or management actions are used to meet other allotment objectives such as to improve livestock distribution and protect sensitive areas (i.e., riparian areas).

Wild Horses

This analysis examines the forage production and the appropriate management level within the Pokegama Herd Management Area that would occur under the alternatives.

Key Points
• Under all alternatives there would be an increase in forage production in the Pokegama Herd Management Area. The increase would be the highest under Alternative 3. • Under all alternatives, the appropriate management level of 30-50 head would be maintained.

Under all alternatives, wild horses would be excluded from certain traditional watering or foraging areas through fencing intended to protect or restore habitat. Exclusion of these watering areas from wild horses would be so limited in number and so scattered geographically that they would not appreciably limit overall watering or foraging areas or change herd movement and distribution.

Under all alternatives, the quantity of forage production within the Pokegama Herd Management Area would not substantially change as a result of fuels treatments. All fuels treatments would occur inside of timber harvest units. Where fuels treatments would occur:

- In the short term (0-5 years), closures would rest these areas after fuels treatments if soil and vegetation are no longer capable of supporting wild horses.
- In the long term (5+ years), treatments would result in increased forage production and enhanced vigor of vegetation.

Under all alternatives, grazing authorizations within the Pokegama Herd Management Area would remain the same. Therefore, there would continue to be adequate forage for livestock grazing and wild horses. See the *Wild Horse* section of *Chapter 3* for the relationship of grazing to the Pokegama Herd Management Area.

The construction of range improvements would vary between the No Action Alternative and action alternatives (See *Table 228*). Under all action alternatives, up to two new reservoirs and five new miles of fence would be constructed within the Pokegama Herd Management Area (See *Chapter 2* maps and *Appendix L, Grazing*.

Forage and water availability is not a limiting habitat factor in the Pokegama Herd Management Area; however, distribution of the wild horse herd is not uniform. Under the action alternatives, construction of range improvements would improve wild horse distribution by shifting:

- Grazing pressure from riparian/wetlands to uplands
- Grazing distribution within the uplands including areas that are not currently used

Off-highway vehicle use affects wild horses through disturbance or harassment. Areas designated as open to off-highway vehicle use would provide more opportunities for disturbance or harassment to the wild horse herd than areas designated as limited to off-highway use. Effects to the wild horse herd would be minor because the Herd Management Area would be designated as limited to off-highway use under all alternatives.

Timber management actions affect forage production through changes to the forest structural stages (see *Figure 287, Changes in structural stage abundance within the Pokegema HMA*). Timber harvest that results in the stand establishment forest structural stage classification would increase the amount of grasses and grass-like species that serve as forage (see the *Wild Horse* section of *Chapter 3*). The young forest structural stage classification would provide the least amount of forage.

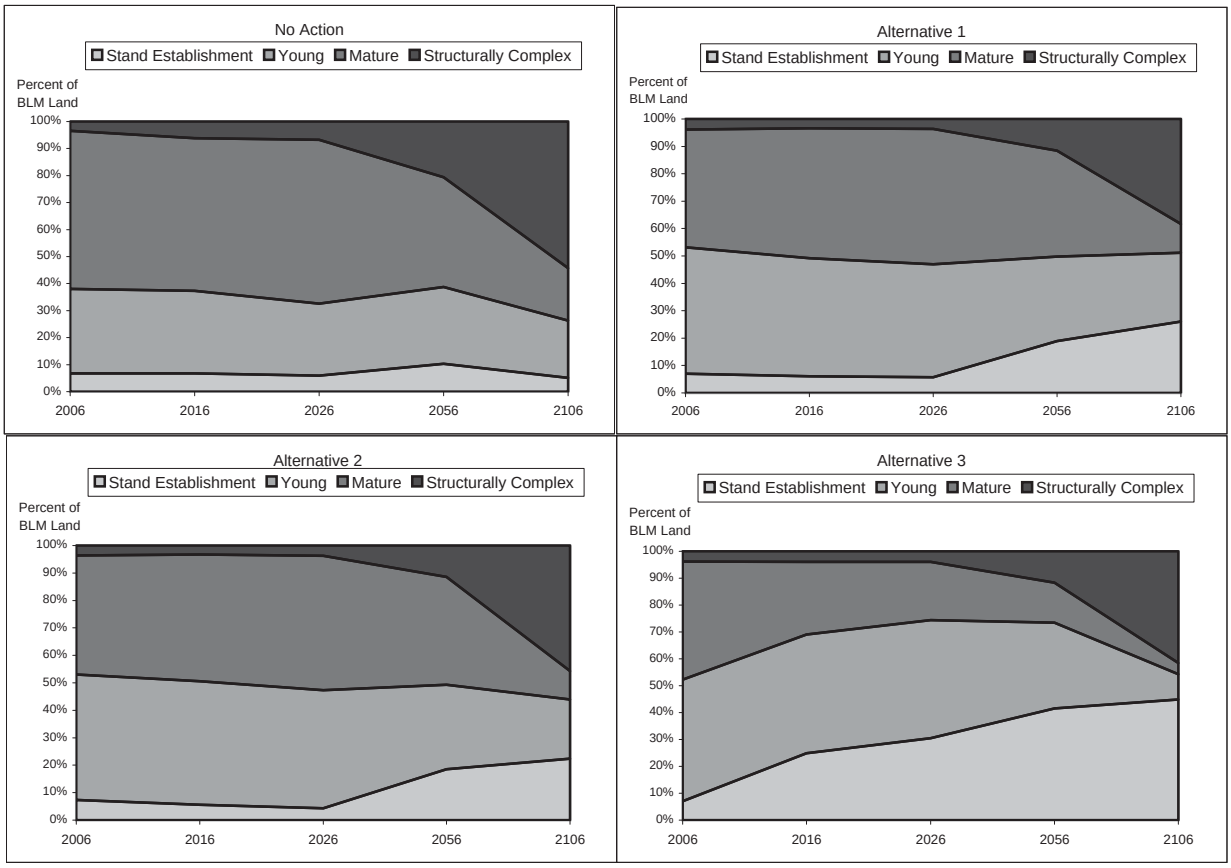
Under the No Action Alternative, the amount in the stand establishment forest structural stage classification within the Pokegama Herd Management Area would decrease from 900 acres to 700 acres over the next 100 years.

Under Alternative 1, the amount in the stand establishment forest structural stage classification within the Pokegama Herd Management Area would increase from 900 acres to 3500 acres over the next 100 years.

Under Alternative 2, the amount in the stand establishment forest structural stage classification within the Pokegama Herd Management Area would increase from 1000 acres to 3000 acres over the next 100 years.

Under Alternative 3, the amount in the stand establishment forest structural stage classification within the Pokegama Herd Management Area would increase from 900 acres to 5900 acres over the next 100 years.

Figure 287. Changes in structural stage abundance within the Pokegama HMA



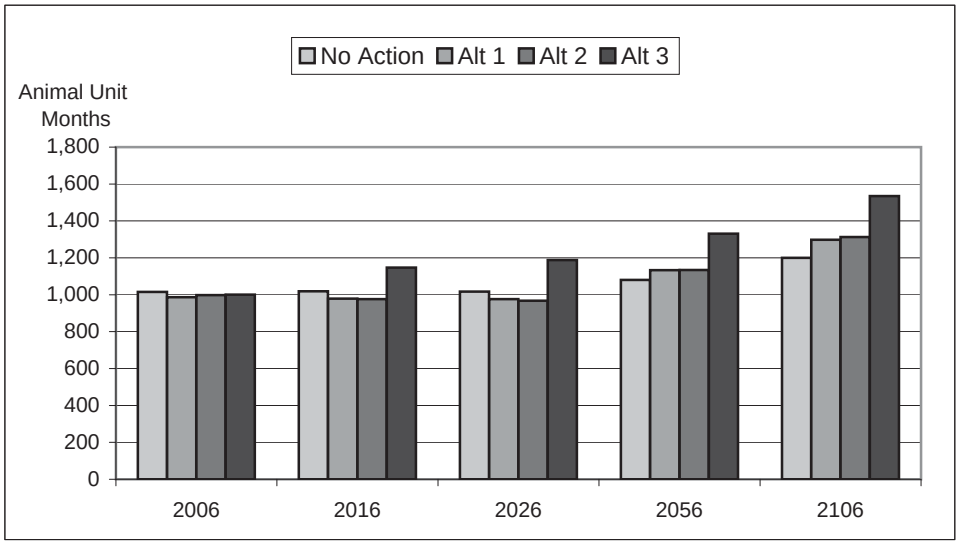
Under all action alternatives, the increase of the stand establishment structural stage classification and decrease in the young forest structural stage classification would result in a corresponding increase in forage production. Under the No Action Alternative, there would be a decrease of the stand establishment structural stage classification, a decrease in the young forest structural stage classification, and an increase in the structurally complex forest structural stage classification. This would result in an overall increase in forage production under the No Action Alternative. The increase in forage production would be the highest under Alternative 3. See *Table 230* (*Changes in wild horse forage production by alternative*) and *Figure 288* (*Changes in wild horse forage production by alternative).*

Increases to forage production would not change the Appropriate Management Level. The Appropriate Management Level is based on suitability of an area for grazing (distance from water, topography, temperature, forage type and availability), wild horse distribution on BLM and private land, and utilization (amount of forage consumed) in addition to forage production. All of these factors would be considered to determine when changes in wild horse numbers would be required (see the *Wild Horses* section of *Chapter 3*).

Table 230. Changes in wild horse forage production by alternative

Year	Forage Production (animal unit months)			
	No Action	Alternative 1	Alternative 2	Alternative 3
2006	1,015	987	998	1,001
2016	1,019	979	976	1,147
2026	1,017	976	968	1,188
2056	1,080	1,133	1,134	1,331
2106	1,200	1,298	1,313	1,535

Figure 288. Changes in forage production by alternative



Areas of Critical Environmental Concern

This analysis examines the designation of areas of critical environmental concern and the relevant and important values that would not receive special management attention under each alternative.

Key Points
The three action alternatives would maintain 65 to 75% of the relevant and important values within the existing and potential areas of critical environmental concern.

Areas of critical environmental concern are established to protect the important and relevant values that require special management attention (see the *Areas of Critical Environmental Concern* section in *Chapter 3*). The lack of special management attention for those that require it would result in the eventual degradation or loss of those important and relevant values. See *Appendix M. Areas of Critical Environmental Concern* for information about the specific important and relevant values for each area of critical environmental concern. Regarding the relevant and important values associated with fish and wildlife, any species listed under the Endangered Species Act would still be protected under that act.

Although there are 132 existing and potential areas of critical environmental concern within the planning area (see the *Areas of Critical Environmental Concern* section in *Chapter 3*), only 124 existing and potential areas of critical environmental concern were analyzed for designation under the three action alternatives. The remaining 8 of the 132 existing or potential areas did not meet the criteria (i.e., relevance and importance, or the need for special management) for further consideration. See *Table 234 (Existing and potential ACEC value categories by BLM district within the 124 areas that were further analyzed for designation)*.

Under each of the three action alternatives, some areas of critical environmental concern were analyzed for designation excluding the O&C lands. Some of the original designations and nominations included only small areas of O&C lands and were expanded beyond the minimum area needed to protect the relevant and important values in order to create more logical units based on administrative boundaries or topographic features. Therefore, in some cases, the exclusion of the O&C lands would still allow for the effective application of special management attention to the relevant and important values.

All areas of critical environmental concern that are also designated as research natural areas would be retained under all four alternatives.

Under the No Action Alternative, all 94 existing areas of critical environmental concern would continue to be designated. Special management attention would continue to be implemented in these areas. See *Table 231 (Total existing and potential ACECs designated by alternative)*. The effect of the application of special management attention on the relevant and important values in the existing areas of critical environmental concern would be to maintain those values as they currently exist, or to change those values in a trend towards the desired condition of those values.

There are five potential areas of critical environmental concern that are currently under interim management. There are another 33 new potential areas of critical environmental concern that

would not be designated under the No Action Alternative (see the *Areas of Critical Environmental Concern* section in *Chapter 3*). These areas would receive interim special management attention until a future planning decision was made to designate or not designate these areas as areas of critical environmental concern. The effect of the application of interim special management attention on the resource values in these areas would be to maintain those values as they currently exist, or to change those values in a trend towards the desired condition of those values.

Under Alternative 1, 92 of the 124 existing and potential areas of critical environmental concern would be designated. See *Table 231 (Total existing and potential ACECs designated by alternative)*. The effect of the application of special management attention on the relevant and important values in these areas would be to maintain those values as they currently exist, or to change those values in a trend toward the desired condition of those values.

Under Alternative 1, 32 of the 124 existing and potential areas of critical environmental concern would not be designated. See *Table 232 (Existing and potential ACECs not designated by alternative)*. The relevant and important values in these areas would not receive the special management attention needed to maintain or protect them. See *Table 233 (Relevant and important value categories that would receive no special management attention)*. These values would eventually be degraded or lost.

Under Alternative 2, 93 of the 124 existing and potential areas of critical environmental concern would be designated. See *Table 231 (Total existing and potential ACECs designated by alternative)*. The effect of the application of special management attention on the relevant and important values in these areas would be to maintain those values as they currently exist, or to change those values in a trend toward the desired condition of those values.

Under Alternative 2, 31 of the 124 existing and potential Areas of Critical Environmental Concern would not be designated. See *Table 232 (Existing and potential ACECs not designated by alternative)*. The relevant and important values in these areas would not receive the special management attention needed to maintain or protect them. See *Table 233 (Relevant and important value categories that would receive no special management attention)*. These values would eventually be degraded or lost.

Under Alternative 3, 82 of the 124 existing and potential areas of critical environmental concern would be designated. See *Table 231 (Total existing and potential ACECs designated by alternative)*. The effect of the application of special management attention on the relevant and important values in these areas would be to maintain those values as they currently exist, or to change those values in a trend toward the desired condition of those values.

Under Alternative 3, 42 of the 124 existing and potential areas of critical environmental concern would not be designated. See *Table 232 (Existing and potential ACECs not designated by alternative)*. The relevant and important values in these areas would not receive the special management attention needed to maintain or protect them. See *Table 233 (Relevant and important value categories that would receive no special management attention)*. These values would eventually be degraded or lost.

The No Action Alternative would provide special management attention or interim special management attention to all 132 existing and potential areas of critical environmental concern.

Alternatives 1 and 2 would designate similar numbers and acres of areas of critical environmental concern and would provide special management attention to similar numbers of relevant and important values. Alternative 3 would designate the fewest number and least acres as areas of critical environmental concern and would provide special management attention to the least number of relevant and important values.

Table 231. Total existing and potential ACECs designated by alternative

BLM Districts	No Action Alternative		Alternative 1		Alternative 2		Alternative 3	
	Number	Acres	Number	Acres	Number	Acres	Number	Acres
Salem	26	18,770	26	17,956	25	19,217	20	15,544
Eugene	14	2,791	13	2,509	15	2,393	14	2,397
Roseburg	10	10,232	9	9,412	9	9,412	9	9,412
Coos Bay	11	9,751	14	13,000	12	9,085	9	7,413
Medford	28	15,812	22	18,122	24	21,457	22	18,104
Klamath Falls Resource Area (Lakeview District)	5	10,317	8	10,776	8	10,754	8	10,748
Totals	**94**	**67,673**	**92**	**71,775**	**93**	**72,318**	**82**	**63,618**

Table 232. Existing and potential ACECs not designated by alternative

BLM Districts	No Action Alternative (interim mgmt)		Alternative 1		Alternative 2		Alternative 3	
	Number	Acres	Number	Acres	Number	Acres	Number	Acres
Salem	11	4,648	9	5,459	10	4,206	15	7,874
Eugene	8	11,902	7	12,181	5	12,298	6	12,296
Roseburg	3	158	3	976	3	977	3	978
Coos Bay	5	4,053	2	804	4	4,720	7	6,391
Medford	7	8,174	11	5,864	9	2,529	11	5,882
Klamath Falls Resource Area (Lakeview District)	4	1,093	0	634	0	658	0	662
Totals	**38**	**30,028**	**32**	**25,918**	**31**	**25,388**	**42**	**34,083**

Table 233. Relevant and important value categories that would receive no special management attention

Value Category	No Action Alternative	Alternative 1		Alternative 2		Alternative 3	
		Number	%	Number	%	Number	%
Cultural, historic, and scenic	0	5	16	4	13	7	22
Fish and wildlife	0	19	34	15	27	24	43
Natural process or system	0	34	28	33	28	43	36
Natural hazard	0	0	0	0	0	0	0
Totals	**0**	**58**	**27**	**52**	**25**	**74**	**35**

See *Table 234 (Existing and potential ACEC value categories by BLM district within the 124 areas that were further analyzed for designation)* for the number of important and relevant values for the 124 existing and potential areas of critical environmental concern that were analyzed for designation under the alternatives.

Table 234. Existing and potential ACEC value categories by BLM district within the 124 areas that were further analyzed for designation

Value Category	Salem	Eugene	Coos Bay	Roseburg	Medford	Klamath Falls	Totals per Value
Cultural, historic, and scenic	7	3	6	1	9	6	32
Fish and wildlife	18	14	7	2	9	6	56
Natural process or system	33	18	16	12	32	9	120
Natural hazard	3	0	0	0	0	0	3
Totals per BLM District	**61**	**35**	**29**	**15**	**50**	**21**	**211**

Cultural Resources

This analysis examines the damage to cultural, paleontological, and traditional use sites that would result from the alternatives.

Key Points
The amount of damage to cultural, paleontological, and traditional use sites would vary little between all the alternatives. Under all four alternatives, no more than 2% of sites would be damaged per decade across the planning area.

Practices that are discussed in this analysis are the same or similar to those practices that have been implemented under the current RMP (the No Action Alternative). It is reasonable to assume that these practices would be implemented in a similar manner under all alternatives because the cultural, paleontological and Native American traditional use resource management objectives of all alternatives are essentially the same.

Nearly all impacts to cultural and paleontological sites would be reduced or eliminated under all alternatives through the practice of predisturbance site discovery and the use of avoidance or protection measures. However, site avoidance would not always be possible which would result in some incidental or inadvertent loss of sites or site values. Examples include:

- Sites that cannot be entirely avoided by project redesign without eliminating the resource benefits provided by the project.
- Projects that cannot be relocated or redesigned. For example, a ridge saddle may be the only economic and engineering feasible location for an access road..
- Site values that are visually dependent on setting.
- Sites that are not fully identified prior to ground disturbing actions due to lack of surface manifestations or reduced surface visibility. For example, some sites are partially or entirely below the ground surface or surface artifacts are not visible during inventory due to dense ground vegetation and thick duff cover.

Sites are not evenly distributed across the landscape or across landforms. The range of site locations is similar for the northern and coastal areas (Salem, Eugene, and Coos Bay districts) and for the southern areas (Roseburg and Medford districts). The Klamath Falls Resource Area has the most recorded sites (See the *Cultural Resources* section on *Chapter 3*).

Over the last nine years (1998 through 2006), the number of newly discovered sites per year were also unevenly distributed:

- 2 new sites in the northern and coastal areas (Eugene, Coos Bay and Salem districts),
- 55 new sites in the southern area (Roseburg and Medford districts), and
- 86 new sites in the Klamath Falls Resource Area.

Any ground-disturbing action which includes timber harvest, fire and fuels management, recreation management, and off-highway vehicle use can damage or destroy cultural,

paleontological and traditional use resources (See the *Cultural Resources* section of *Chapter 3*). Site damage occurred to 22 (0.83%) out of 2,653 recorded cultural sites in the planning area from 1998 through 2006.

- For timber harvest, the rate of site damage averaged one site per 7,640 harvested acres in the northern and coastal area, and one site per 9,125 harvested acres in the southern area over the past decade. There was no damage to sites in the Klamath Falls Resource Area.
- For road construction, no sites were reported damaged in the planning area between 1998 and 2006 so the damage rate is 0%. However, sites damaged by road construction were recorded prior to 1998 so it is assumed damage would occasionally occur.
- For fires and fuels management, the rate of site damage averaged one site per 11,052 treated acres in the southern area and one site per 9,775 treated acres in the Klamath Falls Resource Area over the past decade. No sites were damaged in the northern and coastal area. Fuel treatments also reduce the risk of wildfires damaging sites. While fuel treatments would reduce the risk of wildfires damaging sites, there is no quantified data on risk reduction.
- For recreation site development and use, a total of one site (in the Medford District) was damaged. Damage to one site does not provide enough data to develop a meaningful correlation between the number of recreation sites constructed or number of acres of recreation construction and the risk of damaging cultural sites. However, it is assumed that site damage would occasionally occur.
- Off-highway vehicle use that occurs on existing and designated roads does not impact cultural sites. Use that occurs outside of existing and designated roads, would damage sites. The Medford District and the Klamath Falls Resource Area have each reported one damaged site. The number of cultural sites damaged is too small to demonstrate a meaningful correlation between amount of off-highway vehicle use and rate of site destruction. However, it is assumed site damage would occasionally occur.

The past rate of damage is used to project the rate of damage to cultural sites that would occur under the alternatives.

No data is available to quantify the impacts to paleontological resources within the planning area. These sites have been recorded infrequently with only 45 locations documented.

Under the No Action Alternative, harvest would increase in the next decade to 97,300 acres in the northern and coastal areas which would result in 13 (3%) of the sites being damaged, and to 58,700 acres in the southern area which would result in six (0.4 %) of the sites being damaged. There would be no sites damaged in the Klamath Falls Resource Area.

Under the No Action Alternative, damage due to road construction, recreational site development, and use, and off-highway vehicle use would occasionally occur.

Under the No Action Alternative, ground disturbing hazardous fuels treatments over the next 10 years would occur on 107,000 acres in the Southern area which would result in 10 (0.7 %) of the sites being damaged, and on 77,000 acres in the Klamath Falls Resource Area which would result

in 8 (0.7 %) of the sites being damaged. Fuels treatments in the northern and coastal area would not result in damage to sites.

Under the No Action Alternative total damage would occur to an average of 4 sites per year and 1% of known sites would be damaged in the next decade. This includes:

- One site per year and 3% per decade in the northern and coastal areas,
- Less than two sites per year and 1% of sites in the next decade in the southern area, and
- Less than one site per year and 0.7 % of sites in the next decade in the Klamath Falls Resource Area.

Under Alternative 1, 122,200 acres would be harvested in the next decade in the northern and coastal areas which would result in 16 (4%) of the sites being damaged, and 78,400 acres would be harvested in the southern area which would result in 9 (0.7%) of the sites being damaged. There would be no sites damaged in the Klamath Falls Resource Area.

Under Alternative 1, damage due to road construction, recreational site development and use and off-highway vehicle use would occasionally occur.

Under Alternative 1, ground disturbing hazardous fuels treatment over the next 10 years would occur on 107,000 acres in the southern area which would result in 10 (0.7%) of the sites being damaged, and on 77,000 acres in the Klamath Falls Resource Area which would result in 8 (0.7%) of the sites being damaged. Fuels treatments in the northern and coastal areas would not result in damage to sites.

Under Alternative 1, total damage would occur to an average of 4 sites per year and 1% of known sites would be damaged over the next 10 years. This includes:

- Less than two sites per year and 4% in the northern and coastal areas,
- Two sites per year and 1% of sites in the southern area, and
- Less than one site per year and 0.7 % of sites in the Klamath Falls Resource Area.

Under Alternative 2, 126,600 acres would be harvested over the next 10 years in the northern and coastal areas which would result in 17 (4%) of the sites being damaged, and 90,400 acres in the southern area would be harvested which would result in 10 (0.7%) of the sites being damaged. There would be no sites damaged in the Klamath Falls Resource area.

Under Alternative 2, damage due to road construction, recreational site development and use, and off-highway vehicle use would occasionally occur.

Under Alternative 2, ground disturbing hazardous fuels treatment over the next 10 years would occur on 107,000 acres in the southern area which would result in 10 (0.7%) of the sites being damaged and on 77,000 acres in the Klamath Falls Resource Area which would result in 8 (0.7 %) of the sites being damaged. Fuels treatments in the northern and coastal area would not result in damage to sites.

Under Alternative 2, total damage would occur to an average of 5 sites per year and 2% of known sites would be damaged over the next 10 years. This includes:

- Less than two sites per year and 4% in the northern and coastal areas,
- Two sites per year and 1% of sites in the southern area, and
- Less than one site per year and 0.7% of sites in the Klamath Falls Resource Area.

Under Alternative 3, 147,900 acres would be harvested over the next 10 years in the northern and coastal area which would result in 19 (5%) of the sites being damaged and 126,100 acres would be harvested in the southern area which would result in 14 (1%) of the sites being damaged. There would be no sites damaged in the Klamath Falls Resource Area.

Under Alternative 3, damage due to road construction, recreational site development and use, and off-highway vehicle use would occasionally occur.

Under Alternative 3, ground disturbing hazardous fuels treatment over the next 10 years would occur on 107,000 acres in the southern area which would result in 10 (0.7%) of the sites being damaged and on 77,000 acres in the Klamath Falls Resource Area which would result in 8 (0.7%) of the sites being damaged. Fuels treatments in the northern and coastal areas would not result in damage to sites.

Under Alternative 3, total damage would occur to an average of 5 sites per year and 2% of known sites would be damaged over the next 10 years. This includes:

- Two sites per year and 5% of sites in the northern and coastal areas,
- Two sites per year and 2% of sites in the southern area, and
- Less than one site per year and 0.7% of sites in the Klamath Falls Resource Area.

A summary of the cultural resource sites projected to be damaged under the alternatives is shown in *Table 235* (*Percent of total cultural resource sites damaged under the alternatives over the next 10 years*).

Table 235. Percent of total cultural resource sites damaged under the alternatives over the next 10 years

Area	No Action	Alternative 1	Alternative 2	Alternative 3
Northern and Coastal Areas	3%	4%	4%	5%
Southern area	1%	1%	1%	2%
Klamath Falls Resource Area	0.7%	0.7%	0.7%	0.7%
Total All Areas	**1%**	**1%**	**2%**	**2%**

Impacts to Native American traditional use sites include alteration of sites and site settings, loss of vehicular access to sites, and noise and visual intrusions to site setting. Disturbance or destruction of spiritual sites occurs when physical elements such as cairns, mounds or burials are damaged or removed. Impacts to traditional use resources include reduction or elimination of resources such as huckleberries, bark, hazel and other resources. Competition for special forest products such as berries, bear grass, firewood or greenery contributes to the reduction of traditional resource quantities.

Management actions that would affect traditional use sites and resources include any that would result in ground disturbance, alterations of plant communities, and access restrictions. These include timber harvest, road construction and road decommissioning, fire and fuels management, permitting use of special forest products, and off-highway vehicle management.

Consulting with tribal governments and tribal members early in project planning to identify locations and resources of concern would reduce or eliminate most effects to sites and resources of interest to tribal members.

Under all four alternatives, avoidance of traditional use sites that are identified by tribal governments within the planning area would be the preferred and most common method to eliminate or reduce adverse impacts. However, if avoidance would not be possible, other impact reduction measures would be developed in consultation with the tribal government having an identified interest. Examples of such measures include timing the management action to occur during a period of time when traditional users are not present on the site and permitting use of an alternative location acceptable to traditional users. In those instances, when tribal governments would not be able to provide traditional use site locations in advance of projects, it would not be possible to take measures to protect the site or resource of concern.

Energy and Minerals

This analysis examines the availability, quantity, and abundance of energy and mineral resources under each alternative relative to demand.

Key Points

- All four alternatives would maintain similar levels of availability and quantity of energy and mineral resources.
- Under all four alternatives, energy and mineral resources on public land within the planning area would generally be abundant relative to demand.
- Under all four alternatives, almost all lands would remain available for the location of mining claims under the mining laws, but most on-the-ground activity would be limited to notice-level operations in a few areas that have been traditionally of interest.
- Under all four alternatives, common varieties of rock would continue to be available from existing quarries. A few quarries may be closed, reclaimed, or potentially replaced by new sites.
- Under all four alternatives, those parts of the Coos Bay District in the Coos geologic basin would be of special interest for the exploration and development of coal bed natural gas as an extension of the development that is already under way. As many as 77 wells may be drilled on federal land, which would result in about 525 acres of disturbance.

Under federal law and BLM policy, all public lands are open for energy and mineral exploration and development, unless specific lands are closed or withdrawn from mineral entry. An example of such a withdrawal would be the establishment of a federal wilderness. All four alternatives would provide opportunities for new exploration for all types of minerals. Most of the planning area would remain open to mineral entry. Such entries would be subject to certain restrictions as required by law or as a result of decisions supported by site-specific environmental analysis.

Under all four alternatives, almost all lands would continue to be available for oil and gas leasing and the exploration and development for conventional oil and gas. Although prices for oil and gas are expected to continue to rise relative to the costs of exploration and development, the actual physical occurrence of oil and gas in most parts of the planning area is speculative.

No federal oil and gas leases have been issued within the planning area since the current resource management plans were adopted in 1995. Lands in the southern portion of the Salem District and east of the Mist gas field have the best potential to attract leasing and exploration interest for conventional natural gas.

Among the six districts within the planning area, there are about 370 existing quarries for common variety minerals. It is assumed that up to 20 of these quarries would be depleted over the next 10 years and would likely be replaced by the expansion of existing quarries or the opening of new sites. Demand for common variety material is closely correlated with population growth and road maintenance needs.

Under all four alternatives, most lands would continue to be open for the location of mining claims under the Mining Law of 1872 (as amended). The levels and locations of activity would be about the same as it is currently. The highest levels of activity would continue to be in portions of the Medford District, followed by portions of the Roseburg and Eugene districts. See *Table 236 (Current claims, notices, and plans of operations within the planning area)* for the current level of claims, notices, and plans of operation by district.

Table 236. Current claims, notices, and plans of operations within the planning area

BLM Districts	Claims	Notices	Plans of Operation
Salem	133	0	0
Eugene	224	5	0
Roseburg	273	16	0
Coos Bay	304	0	0
Medford	1,363	85	1
Klamath Falls Resource Area (Lakeview District)	3	0	0

The current Coal Bed Natural Gas play on private and county lands, south of the city of Coos Bay, may eventually extend on to BLM-administered lands, although no lease nominations have been received to date. Based on the current level and location of activity, it is likely during the next 10 to 15 years that leases would be issued and up to 77 wells would be drilled, which would result in about 525 acres of total disturbance from the construction of access roads, drill pads, and product gathering pipelines. Under all four alternatives, the location of well pads and roads for the purpose of drilling would be limited to existing roads in riparian reserves and riparian management areas. Under all four alternatives, most development activity would occur on existing log landings and associated roads. See *Appendix P. Energy and Minerals* for a detailed discussion of Coal Bed Natural Gas. Should new wells encounter excessive amounts of produced water, no water would be discharged on the surface and any off-site water disposal would comply with applicable state regulations.

Biomass

It is estimated that the biomass opportunities that would result from timber sales would range from 5 to 10% of the standing merchantable volume of stands that would be harvested under each alternative. This level is based upon the assumption that only boles would be available for removal, as no method has been demonstrated that can consistently remove limbs economically and effectively except with ground-based, mechanized ground operations. This level would equate to between 0.35 and 0.7 dry tons per thousand board feet harvested.

Several factors would interact to vary this amount depending upon the location, district, and type of stand. These factors include the amount of nonmerchantable hardwoods, the amount of submerchantable material designated for cutting and removal in fire-prone stands, and the level of defect within a stand. Thinnings would typically contain material that consists mainly of tops and submerchantable stems, while older stands would contain more cull material and broken pieces. In addition, with ground-based operations where the yarding of whole trees is required, the potential biomass in the limb component may be included in both the thinning and harvesting of older stands.

Topography, vegetation, and yarding systems would affect the availability of biomass by reducing the recovery level of material. Areas suitable for ground-based equipment would have a higher recovery level, while areas of steep, dense brush would have a lower recovery level due to the difficulty of locating the material and bringing it to a landing with cable yarding systems.

The effects of yarding additional material would largely be similar to those created by yarding merchantable timber. In fire-prone stands, thinning (cutting and removing) the submerchantable material would reduce the risk of high-severity fires.

Chapter 5 – Coordination and Monitoring

Chapter 5 describes the public participation and interagency coordination that has occurred during the preparation of this Draft Environmental Impact Statement. It also includes a list of staff involved in the Western Oregon Plan Revision. Finally, the chapter describes how the monitoring plan will be created for the Proposed Resource Management Plan and the role of adaptive management in the land use planning process.

In this chapter:

Introduction **821**

Public Contact and Scoping **822**

Formal Cooperators **823**

Government-to-Government Coordination **825**

Consistency with Other Agency Plans and Programs **826**

Section 7 Consultation under the Endangered Species Act **829**

Preparers **830**

Monitoring **845**

Adaptive Management **848**

Introduction

An interdisciplinary team of resource specialists from the BLM Western Oregon districts and Oregon State Office, and contract personnel, prepared the Western Oregon plan revision. Initial preparation and planning for the plan revisions began in August 2003 when the Secretary of Interior, the American Forest Resource Council, and the Association of O&C Counties entered into the Settlement Agreement. Plan evaluations conducted in 2004 showed that the timber harvest decisions in the 1995 Oregon RMPs were not being met. The Notice of Intent, published in the Federal Register on September 7, 2005, initiated the public scoping process, and notified the public of the intent to revise the 1995 Oregon RMPs with a single Environmental Impact Statement. The Analysis of the Management Situation was published in October 2005. The Planning Criteria was published in February 2006. The planning process involved many steps with public participation, as well as consultation and coordination with many agencies and organizations thought-out the process.

Public Contact and Scoping

Public Contact and Scoping was conducted with direct mailings, public meetings, and internet web sites. The current mailing list includes approximately 1600 individuals and organizations. Public meetings were held in the all District Offices and at other locations across the planning area. District and State Office personnel met with many different partnerships including the Applegate Partnership, Soil and Water Conservation Districts and Counsels; Watershed Associations; Forest Protective Associations; Wildlife groups such as Ducks Unlimited and the Rocky Mountain Elk Foundation; the Native Plant Society; Environmental Education Groups; Recreation Groups such as horsemen, all terrain vehicle users, and trail associations; and environmental groups such as Audubon and the Nature Conservancy.

Some of the public contact and scoping activities that occurred just prior to and following the initiation of the planning process by the publication of the Notice of Intent in September 2005 include:

Newsletter #1 – Scoping – Introduction to WOPR – August 2005

Public Web Page Available – August 2005

County Fair Booths, August 2005

NOI and News Release – September 7, 2005

Scoping Meetings – September/October 2005

Scoping Key Contact Meetings – September/October 2005

State Director Editorial Boards – September/October 2005

Economic Profile System Workshops, September/November 2005

ACEC Nomination Process – Mailed to mailing list, October 5, 2005

Analysis of the Management Situation Printed – October 2005

Newsletter #2 - Summary of the Analysis of the Management Situation, December 2005

State Director and Governor sign WOPR MOU, December 1, 2005

Proposed Planning Criteria and State Director Guidance published February 2006

Scoping Report issued, February 2006

Newsletter #3 - Scoping Report, Planning Criteria, and ACEC Nominations, February 2006

Planning Criteria / Alternatives – Public Meetings, March 2006

Public Interest Environmental Law Conference – March 3-4, 2006

Newsletter #4 - Planning Criteria & Use of Science in Plan Revisions, April 2006

State-of-the-Science Forum -- Corvallis, June 15, 2006

Newsletter #5 – Summary of the Alternatives to be Analysed in the Environmental Impact Statement, October, 2006

Newsletter #6 – Pre Draft Environmental Impact Statement Update, April, 2007

Formal Cooperators

The Federal Land Policy and Management Act and the National Environmental Policy Act provide direction regarding coordination and cooperation with other agencies and governments. The Federal Land Policy and Management Act emphasizes the need to ensure coordination and consistency with the plans and policies of other relevant jurisdictions. The National Environmental Policy Act provides for what is essentially a cooperative relationship between a lead agency and cooperating agencies in the National Environmental Policy Act process.

Cooperating agency status provides a formal framework for governmental units—local, state, tribal, or Federal—to engage in active collaboration with a lead Federal agency to implement the requirements of the National Environmental Policy Act. Within the constraints of time and resources, cooperating agency staff members are encouraged to participate fully with BLM as members of the planning and environmental impact statement team.

The Council on Environmental Policy regulations specify that a Federal agency, state agency, local government, or tribal government may qualify as a cooperating agency because of ". . . jurisdiction by law or special expertise."

1) Jurisdiction by law means ". . . agency authority to approve, veto, or finance all or part of the proposal." (40 CFR 1508.15)

2) Special expertise means ". . . statutory responsibility, agency mission, or related program experience." (40 CFR 1508.26)

Cooperators are important to successful revisions of BLM's resource management plans, and therefore will be involved early and often in the planning process. They can provide expertise in much of the subject matter being analyzed. Some cooperators can provide advice based on experiences with similar planning efforts.

The Cooperators have met with the BLM managers and planning core team and throughout the planning process, including the development of issues, the planning criteria and the alternatives.

Federal Cooperators are:

United States Forest Service

National Oceanic and Atmospheric Administration – Fisheries

United States Fish and Wildlife Service

Environmental Protection Agency

For the State of Oregon, the Governor's Office and ten state resource agencies are under a single Memorandum of Understanding.

The State of Oregon Cooperators are:

Oregon Governor's Office

Oregon Department of Forestry (Lead agency for the state)

Oregon Department of Fish & Wildlife

Oregon Department of Environmental Quality

Oregon Department of Transportation

Oregon Department of Geology and Mineral Industries

Oregon Department of Agriculture

Oregon Department of Parks and Recreation

Oregon Department of State Lands

Oregon State Marine Board

Oregon Water Resources Department

Oregon Counties that are potentially affected by a BLM Planning process qualify for cooperator status based on the special expertise resulting from their knowledge of the local social, economic, and political conditions that exist within the planning area. Sixteen Oregon Counties are Cooperators. While each county has a separate Memorandum of Understanding with the BLM, the Association of O&C Counties represents them as a group.

Oregon County Cooperators are:

Clackamas Co.

Columbia Co.

Coos Co.

Curry Co.

Douglas Co.

Jackson Co.

Josephine Co.

Linn Co.

Klamath Co.

Lane Co.

Lincoln Co.

Marion Co.

Polk Co.

Tillamook Co.

Washington Co.

Yamhill Co.

Government-to-Government Coordination

There are seven recognized tribes within the planning area. All of the tribes have stated that they want government-to-government relationships rather than cooperator relationships. The Coquille Tribe is directly engaged in the planning process because, by law (25 U.S.C. §715c), the management of their tribal lands must be consistent with the management of the surrounding federal lands.

Recognized tribes within the planning area are:

Confederated Tribes of the Coos, Lower Umpqua, and Siuslaw Indians

Coquille Indian Tribe

Cow Creek Band of Umpqua Tribe of Indians

Confederated Tribes of Grand Ronde

Confederated Tribes of Siletz

Confederated Tribes of the Warm Springs Reservation

The Klamath Tribes

Consistency with Other Agency Plans and Programs

The BLM planning regulations require that resource management plans be ". . . consistent with officially approved or adopted resource-related plans and the policies and procedures contained therein, of other federal agencies, state and local governments, and Indian tribes, so long as the guidance and resource management plans are also consistent with the purposes, policies, and programs of federal laws and regulations applicable to public lands . . . " (43 CFR 1610.3-2). The alternatives are intended to be consistent with other agencies plans. A consistency review will be completed for the proposed RMP and Final Environmental Impact Statement.

Federal Agencies

U.S. Department of Agriculture

- Forest Service
  - Forest-wide land use plans for adjacent national forests.
- Soil Conservation Service
  - Soil Surveys and Watershed Plans
- Animal and Plant Inspection Service
  - Pest Management including noxious weeds

U.S. Department of the Interior

- Fish and Wildlife Service
  - Pacific Bald Eagle Recovery Plan
  - Draft Northern Spotted Owl Recovery Plan
  - Draft Snowy Plover Recovery Plan
  - Marbled Murrelet Recovery Plan
  - Fish and Wildlife Service determination of critical habitat for northern spotted owl
- National Park Service
  - National rivers inventory and related review procedures

U.S. Department of Defense

- Army Corps of Engineers
  - Applicable project-specific recreation plans and navigable river (Sec. 404) permits

U.S. Department of Energy

- Bonneville Power Administration
  - Transmission and System Facilities Resource Program

U.S. Department of Commerce

- National Oceanic and Atmospheric Administration - Fisheries
- Anadromous Fish Recovery Plans and Critical Habitat

Northwest Power Planning Council

- Columbia River Basin, Fish and Wildlife Program, and subordinate species-specific strategies.

State Agencies

Department of Agriculture

- Weed Control Plans
- State-listed endangered plant species

Department of Environmental Quality

- Visibility Protection Plan and air quality standards
- Water Quality Management Plan
- Public use watersheds

Department of Fish and Wildlife

- Statutory Wildlife Policy
- Oregon Endangered Species Programs
- Sensitive Species Rule
- Non-game Wildlife Plan
- Big Game Population Management Objectives
- The Oregon Conservation Strategy
- Oregon Plan for Fish
  Wild Fish Policy
  Coho, Steelhead Trout Plans
- Basin Fish Management Plans

Department of Forestry

- Smoke Management Plan
- Oregon Forest Practices Act
- Forestry Program for Oregon

Water Resources Department

- River basin programs
- Water Resources Commission rules and statutes

Parks and Recreation Department

- State-wide Comprehensive Outdoor Recreation Plan
- State Parks and Recreation System Plan
- State Recreation Trails Plan
- State Historic Preservation Program
- Oregon Beach Law
- State-designated Scenic Waterways

Department of Transportation, Highway Division

- Oregon Highway Plan

Division of State Lands

- Removal-fill Law
- Natural Heritage Program

Oregon Department of Land Conservation and Development

State-wide land use planning goals of the Oregon Land Conservation and Development Commission will serve as the analytical foundation for documenting consistency with both state-wide planning goals, approved county and city-wide comprehensive plans, and the Oregon Coastal Management Program.

Oregon Coastal Management Program

According to 15 CFR 930, a Federal agency may use its NEPA documents as a vehicle for its consistency determination or negative determination. However, a Federal agency's federal consistency obligations under the Act are independent of those required under NEPA and are not necessarily fulfilled by submission of a NEPA document. The BLM will include its consistency determination or negative determination in the RMP/EIS and ensure that the NEPA document includes the information and adheres to timeframes required by the regulations.

Local Government

A brief narrative will be prepared addressing consistency with county and city comprehensive plans. The narrative will note any inconsistencies between RMP alternatives and county plans that might affect RMP implementation. Most counties in the planning area are participating as cooperators in the preparation of the plan to facilitate consistency.

Tribal Plans and Treaties

Separate narrative discussions of any relevant tribal plans, programs or policies, or treaty interests will be included after consulting with appropriate tribal leaders.

Section 7 Consultation under the Endangered Species Act

Introduction

The revision of the Resource Management Plans with management action for western Oregon BLM's resource programs constitutes a federal action that is subject to Endangered Species Act consultation.

Consulting on the RMP and Environmental Impact Statement provides for an evaluation of whether jeopardy, or destruction or adverse modification of critical habitat are likely to occur at the program scale, and will facilitate the consultation process for site-specific, project scale management actions. Subsequent consultation at the project level would provide an evaluation of specific effects of individual management actions to listed species and critical habitat. The site-specific, project level proposals would include a description of all management actions, conservation measures and project level best management practices.

Information relating to proposed and listed species and proposed and designated critical habitat (e.g., conclusions on how the alternatives affect listed species) has been incorporated into the Draft Environmental Impact Statement and will be used in the development of the Biological Assessment. The Federal agencies will convene an interagency team to conduct consultation.

Biological Assessment

The purpose of a Biological Assessment is to assess the effects of the implementation of the proposed RMP as described and analyzed in the Final Environmental Impact Statement.

The process used to develop the Biological Assessment will provide for early interagency coordination, provide the logic for conclusions on effects to species, and provide a mechanism for comment and input from the consulting agencies.

The final Biological Assessment will incorporate changes to the preferred alternative and comments received. A Biological Opinion from the consulting agencies will only be prepared after the final Biological Assessment is completed.

Preparers

Steering Committee

The eight-member Steering Committee is comprised of management staff from the BLM Oregon/Washington State Office in Portland and the six BLM districts represented in the Western Oregon Plan Revisions. This committee provides leadership, on behalf of the BLM west-side districts and the Oregon State Office, to the Resource Management Plan Revisions process.

Members of the Steering Committee are listed below:

- Edward W. Shepard — Oregon/Washington State Director
- Mike Mottice — Deputy State Director, Division of Resources
- Aaron Horton — District Manager, Salem
- Ginnie Grilley — District Manager, Eugene
- Jay Carlson — District Manager, Roseburg
- Tim Reuwsaat — District Manager, Medford
- Shirley Gammon — District Manager, Lakeview
- Mark E. Johnson — District Manager, Coos Bay

Key Project Staff

The following table lists the staff who prepared the Draft RMP/EIS and their specific area of responsibility, as well as the organization where each staff member works. Biographies for each staff member are included below the table.

Table 237. Key project staff for the Western Oregon Plan Revision

Key Staff and Assigned Responsibilities		
Responsibility	**Name**	**Oraganization**
Project Manager	Richard Prather	Oregon State Office BLM
Lead Planner	Philip Hall	Mason, Bruce and Girard Inc.
Planner	Anne Boeder	Oregon State Office BLM
Forester/Planner	Alan Wood	Oregon State Office BLM
Writer-Editor	Linda Chesnut	Mason, Bruce and Girard Inc.
GIS/Data Analysis	Duane Dippon	Oregon State Office BLM
Administrative Record Coordinator	Mary Ceciliani	Oregon State Office BLM
Logistics Coordinator	Jerry Hubbard	Oregon State Office BLM
Public Involvement Coordinator	Alan Hoffmeister	Oregon State Office BLM
Vegetation/Land Use Allocation Mapping	Chris Cadwell	Oregon State Office BLM
Forester/Planner	Paul Ausbeck	Roseburg BLM
Graphics Editor	Kristen Hiatt	Lakeview BLM
Cartographer	Paul Fyfield	Oregon State Office BLM
Cultural	Fran Philipek	Salem BLM
Ecology	Richard Hardt	Eugene BLM
Energy/Minerals	Patrick H. Geehan	Oregon State Office BLM
Energy/Minerals	Eric Hoffman	Oregon State Office BLM
Fire	John Dinwiddie	Medford BLM
Fisheries	Nikki Moore	Coos Bay BLM
Fisheries	Bill Hudson	Coos Bay BLM
Grazing	Kim Hackett	Medford BLM
Hydrology	Dan Carpenter	Coos Bay BLM
Recreation	Chris Church	Coos Bay BLM
Roads, Lands	John Styduhar	Oregon State Office BLM
Silviculture	Craig Kintop	Roseburg BLM
Socio-Economic	Mark Rasmussen	Mason, Bruce and Girard Inc.
Soils	Clif Fanning	Oregon State Office BLM
Special Areas	Lou Whiteaker	Klamath Falls BLM
Timber	Dave DeMoss	Eugene BLM
Vegetation/Botany	Doug Kendig	Medford BLM
Vegetation/Botany	Claire Hibler	Salem BLM
Wildlife	Chris Foster	Roseburg BLM

Interdisciplinary and EIS Team

Paul Ausbeck – *Planner/Forester.* Paul has a B.S. in Wood Technology & Utilization and Forest Sciences from the University of Illinois, and an M.S. in Forest Products from the University of Washington. He has 25 years of government service, including 8 years with the U.S. Forest Service on the Mount Baker-Snoqualmie National Forest In his 17 years with the BLM in Oregon, Paul worked in timber sale planning, preparation and administration for 8 years and has been the Environmental Coordinator for the South River Field Office, Roseburg District, BLM since 1998.

Anne Boeder - *Planner*. Anne holds a B.A. in Cartography and Geography from the University of Wisconsin and a Master of Public Administration from the University of Utah. Anne has 23 years of government service, including 13 years with the U.S. Forest Service and 8 years with the BLM. She most recently served in various leadership roles on the interagency team for the 2004 Survey and Manage Environmental Impact Statement and Record of Decision. She has also worked on both the Roseburg and Coos Bay Districts.

Chris Cadwell - *Forester/Resource Analyst*. Chris served on the Forest Ecosystem Management Assessment Team in the estimation of probable sale quantities. He has coordinated probable sale quantities estimations and geographic information system analysis supporting development and implementation of the BLM resource management plans in western Oregon. He is co-author of the implementation guidance for the 15 percent standard and guideline. Chris served as co-lead in developing interagency vegetation standards and served on the team that developed interagency land allocation standards for the Northwest Forest Plan area. He participated in the Survey and Manage Final Supplemental Environmental Impact Statements in the assessment of timber effects and development of late-successional forest. He is the state data steward for the forest operations inventory, timber production capability classifications, and land use allocations for the BLM. Chris has 25 years experience with the BLM in western Oregon and currently is employed by the BLM Oregon/Washington State Office. He holds a B.S. in Forest Management from Humboldt State University.

Dan Carpenter – *Hydrologist*. Dan has a B.S. in Soil Science, from Washington State University. He has worked as a professional hydrologist, for the past 25 years (12 with the U.S. Forest Service and 13 with the BLM) on the Oregon Coast, Western Cascades and Great Basin in Nevada. His area of expertise includes watershed planning, modeling, and watershed restoration. His most recent assignments included working on an interagency Port-Orford-Cedar Environmental Impact Statement and environmental planning roles in the permitting of the Coos County Natural Gas Pipeline. Dan is currently employed as a hydrologist on the Coos Bay District.

Mary Ceciliani – *Program Assistant.* Beginning October 1, 2005 Mary assumed the position as coordinator for the Administrative Record of the Western Oregon Plan Revision of the Northwest Forest Plan. Previous positions included working at the Oregon Federal Executive Board, where she managed all the training, coordinated Health Fairs for agencies during the Open Season, and assisted in preparation for numerous committee meetings. Mary started her career in the BLM Division of Minerals. Her BLM employment totals approximately 23 years.

Linda Chesnut – Linda has a B.S. in Graphic Design from Oregon State University and over 12 years experience as a technical writer, editor, and illustrator. Linda has edited, proofread, and formatted various environmental, scientific, and grant proposal documents for the Environmental Protection Agency. With a strong familiarity with the standards of ANSI, ISO, SEMI, and Six Sigma that govern operations, repeatability, safety, and quality, she has developed content for the semiconductor and video security equipment industries. Linda has also developed templates and style guidelines, as well as led cross-functional teams to develop improved interdepartmental operating procedures. Linda's expertise is in creating user-friendly end-user, process, and marketing documentation. She is currently employed by a contractor to the BLM.

Chris Church – *Recreation, National Landscape Conservation System* – Chris has a B.S. in Wildlife and Fisheries Science from Texas A&M University. He has nine years of experience developing community-based conservation and recreation-related projects with the BLM, University of Oregon, and the U.S. Peace Corps. Chris currently works for the Coos Bay BLM District, managing the Areas of Critical Environmental Concern program.

David DeMoss – *Forester.* Dave is currently the district staff forester and district silviculturist for the Eugene BLM District. He holds a B.S. in Forestry from the University of California - Berkley, and has 29 years experience on the Eugene BLM District in timber sales and silviculture. He served as the silviculturist on the Late Successional Reserve # 267 Restoration Environmental Impact Statement and has experience in stand dynamics and modeling.

John Dinwiddie – *Fire/Fuels/Air Quality.* John's forestry education includes 2 years at Central Oregon Community College and completion of Technical Fire Management in 1989. John worked in private industry for 2 years and for the U.S. Forest Service for 5 years. His BLM employment totals 25 years.

Duane Dippon – *Geographic Information System/Data Team Leader*. Duane earned a B.S. and M.S in Forestry and Forest Economics at Purdue University and a Ph.D. in Forest Management, with a Minor in Operations Research, from Oregon State University. He served as the Forest Ecosystem Management Assessment Team co-Geographic Information System /Data Team Leader, building the geospatial database covering over 24 million acres of federal lands across the Pacific Northwest and used by the Forest Ecosystem Management Assessment Team scientists in the development of the Northwest Forest Plan. Duane came to the Bureau in 1988 to integrate the use of geospatial data, modeling, and geographic information system technology in support of federal land planning. He has served as the chair or co-chair of the Interagency Resources Information Coordination Council from 1994-98 and 2003-04 and serves on the Oregon Geographic Information Council. Prior to joining the BLM, Duane was an Associate Professor at the University of Florida teaching Forest Management, Forest Economics and Quantitative Methods in Natural Resources Management.

Clif Fanning – *Soil Scientist.* Clif holds a B.S. in Soil Science from California Polytechnic State University. He has 32 years of federal service and has been working with the BLM since 1977. Cliff previously worked in Dillon and Butte, Montana; and in Cheyenne, Wyoming. He has served on numerous planning efforts over the years and has been the Oregon/Washington state soil scientist since 1991.

Paul Fyfield – *Cartographer***.** Paul has been a Cartographer in the BLM Oregon State Office in Portland since 2001. He earned a Master's degree in Geography from Portland State University in 2003

Chris Foster – *Wildlife Biologist*. Chris is currently the District Wildlife Biologist for the Roseburg BLM District. He holds a B.S. in Forest and Wildlife Management from the University of Maine, and an M.S. in Wildlife Management from West Virginia University. Chris has more than 15 years experience working for the U.S. Forest Service and the BLM. Chris has held positions as a Wildlife Biologist and as a forester specializing in watershed analysis and planning.

Patrick H. Geehan- *Mineral Economist*. Patrick is the Chief, Minerals Section in the Oregon/Washington State Office. He has a B.A. in Economics from The Colorado College and a M.S. in Mineral Economics from the Colorado School of Mines. He has 33 years experience with BLM and has been coal leasing program leader, Deputy State Director for Minerals; and Chief, Branch of Physical Sciences. He has managed special projects including the Interior Columbia Basin Ecosystem Management Project and the Umpqua Land Exchange Project.

Kimberly Hackett – *Rangeland Management Specialist*. Kimberly Hackett has a B.S. in Wildlife Science with a Range Science Emphasis from New Mexico State University. She has worked for the BLM for 17 years. Kimberly is currently the Medford BLM District Rangeland Management Specialist. She previously worked as a Rangeland Management Specialist for 11 years in Idaho and 5 years in Nevada.

Phil Hall – *Planner*. Phil holds a B.S. in Forestry and a B.S. in Conservation from North Carolina State University. Phil served on the interdisciplinary team for the Northwest Forest Plan Supplemental Environmental Impact Statement (1994) and was a lead planner in developing the western Oregon resource management plans tiered to the Northwest Forest Plan. He has served on regional teams for the development of watershed analysis guides and monitoring and research. Phil has provided national level training for the National Environmental Policy Act and Resource Management Planning. Phil has a broad understanding and familiarity of BLM programs and plans, including the Northwest Forest Plan and environmental impact statements. He has 33 years of federal service, including 30 years with the BLM (1976-2006) on two BLM districts and in several resource areas. He served on special assignments to BLM's national office in Washington, DC and to other BLM districts in the western United States. He is now employed by a contractor to the BLM.

Richard Hardt – *Ecologist*. Richard has a B.A. in Natural Sciences from John Hopkins University, an M.L.A in Landscape Architecture from Harvard University, and a Ph.D. in Forest Resources from the University of Georgia. He has 11 years of experience working for the BLM and is currently employed at the Eugene BLM District. Richard's expertise is in forest ecology, planning, and the National Environmental Polity Act.

Kristen Hiatt- *Graphics Editor.* Kristen has a B.S. in Environmental Science from Oregon Institute of Technology. She is currently pursuing a M.S. in Environmental Policy and Management with an emphasis in Natural Resource Management from the University of Denver. Kristen has been with the BLM for two years as a STEP student and currently works as a wildlife biological technician on the Klamath Falls Resource Area.

Claire Hibler – *Botanist.* Claire has served as the Lead Botanist for the Salem BLM District since 2001. She holds a B.S. in Forest Management from Oregon State University and a B.A in General Biology from Humboldt State University. Claire was a founding member of and participates on the steering committee for the Northwest Oregon Invasive Weed Management Partnership, which spans the northwest corner of Oregon and part of southwest Washington. She has worked in the Salem BLM District for more than 15 years in the botany and invasive plant programs, at both the resource area and district level.

Eric Hoffman - *Mining Engineer*: Eric holds a B.S. in Geology from Washington State University with additional hours in environmental geology and engineering from Eastern Washington State University and George Washington University in D.C.. He has completed 37 years of government service, including 8 years with the former U.S. Bureau of Mines in Washington state and at headquarters in Washington, D.C.; 9 years with the U.S. Geological Survey at Grand Junction, Colorado; and 20 years with BLM in Oregon/Washington. Eric's career has encompassed work on mineral resource evaluation, mined land reclamation, and Federal/Indian mineral program management. Eric is currently serving as the Acting Section Chief for the OR/WA State Office Minerals Section.

R. Alan Hoffmeister - *Public Involvement Coordinator*. Alan is currently assigned to the planning staff to coordinate and support all public involvement activities for the plan revision effort. He holds a B.S. in Forest Science from the University of Illinois. He began his government career with the U.S. Forest Service and Soil Conservation Service and has worked for the BLM as a public affairs specialist for 27 years in California, New Mexico, and Oregon. Most recently he served as the Public Affairs Officer for the BLM's Coos Bay District.

Jerry Hubbard – *Logistics Coordinator*. Jerry has a B.S. in Forest Sciences from the University of Washington and an M.S. in forestry (Silviculture) from Pennsylvania State University. Jerry has held a variety of positions in BLM in Oregon: Forester on the Roseburg District, Soils/Watershed Specialist on the Medford District, Public Affairs Specialist on the Vale District, and Management Analyst in the Oregon State Office. Additionally, as part of a management development curriculum, he produced a regional economic analysis of western Oregon's timber and recreation economies for the period 1972-1986.

William F. Hudson – *Fishery Biologist*. Bill has a B.S. in Wildlife Management and a M.S. in Biology (Fisheries) from Tennessee Technological University. He has worked for the BLM for 25 years in the Coos Bay District. Early in his career he worked as a resource area biologist, assisting in fisheries and wildlife management. Currently, Bill is the Coos Bay BLM District Fisheries Biologist and has spent the last 7 years working on various Endangered Species Act consultations with National Oceanic and Atmospheric Administration-Fisheries, including local project consultations and regional consultations at the plan level for the Interior Columbia Basin and the Northwest Forest Plan. Recently, Bill chaired an interstate and interagency team that developed an Analytical Process for Developing Biological Assessments for Federal Actions Affecting Fish within the Northwest Forest Plan Area.

Douglas Kendig – *Botanist/District Native Plant Coordinator*. Doug has 21 years experience with the BLM and 3 years with the Peace Corps in Guatemala. He served as area and district botanist and resource specialist for the last 11 years, representing botany, native plants and restoration. Doug has been a resource area team member on numerous environmental assessments and watershed analysis. He holds a B.A. in International Studies from Southern Oregon University and graduate class work in Botany from Southern Oregon University and the University of Washington.

Craig Kintop – *Forester.* Craig is currently the District Silviculturist for the Roseburg BLM District. He holds a B.S. in Forest Resources Management from the University of Minnesota. Craig has more than 29 years experience working for the U.S. Forest Service and the BLM. He was a member of the silviculture/inventory team that developed silvicultural prescriptions and growth and yield information for the 1995 resource management plans.

Nikki M. Moore – *Fishery Biologist*. Nikki is currently a fisheries biologist for the Coos Bay District BLM. She holds a B.S. in Fisheries Biology from Oregon State University. She has worked for the BLM and U.S. Forest Service for about 8 years. Nikki also worked for the National Oceanic and Atmospheric Administration-Fisheries where she completed Endangered Species Act biological opinions for local and regional projects.

Frances Philipek – *Archeologist.* Fran holds a B.S. and M.A. in Anthropology from Portland State University. Fran has 28 years of government service, including 7 years with the U.S. Forest Service in Lakeview and Klamath Falls and 21 years with BLM in Idaho, North Dakota, and Oregon. Fran currently is the District Archeologist for the Salem BLM District. She is the state-wide lead for the Heritage Education and project archeology programs.

Dick Prather – *Project Manager*. Dick is a graduate of the Northern Arizona University School of Forestry in Flagstaff, Arizona. He served as team leader for the Final Supplemental Environmental Impact Statement for Survey and Manage in 2001 and 2004. He is a 34-year veteran of the BLM. Prior to his assignments on EIS teams, he was Field Manager in the Salem District for 18 years. He previously worked in Coeur d'Alene, Idaho and Coos Bay, Oregon as a forester.

Mark Rasmussen – *Economist*. Mark has an MS in Forest Economics and a BS in Environmental Studies. Since 1997, he has been a principal at Mason, Bruce, and Girard where he leads the Forest Economics and Planning Group. For 25 years, Mark's work has focused on land management planning for federal, state, private, and tribal land owners including economic analysis of land management policy.

John Styduhar – *Senior Realty Specialist.* John has a B.S. in Forestry Science from Penn State University. He has worked for the BLM as a forester, area engineer, and realty specialist for 27 years: 10 years in timber sale planning and administration, 5 years in forest road engineering and transportation management, and 12 years as senior realty specialist at the BLM Oregon State Office specializing in public land law administration and O&C lands.

Lou Whiteaker - *Botanist*. Lou is the resource area botanist in the BLM Klamath Falls Field Office. He holds a B.S. in Finance from the University of Southern California and an M.S. in Botanical Sciences from the University of Hawaii. Lou has worked in resource management and plant ecology research in Hawaii, Florida, and Oregon. His 18 years of federal government employment include 15 years with BLM.

Alan Wood – *Planner/Forester.* Alan holds a B.S. in Forestry from the University of Minnesota. He is a 30-year veteran of the BLM and has worked in both Idaho and Oregon. Alan was a forester and Operations Chief in Salmon, Idaho, and worked extensively on fire and fuels issues. He served for 10 years as a Field Manager in the Roseburg BLM District, and most recently as a forester in the BLM Oregon State Office.

Science Team

A list of the members of the Science Team, along with their credentials, is provided below.

Sarah Crim – *Forest Economist/Analyst, U. S. Forest Service*

Area of Science Review - Timber harvest scheduling, growth and yield modeling.

Sarah works in the U.S. Forest Service Regional Office in Portland. She has a Ph.D. in Forest Management from the Department of Forestry at Colorado State University and an extensive background in timber harvest scheduling models. She provided guidance for Forest Service planning teams on development and use of timber harvest scheduling models during the forest planning effort prior to the Northwest Forest Plan, and helped develop the timber harvest estimates for National Forests as part of the FEMAT team. Sarah works extensively with National Forests on the NEPA process associated with timber sales, as well as on any litigation that arises.

Doug Drake - *Aquatic Biologist, Oregon Department of Environmental Quality*

Area of Science Review - Water quality and monitoring

Doug has worked for the last 18 years in the Watershed Assessment Section of the Laboratory Division at the Oregon Department of Environmental Quality. His most recent projects relevant to the BLM Science Team include: developing RIVPACS predictive model for state-wide stream assessment using macroinvertebrates; developing a draft wadeable stream sediment benchmark for use in Impaired Waters report (303-d listing process); team leader for data analysis and stressor tool development using probabilistic and targeted sampling approaches; serving on Oregon DEQ Numeric Biological Criteria Technical Advisory Committee; and serving on EPA National Sediment Criteria Workgroup.

Joan Hagar – *Wildlife Ecologist, U.S. Geological Survey*

Area of Science Review: Wildlife ecology

Joan works at the USGS Forest and Rangeland Ecosystem Science Center in

Corvallis, Oregon. She has an M.S. and a Ph.D. in Forest Ecology from the Department of Forest Science at Oregon State University. In doing the research for both of these degrees, Joan investigated wildlife-habitat relationships in managed forests, specifically addressing the response of songbirds and their food resources to commercial thinning and partial harvesting in western Oregon. In addition to the research for academic degrees, Joan has worked extensively for the past 15 years with forest managers, silviculturists, and biologists on research projects and problem analyses in Pacific Northwest forests.

Chris Jordan - *Research Biologist, National Marine Fisheries Service*

Area of Science Review: *Fish biology*

Chris is stationed at the Northwest Fisheries Science Center. His current work primarily involves design and implementation of large-scale monitoring programs to assess anadromous salmonid freshwater habitat and population status, as well as the watershed-scale effect of management actions on salmonid habitat and population processes. The research component of these projects is the development of novel monitoring methods, including sampling designs, metrics and indicators, to address specific data and information needs for managing ESA-listed Pacific Northwest salmonid populations. To support the broad-scale application of monitoring research and the analysis of monitoring data, Chris is developing a landscape classification scheme for watersheds of the Pacific Northwest. The scheme is based on immutable geomorphic and climatic characteristics, as well as anthropogenic impacts. And finally, to test the relevance of current and future monitoring programs, he is collaborating with co-manager groups to evaluate ongoing status and effectiveness monitoring programs based on management decisions these programs support.

Tom Spies - *Research Forester, U.S. Forest Service.*

Area of Science Review: *Forest ecology and landscape ecology.*

Tom works for the Pacific Northwest Research Station, based in Corvallis, Oregon, and is also professor (courtesy) in the Department of Forest Science, Oregon State University. Since completing his Ph.D. at the University of Michigan in 1983, he has worked in western Oregon and Washington on a wide variety of forest ecology issues, including characterization and definition of old-growth forests. He was a participant in FEMAT and is currently co-team leader of CLAMS (Coastal Landscape Analysis and Modeling Study). His active research includes integrated regional models for ecological and socio-economic assessments; indicators of biological diversity in forest landscapes; old-growth characteristics and conservation; riparian forest ecology; gap dynamics; and applications of remote sensing to ecosystem management.

Fred Swanson – *Research Geologist,U.S. Forest Service.*

Area of Science Review: Geology, landscape ecology, and watershed processes.

Fred is assigned to the Pacific Northwest Research Station, based in Corvallis, Oregon, and is also professor (affiliate) in the Departments of Geosciences and Forest Science, Oregon State University. Since completing his Ph.D. in Geology at the University of Oregon in 1972, he has worked at the H.J. Andrews Experimental Forest and elsewhere in the Northwest on a wide variety of watershed and ecosystem topics. His main focus has been with natural and management disturbance processes in forest and stream systems. Experiences relevant to participation on the BLM Science Team include: long-term, close working relationship with federal forest managers, most notably through the Central Cascades Adaptive Management Area; participant in FEMAT; co-organizer and co-editor of a conference and book on bioregional assessments (Island Press 1999) and deep involvement in interdisciplinary ecosystem research over more than three decades.

John Cissel – *Western Oregon BLM Science Coordinator*

Role on Science Team - Team Leader, Science Coordination

John works for the BLM-Oregon State Office and also holds an affiliate faculty appointment in the Department of Forest Science at Oregon State University. He is responsible for connecting the western Oregon BLM districts to science by integrating management needs into research projects, developing management studies to address management questions, sharing recent science findings with managers, and by developing and demonstrating applications of new science concepts and findings. John has worked in a science-management interface role for the last 15 years, and has particular experience with landscape analysis and planning. John is responsible for science support to the western Oregon plan revision.

Vegetation Modeling Team Members

In addition there were numerous individuals working on teams to provide the data, modeling and geographic information that support the analysis in the document. Those individuals are:

OPTIONS Team

Kristine Allen	D. R. Systems Inc.
Chris Cadwell	BLM Oregon State Office
Joe Graham	BLM Oregon State Office
Mark Perdue	D. R. Systems Inc.
Don Reimer	CEO, D. R. Systems Inc.

Growth and Yield Team

Alan Bergstrom	BLM Medford District Office
Steve Brownfield	BLM Salem District Office
Kevin Carson	BLM Roseburg District Office
Art Emmons	BLM Eugene District Office
Mark Hanus	FORSight Resources, Vancouver Wa.
Frank Hoeper	BLM Medford District Office
Carolina Hooper	BLM Salem District Office
William Johnson	BLM Lakeview District Office
Walter Kastner	BLM Salem District Office
Richard Kelly	BLM Eugene District Office
Craig Kintop	BLM Roseburg District Office
Robert Ohrn	BLM Eugene District Office
Michael Oxford	BLM Coos Bay District Office
Robert Pierle	BLM Medford District Office
Gregory Reddell	BLM Lakeview District Office
Daniel Schlottmann	BLM Salem District Office
Mark Stephen	BLM Eugene District Office
Douglas Stewart	BLM Medford District Office

CVS / Statistical Team

Jim Alegria	BLM Oregon State Office
Carol Apple	FS PNW Region Regional Office

GIS Team

Eric Brewster	Northrop Grumman, Oregon State Office
Duane Dippon	BLM Oregon State Office
Craig Ducey	BLM Oregon State Office
Maria Fiorella	Northrop Grumman, Oregon State Office
Jay Flora	BLM Coos Bay District Office
Paul Fyfield	BLM Oregon State Office
Dennis Glover	BLM Medford District Office
Ryan Good	Northrop Grumman, Oregon State Office
Dale Gough	BLM Roseburg District Office
John Guetterman	BLM Coos Bay District Office
Eric Hiebenthal	Northrop Grumman, Oregon State Office
Jeremy Hruska	Northrop Grumman, Oregon State Office
Thomas Jackson	BLM Eugene District Office
Ryan Kelley	Northrop Grumman, Oregon State Office
Jeanne Keyes	Northrop Grumman, Oregon State Office
Mark Koski	BLM Salem District Office
Mike Limb	BLM Klamath Falls Field Office
Bron Macdougall	Northrop Grumman, Oregon State Office
Bryant Mecklem	Northrop Grumman, Oregon State Office
Arthur Miller	BLM Oregon State Office
Shelley Moore	Northrop Grumman, Oregon State Office
Kiet Nguyen	BLM Oregon State Office
Jeff Nighbert	BLM Oregon State Office
Annett Parsons	BLM Medford District Office
Jay Ruegger	BLM Eugene District Office
Steve Salas	Northrop Grumman, Oregon State Office
Alan Ward	BLM Coos Bay District Office

Ten-Year Scenario Quality Control Team

BLM Salem District Office
- Carolina Hooper
- Mark Koski
- Phil Sjoding
- Lisa Ball
- Cory Geisler
- Randy Herrin
- Michael Barger
- Keith Walto

BLM Eugene District Office
- Tom Jackson
- Jay Ruegger
- Dave DeMoss
- Jack Zwiesler
- Gary Wilkinson

BLM Coos Bay District Office
- Terry Evans
- Paul Fontaine
- Paul Leman
- Chris Schumacher
- Alan Ward

BLM Roseburg District Office
- Jay Besson
- Mark Beardsley
- Jim Schwab
- Bruce Baumann
- Dale Gough

BLM Medford District Office
- John Schneider
- Sarah Bickford
- Vince Randall
- Jim Brown
- Dave Caulfield
- Terry Garner
- Laura Schaefer
- Jeff Brown
- Dennis Glover
- John McGlothlin
- Steve Timmons
- Mike Korn
- John Bergin
- Phil Ritter
- John Samuelson
- Bill Freeland

Klamath Falls Field Office
- Rob McEnroe
- Mike Limb
- Mike Angell
- Mike Bechdolt

Monitoring

Monitoring provides information about whether management actions were implemented as directed in the resource management plan, and examines their effectiveness in achieving desired outcomes. Monitoring can also determine whether the analysis contained in the Environmental Impact Statement was accurate.

The monitoring plan for the alternative which is selected in the record of decision would examine questions surrounding the implementation, effectiveness and validity of plan objectives, land use allocations and management actions. These items vary by alternative and therefore, a monitoring plan with specific management questions would not be of great utility at this stage of the planning process. A detailed proposed monitoring strategy is provided here for public comment. An even more detailed monitoring plan will be provided for the Proposed Resource Management Plans in the final environmental impact statement. The monitoring plan for each of the Approved Resource Management Plans will be published in the records of decision for this plan revision.

Monitoring for the resource management plans would consist of three parts:

1. Implementation monitoring to determine if management actions follow RMP direction.
2. Effectiveness monitoring to determine if RMP objectives or desired outcomes are being met or are likely to be met.
3. Validation monitoring to determine if RMP objectives and management actions are based on correct and accurate assumptions and to validate conceptual models.

Monitoring of the resource management plans would be carefully and reasonably designed to avoid prohibitive costs while effectively answering implementation, effectiveness and validation questions. It would not be necessary or desirable to monitor every management action. Components of the monitoring plans would include:

- Key monitoring questions
- Standards
- Methods
- Sample size and intervals

Implementation monitoring would constitute most of the monitoring effort. Implementation monitoring ensures compliance with the plan decisions.

Effectiveness monitoring would be another component of the monitoring plans. Many of the relationships and outcomes of natural resource management are well enough established as to not require effectiveness monitoring for all management actions. For instance, if a stream is fully shaded by vegetation in a riparian management area (implementation monitoring), it is not necessary to also apply effectiveness monitoring to determine if BLM actions on that stream are contributing to the maintenance of stream temperature (effectiveness monitoring). In addition, validation monitoring would not be necessary to address the underlying assumption

that salmonids require stream temperatures within a certain range. The relationships of shade to stream temperature and salmonids to stream temperature and are well enough established as to not require effectiveness and validation monitoring. In addition, certain objectives do not lend themselves to effectiveness monitoring because they will be achieved only after many years or decades, such as the thinning of forest stands to accelerate the achievement of structurally complex characteristics. Such an objective would not be achieved within the life of the plan.

The monitoring plan would establish priorities for monitoring activities. The priority for monitoring would be those actions which are related closely to the purpose and need and issues described in chapter 1. The following are situations or circumstances that will warrant high priority for monitoring:

- Highly sensitive or important resource values (often related to the purpose and need and issues of this plan revision)
- Actions involving new or untested procedures or methods, or involving a high degree of uncertainty regarding the effects of the procedure or method.
- Actions of high public interest or controversy.
- Actions of high management interest

Key monitoring questions would be employed to avoid unnecessary detail and unacceptable costs. A key monitoring question is a question of high management interest. Most key questions would be designed to provide information as to whether management direction has been followed while some key questions would provide information as to whether objectives have been met or are likely to be met. The key questions would be accompanied by standards or thresholds by which information would be evaluated.

Sampling would also be employed to avoid unnecessary detail and unacceptable costs. Each key question would be accompanied by a sample size and interval for the monitoring item. Sampling would not necessarily be random or statistically based. Sampling would target projects of high management or public interest. Sampling would also target certain projects and areas because they would allow multiple monitoring questions to be addressed and therefore would be cost efficient to monitor. Sampling would not be specifically designed to distribute monitoring evenly among field offices.

The level and intensity of implementation monitoring (sample size and interval) would vary depending on the sensitivity and scope of the management action, resource or area being monitored. In cases where implementation or effectiveness monitoring indicates very high compliance with the plan, the monitoring interval and sample size would be adjusted for cost and time efficiency.

All applicable implementation monitoring questions would be addressed on each BLM district. Effectiveness and validation monitoring would not be duplicated on each district where the results of such monitoring can be applied to similar situations on other districts. For instance, if management action directs that large wood be placed in streams of high intrinsic potential, implementation monitoring to measure plan compliance would occur on each district which had that management action in its resource management plan. If it were determined that

effectiveness monitoring was needed to address the question of whether or not large wood creates fish habitat, such monitoring of general principles or relationships would not need to be duplicated on every district.

The monitoring plan would be evaluated at each monitoring interval to ascertain if monitoring questions, standards, methods, sample size, and intervals need to be changed. As a result of experience, where necessary, key monitoring questions, standards, methods, sample size and intervals would be:

- Modified
- Discontinued
- Added

Such changes to the monitoring plan would be accomplished through plan maintenance.

Monitoring would occur at multiple administrative levels and at multiple spatial and temporal scales.

Monitoring of the western Oregon resource management plans would be done in a consistent and coordinated manner to allow district information to be compiled and considered at the scale of the entire western Oregon planning area. Coordination and consistency would be the joint responsibility of each district and the Oregon State Office. Each district would be responsible for the collection, compilation, and analysis of most of the monitoring information. The BLM Oregon State Office would be responsible for coordinating or conducting certain effectiveness and validation monitoring.

Monitoring results would be reported periodically in a Program Summary and Monitoring Report. The Program Summary and Monitoring Report would specifically address the questions posed in the monitoring plan. It would report, track and assess the progress of plan implementation; state the findings made through monitoring; and serve as a report to managers and the public.

Adaptive Management

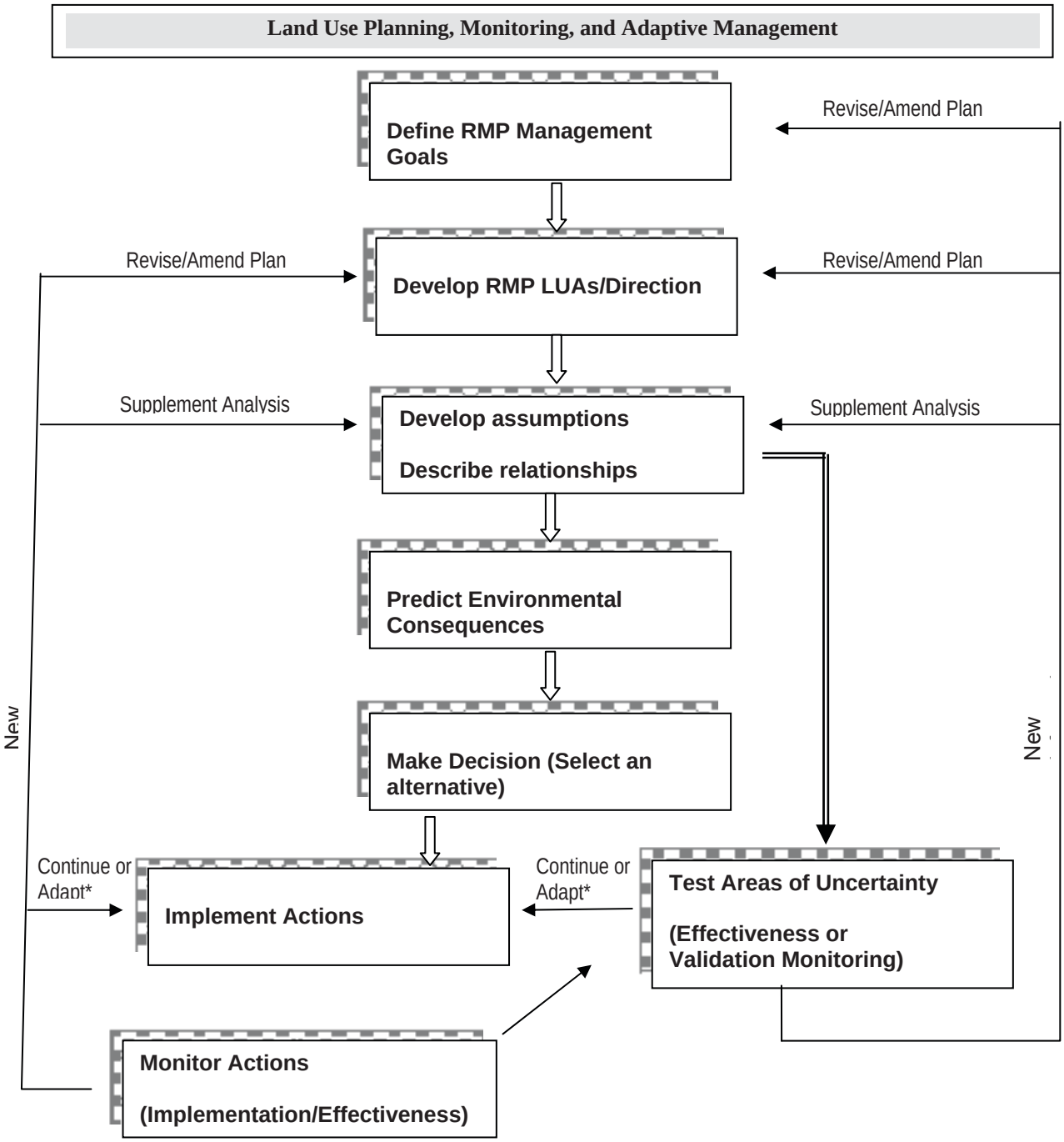
Adaptive management is not a stand alone program or process. Adaptive management for the western Oregon resource management plans would be integrated into NEPA and land use planning processes (see Figure 289). Identified outcomes for the resource management plan are described in the plan's goals and objectives statements. Resource management plan monitoring would determine if the goals and objectives are being met or are likely to be met.

In addition, new information or changed circumstances would be evaluated as to whether changes in resource management plan decisions or supporting NEPA analyses were warranted. Adaptive management tools and procedures would be used to make changes in the plan in response to monitoring information, new information or changed circumstances include plan maintenance, plan evaluations, plan amendments and plan revisions In addition to these planning instruments, NEPA documentation may be necessary. NEPA procedures relevant to adaptive management would include the use of categorical exclusions, determination of NEPA adequacy reviews, environmental assessments, and environmental impact statements.

In some instances, management direction contained in the alternatives provides for a range of activities or resource uses. In these cases, levels of activities or resource uses would vary within the range prescribed by the management direction without the use of planning steps or NEPA analyses. The level of activities would be adapted within the range given by management direction, depending on variation in resource needs or organizational capability.

In addition to the constraints or latitude provided by management direction for the alternatives, the ability to adapt or change management without the use of planning steps or NEPA analyses would also be restricted by analytical assumptions contained in the environmental impact statement. The conclusions of environmental consequences are derived from analytical assumptions. Analytical assumptions include such things as levels or methods of activities, number of acres treated, and miles of roads maintained. If, as a result of the need for adaptive management, actual implementation of the resource management plan would so alter the methods or levels of activities such that the environmental consequences might be substantively different than those anticipated in the environmental impact statement, then formal planning steps and NEPA procedures could be required. The determination as to when formal planning steps and NEPA procedures would be required would be made through the plan evaluation process. Plan evaluations could consist of an overall resource management plan evaluation or they could consist of a narrowly focused evaluation on a specific aspect of the resource management plan.

Figure 289. Land Use Planning, Monitoring, and Adaptive Management.



* When monitoring shows the plan is being implemented as written, continue to implement. Where management direction specifically describes the conditions where adaptation is allowable without supplementing/revising/amending plan then adapt actions.

Additionally, monitoring plan should be informed by areas of uncertainty and sensitivity of assumptions and relationships.

Acronyms

This chapter provides the main acronyms used in the document. Most of the acronyms that appear in the document show up in tables and figures and are used for brevity. Elsewhere, terms are generally spelled out in the text.

Acronyms

ACEC	area of critical environmental concern
ASQ	allowable sale quantity
AUM	animal unit month
bf	board foot or board feet
BLM	Bureau of Land Management
CBWR	Coos Bay Wagon Road
CFR	Code of Federal Regulations
cfs	cubic feet per second
dbh	diameter at breast height
EPA	Environmental Protection Agency
ERMA	extensive recreation management area
FEMAT	Forest Ecosystem Management Assessment Team
FLPMA	Federal Land Policy and Management Act
FLTFA	Federal Land Transaction Facilitation Act
GIS	geographical information system
km	kilometer
LSMA	late-successional management area
LSR	late-successional reserve
mbf	thousand board feet
mmbf	million board feet
NSO	northern spotted owl
NWFP	Northwest Forest Plan
O&C	Oregon and California Lands Act
OHV	off-highway vehicle
R&PP	recreation and public purpose
RMP	resource management plan

ROD	record of decision
SRMA	special recreation management area
VRM	visual resource management
WOPR	western Oregon plan revisions

Glossary

This chapter provides the definitions of terms used in this document that cannot be found in a standard dictionary.

3P fall, buck, and scale sampling	A sampling method that determines the volume and value of merchantable timber. The method starts with visual estimation of a stand using the 3P sampling method (i.e., PPP, or, probability proportional to prediction), which operates under the assumption that the probability of a tree being sampled is proportional to its predicted occurrence in a stand. The estimation is verified by cutting down a sampled tree (fall), cutting it into merchantable log lengths (buck), and measuring the logs (scale) noting indicators for defects and log grades. For managed second-growth stands, 3P sampling is generally used to develop volume tables from which stand volumes may be extrapolated. For uneven-aged stands, typically containing larger and often more defective timber, 3P sampling is useful in determining the net volume (recovery).
acre	A measure of surface land area in U.S. customary units that is 43,560 square feet, which is 1/640th of a square mile (or approximately 0.4 hectares). If square, it is nearly 209 feet on each side.
activity fuel	Debris (wood chips, bark, branches, limbs, logs, or stumps) left on the ground after management actions, such as logging, pruning, thinning, or brush cutting, versus debris left after storms or fires.
adaptive management	A forest management methodology that continually monitors, evaluates, and adjusts decisions and management actions to improve implementation and to ensure that the goals and objectives of resource management plans are being met.
adaptive management area	A Northwest Forest Plan term that denotes a land use allocation (or landscape unit) whose lands are designated for development and for testing technical and social approaches for achieving desired ecological, economic, and other social objectives.
adverse modification	An Endangered Species Act term that is not specifically defined by the act but is generally accepted to denote a direct or indirect alteration of habitat that appreciably diminishes the value of an area with respect to the survival, or in some instances the recovery, of a listed species. In most instances, this standard is considered the same as or nearly identical to the jeopardy standard.
age classification	A system that categorizes trees, forests, stands, or forest types by intervals of years. Age classifications differ around the U.S. by forest type (wet, dry, evergreen, deciduous, or succulent). For this analysis, the interval is usually 10-year increments.
allowable sale quantity/annual productive capacity	These terms are synonymous. The timber yield that a forest can produce continuously under the intensity of management outlined in the RMP from those lands which are allocated for permanent forest production.
alternative	One of several proposed management actions that have been studied and found to meet the goals and objectives of a project's purpose and need and, as a result, is suitable to aid decision making.
anadromous fish	Fish that are born and reared in freshwater, move to the ocean to grow and mature, and return to freshwater to reproduce. Includes species such as salmon and steelhead. Also see *salmonid.*
analysis	The scientific evaluation of the environmental impacts of proposed planning decisions. The BLM employs many types of analysis (e.g., surface, linear, raster, contiguity, and topological overlay analysis) with a variety of data sets (e.g., inventory and GIS) and tools (e.g., physical, quantitative, data, and spatial modeling).
analytical assumption	A judgmental decision that is based on the science and relationships of natural systems that are assumed to be true and from which conclusions can be drawn in order to supply the missing values, relationships, or societal preferences needed to proceed with an analysis of alternatives.
animal unit month (AUM)	The amount of forage that is necessary for the sustenance of one cow (or its equivalent) for one month.
annual productive capacity	An O&C Act term denoting the volume of timber that is determined will grow in one year in a given area. Also see *allowable sale quantity (ASQ)*, *offer*, and *sustained yield capacity*.
Aquatic Conservation Strategy	A Northwest Forest Plan methodology designed to restore and maintain the ecological health of watersheds and aquatic ecosystems, consisting of four components: riparian reserves, key watersheds, watershed analysis, and watershed restoration.

aquatic habitat	Habitat for vertebrate and invertebrate wildlife species and vascular and non-vascular plants occurring in free water, i.e. lakes, ponds, streams, rivers, springs and seeps.
area	A generic forestry term that refers to the surface land included within specific boundaries and usually allocated for a specific purpose, such as a late-successional management area, a timber management area, a traditional use area, a recreational use area, or a wilderness area. Contrast with *block*.
Area of Critical Environmental Concern (ACEC)	Land where special management attention is needed to protect life, to provide safety from natural hazards, or to prevent irreparable damage to important values (historic, cultural, or scenic), resources (fish and wildlife), or processes (natural systems).
assessment area	A subdivision of a sustained yield unit (BLM district) that has been divided by physiographic provinces.
at-risk species	Species that are determined by a detailed assessment to be in danger of becoming locally or completely extinct.
at-risk community	A group of homes or structures that exist within the vicinity of federal lands or a wildland/ urban interface for which a significant threat to human life or property exists as a result of a wildland fire.
authority	The right and power to make decisions and give orders such as the United States Congress exerts when passing legislation like the O&C Act and the Endangered Species Act.
awarded timber sales	A sale where the government has accepted a bit from a qualified high bidder, is binding on the government, and grants specific rights to the purchaser.
backcountry byways	A road segment designated as part of the National Scenic Byway System.
basal area	The cross-sectional area of a single stem, of all stems of a species in a stand, or of all plants in a stand (including the bark) that is measured at breast height (about 4.5 feet up from the ground) for larger plants (like trees) or measured at ground level for smaller plants.
baseline	The starting point for the analysis of environmental consequences, often referred to as the Affected Environment.. This starting point may be the condition at a point in time (e.g., when inventory data is collected) or may be the average of a set of data collected over a specified number of years. Also see *analysis*, *environmental consequences*, and *inventory data*.
beneficial use	In general, any reasonable use of a resource for a purpose consistent with the laws and best interests of the people of a state. In water use law, such uses include, but are not limited to: instream, out of stream, and ground water uses; domestic, municipal, and industrial water supplies; mining, irrigation, and livestock watering; fish and aquatic life; wildlife watering; fishing and water contact recreation; aesthetics and scenic attraction; hydropower; and commercial navigation.
Best Management Practices	BMPs are defined as methods, measures, or practices selected on the basis of site-specific conditions to ensure that water quality will be maintained at its highest practicable level. BMPs include, but are not limited to, structural and nonstructural controls, operations, and maintenance procedures. BMPs can be applied before, during, and after pollution-producing activities to reduce or eliminate the introduction of pollutants into receiving waters (40 CFR 130.2, EPA Water Quality Standards Regulation).
biological assessment	A biological assessment is a document that evaluates the potential effects of a proposed action to listed and proposed species and designated and proposed critical habitat and determines whether any such species or habitats are likely to be adversely affected by the action. It is used in determining whether formal consultation or conferencing with the U.S. Fish and Wildlife Service or National Marine Fisheries Service is necessary. (50 CFR 402.12(a))
biological opinion	A formal opinion by the United States Fish and Wildlife Service or the National Marine Fisheries Service as to whether or not a federal action is likely to jeopardize the continued existence of listed species or would result in the destruction of or adverse modification of critical habitat. It is delivered in an environmental site assessment (ESA) and may also offer suggestions for mitigating any excessive impacts so that an action can proceed.

biomass	Unmerchantable and waste plant materials used as a source of renewable combustible fuel.
block	A term that denotes an area of land that has been approved for special management, such as a northern spotted owl reserve or a fire suppression area. Contrast with *area*.
board foot	A unit of measure for unfinished solid wood used by the lumber industry that is typically expressed as bf or bd. ft. and equals the volume contained in a 1-inch thick, 12-inch long, and 12-inch wide board.
Bureau Assessment Species	A special status species category established by the BLM that includes those plant and vertebrate species that are not presently eligible for official federal or state status but are of concern in Oregon or Washington and may, at a minimum, need protection or mitigation in BLM activities. Also see *bureau sensitive species*.
Bureau of Land Management (BLM)	A federal agency within the U.S. Department of the Interior that is responsible for administering 261 million surface acres of federally owned lands in accordance with all applicable laws to sustain the health, diversity, and productivity of those lands. Most of the acreage is in Alaska and the western states.
Bureau Sensitive Species	A special status species category established by the BLM that includes those plant and animal species that are eligible for status as federally listed, federal candidate, state listed, or state candidate (plant) species; on List 1 of the Oregon Natural Heritage Database or approved for this category by the BLM state director; or included under agency species conservation policies. Also see *bureau assessment species*.
candidate species	Those plant and animal species that, in the opinion of the U.S. Fish and Wildlife Service or the National Marine Fisheries Service, may qualify for listing as endangered or threatened. The U.S. Fish and Wildlife Service recognize two categories of candidate species. Category 1 candidates are species for which the U.S. Fish and Wildlife Service has on file sufficient information to support proposals for listing. Category 2 candidates are species for which information available to the U.S. Fish and Wildlife Service indicates that proposing to list is possibly appropriate, but for which sufficient data are not currently available to support proposed rules.
canopy	The more or less continuous cover of branches and foliage formed collectively by adjacent trees and other woody species in a forest stand. Where significant height differences occur between trees within a stand, formation of a multiple canopy (multi-layered) condition can result.
canopy closure	The ground area covered by the crowns of trees or woody vegetation as delimited by the vertical projection of crown perimeter and commonly expressed as a percent of total ground area.
checkerboard land ownership pattern	A land ownership pattern in which square-mile sections of federal lands are typically intermixed, on the basis of alternating sections, with adjoining private lands. The O&C lands of western Oregon is an example of checkerboard ownership. This ownership pattern resulted from the revestment back to the federal government of lands granted by the federal government to early railroad companies. The checkerboard ownership pattern of the O&C lands creates additional access, management, and perception issues. Also see *O&C Act*.
clear-cut	A timber harvesting method that removes essentially all of the trees in an area, whether merchantable or not, producing a fully exposed microclimate for the development of a new age class.
coarse woody debris	That portion of trees that has naturally fallen or been cut and left in the woods. Usually refers to pieces that are at least 20 inches in diameter. Also see *coarse woody debris classes*.
coarse woody debris classes	There are four classes that are used to describe coarse woody debris. The classes range from Class I which has the least decay and the bark is intact, the log is hard, to Class four in which the coarse woody debris has decayed to the point that it is nearly incorporated into the forest floor.
commercial forest land base	Forest lands declared suitable for producing timber and having a minimum level of productivity of 20 cubic feet/acre/year. Contrast with *harvest land base*.

commercial thinning	Any type of thinning producing merchantable material at least equal to the value of the direct cost of harvesting. See *thinning*.
congressionally reserved areas (or congressional reserves)	Areas that are established by an Act of Congress or Executive Order, such as national parks, wild and scenic rivers, national recreation areas, wilderness, and national monuments.
connectivity block	A Northwest Forest Plan term that denotes a corridor that links areas of northern spotted owl habitat. Contrast with *Connectivity/Diversity Block*.
Connectivity/ Diversity Block	A subdivision of the matrix land use allocation in the current Resource Management Plans that serves as a corridor to link late-successional and old-growth forests to facilitate the movement, feeding, and breeding of late-successional and old-growth species. These blocks are managed to maintain between 25 and 30 percent of late-successional forest within them. Contrast with *connectivity block*.
conservation	The management of natural resources (a species, group of species, or ecosystem) such that plant and animal habitat is protected and resource productivity is sustainable, while providing for human use and ensuring that the full complement of species and processes will continue to exist well-distributed throughout a planning area.
conservation agreement	A document of agreement between agencies that outlines conservation goals necessary to reduce, eliminate, or mitigate specific threats to species at risk, and provides general guidance on species management.
conservation strategy	A management plan for a species, group of species, or ecosystem that prescribes standards and guidelines that if implemented provide a high likelihood that the species, groups of species, or ecosystem, with its full complement of species and processes, will continue to exist well-distributed throughout a planning area.
consultation	A formal review between the U.S. Fish and Wildlife Service or National Marine fisheries Service, and another federal agency when it is determined that an action by the agency may affect critical habitat or a species that has been listed as threatened or endangered to ensure that its action does not jeopardize a listed species or destroy or adversely modify critical habitat. Also see *environment site assessment (ESA)*.
cooperators and cooperating agencies	Those individuals and agencies that provide qualified information to a federal agency, such as the BLM, to use in formulating resource management actions and analyzing environmental consequences. The Council on Environmental Quality regulations that implement the requirements of the National Environmental Policy Act define a cooperating agency as any agency that has jurisdiction by law or special expertise for proposals that are covered by the National Environmental Policy Act (40 CFR 1501.6). BLM planning regulations (43 CFR 1610.3-15(b)) further provide that eligible Federal agencies, state and local governments, and federally recognized Indian tribes may also participate as cooperating agencies.
Coos Bay Wagon Road (CBWR) lands	The public lands that were granted to the Southern Oregon Company, for the construction of a military road, and subsequently revested by the United States and later incorporated into the O&C Act. Also see the *Oregon and California Lands (O&C) Act*.
corridor	A strip of land that links areas in a fragmented landscape to facilitate the passage of animals, plants, people, energy, or materials between habitat or service areas. Examples are biological, recreation, transportation, or utility corridors. Biological corridors are reserved from substantial disturbance. Also see *connectivity block* and *connectivity/ diversity block*.
critical habitat	An Endangered Species Act term that denotes a specified geographic area that is occupied by a federally-listed species and on which the physical and biological features are found that are essential to the conservation and recovery of that species and that may require special management or protection.
crown	The upper part of a tree that has live branches and foliage.

crown bulk density	A measure of the fuel in a forest's canopy that is usually calculated by dividing the canopy volume by the weight of the needles, leaves, and smaller branches (or calculated using the height-to-crown base, tree height, and basal area values). Contrast with *crown density*.
crown density	A measure of the density of a tree's crown that is calculated from the amount, compactness, and depth of the foliage in the tree's crown. Contrast with *crown bulk density*.
crown fire	Fire that moves through the crowns of adjacent trees independent of any surface fire. Crown fires can often move faster and ahead of ground fires.
cumulative effect	The impact on the environment that results from the incremental impacts of an action when added to other past, present, and reasonably foreseeable future actions regardless of what agency or person undertakes such other actions. Cumulative impacts can result from individually minor, but collectively significant, actions taking place over a period of time.
determination of NEPA adequacy (DNA)	An interim step in BLM's internal analysis process that documents that a proposed action is adequately analyzed in an existing NEPA document (EIS or EA). Where applicable, the determination also documents conformance with an approved land use plan. (BLM NEPA Handbook, 516 DM 11.
dispersal habitat	Forest habitat that allows northern spotted owls to move (disperse) across the landscape, typically characterized by forest stands with average tree diameters of greater than11 inches, and conifer overstory trees having closed canopies (greater than 40 percent canopy closure) with open space beneath the canopy to allow owls to fly.
disturbance (natural)	A force that causes significant change in structure and/or composition through natural events such as fire, flood, wind, or earthquake, mortality caused by insect or disease outbreaks.
dominant use	A land use that is the primary purpose for the land use designation, for instance, wildlife habitat on National Wildlife Refuges or timber production on O&C lands. Contrast with *multiple use*
environmental consequences	The direct, indirect and cumulative effects of a proposed action or alternative on existing conditions in the environment in which the action(s) would occur. >… Also see *baseline*.
environmental impact statement	A detailed statement, required under the National Environmental Policy Act of 1969, of a federal project's environmental consequences, including adverse environmental consequences, including adverse environmental effects that cannot be avoided, alternatives to the proposed action, the relationship between local short-term uses and long-term productivity, and any irreversibly or irretrievable commitment of resource.
Evolutionary Significant Unit	A population or group of populations considered "distinct", and hence a "species" for purposes of the Endangered Species Act, representing an evolutionarily significant unit (ESU) of the biological species. A population must satisfy two criteria to be considered an ESU. It must be reproductively isolated from other conspecific population units, and it must represent an important component in the evolutionary legacy of the species. Isolation does not have to be absolute, but must be strong enough to permit evolutionarily important differences to accrue in different population units. The second criterion is met if the population contributes substantially to the ecological/genetic diversity of the species as a whole. (NOAA Technical Memorandum NMFS F/NWC-194)
fifth-field watershed	One of the classifications of watersheds used by the United States Geological Survey that identifies some of the smallest watersheds and is useful for assessing water-related issues generally 20 to 200 square miles in size. For details about the classification of drainage areas, see http://water.usgs.gov/GIS/huc.html. Also see *watershed*.
forest	An ecosystem that is characterized by stands of trees varying in characteristics such as species composition, structure, age class, and associated processes, and commonly including meadows, streams, fish, and wildlife.
floodplain	Level lowland bordering a stream or river onto which the flow spreads at flood stage.
forage	All browse and herbaceous matter available to grazing animals, including wildlife and domestic livestock.

Forest Ecosystem Management Assessment Team	The 1993 presidentially assigned team of scientists, researchers, and technicians from seven federal agencies that created the report that was used as the basis for the Northwest Forest Plan.
forest land	Land at least 10 percent stocked by forest trees of any size, and including land that formerly had such tree cover and that will be naturally or artificially regenerated
Forest Operations Inventory (FOI)	An intensive inventory that provides managers with information regarding the age, species, stand location, size, silvicultural needs, and recommended treatment of stands based on individual stand conditions and productivity.
fuel loading	The dry weight of all accumulated live and dead woody and herbaceous material on the forest floor that is available for combustion, and which poses a fire hazard.
green tree	A live tree.
green tree retention	A stand management practice in which live trees as well as snags and large down wood, are left within harvest units to provide a legacy of habitat components over the next management cycle
growth and yield modeling	Estimations of timber volumes that are expected to be produced per unit area under a certain set of conditions. Also see *modeling*.
forest habitat	An area containing the forest vegetation with the age class, species composition, structure, sufficient area, and adequate food source to meet some or all of the life needs (foraging, roosting, nesting, breeding) of specific species.
habitat-capable forests	Forested stands that are capable of developing into suitable habitat specifically for the northern spotted owl.
harvesting	The process of on-site cutting and removing merchantable trees from a forested area.
harvest land base	Those lands that are available for timber harvesting on a programmed sustained basis. Generally, a harvest land base does not include managed or other reserved lands, nonforested lands, or areas that the timber production capability classification inventory has determined are not capable of sustaining timber production. Also see *timber production capability classification*.
incidental take	An Endangered Species Act term that denotes the taking of a species that is listed as threatened or endangered inadvertently, rather than purposely, while carrying out otherwise lawful activity. Also see *take*.
incorporated by reference	Documents referenced in this draft environmental impact statement that are provided by the individual subject matter experts, are maintained as a part of the administrative record housed at a centralized location, and are available upon request.
intensively managed timber stands	Forest stands that are managed to obtain a high level of timber volume and quality per unit area by using growth-enhancing practices, such as precommercial thinning, commercial thinning, and fertilization.
intrinsic potential	A stream's inherent ability to provide high-quality habitat for salmonids.
inventory data	Information collected by the use of objective sampling methods designed to quantify the spatial distribution, composition, and rates of change of forest parameters within specified levels of precision. Note, inventories may be made of all forest resources including treas and other vegetation, fish and wildlife etc. Also see *baseline*.
jeopardy	The endangerment of the continued existence of a species that is listed as threatened or endangered under the Endangered Species Act. Also a finding made through consultation by a federal agency under the Endangered Species Act regarding an action proposed by the agency that may cause such endangerment.
key watershed	A Northwest Forest Plan term, that denotes a watershed that contains habitat for potentially threatened species, stocks of anadromous salmonids, or other potentially threatened fish, or is an area of high-quality water and fish habitat. Also see *watershed*.
land use allocation	A designation for a use that is allowed, restricted, or prohibited for a particular area of land, such as the matrix, adaptive management, late-successional reserve, or critical habitat land use allocations.
landscape	A broad expanse of terrain up to the watershed scale of 10,000 to 20,000 acres that spans several ecosystems irrespective of ownership or other political boundaries.

late-successional forest	A forest that is in its mature stage and contains a diversity of structural characteristics, such as live trees, snags, woody debris, and a patchy, multilayered canopy.
late-successional management area	A designated area outside of the harvest land base that is actively managed to protect or enhance conditions of late successional forest base.
late-successional reserve	A Northwest Forest Plan term that denotes a land use allocation and has been reserved from programmed timber harvesting and designated to maintain existing or future mature old-growth, or late successional habitat.
load	The amount of material entering a system, such as point source and nonpoint source pollutants. Typically measured as pounds per day and significant in relation to the volume and circulation of the water or air mass in question. Also see *point source* and *nonpoint source*.
long term	A period of time that is used as an analytical time frame and starts more than 10 years after the implementation of a resource management plan, depending on the resource being analyzed. Also see *short term*.
matrix	A Northwest Forest Plan term that denotes a land use allocation for the federal lands that are outside of reserves, withdrawn areas, and late-successional areas. For the purpose of this draft environmental impact statement, this term will apply only to the No Action alternative.
mature stage	Generally begins as tree growth rates stop increasing (after culmination of mean annual increment), and as tree mortality shifts from density-dependent mortality to density-independent mortality.
merchantable	trees or stands having the size, quality and condition suitable for marketing under a given economic condition, even if not immediately accessible for logging
modeling	A scientific method that operates by a structured set of rules and procedures to simulate current conditions and predict future conditions. Also see *analysis*.
multiple use	A Federal Land Policy and Management Act term that denotes "…the management of the public lands and their various resource values so that they are utilized in the combination that will best meet the present and future needs of the American people; making the most judicious use of the land for some or all of these resources or related services over areas large enough to provide sufficient latitude for periodic adjustments in use to conform to changing needs and conditions; the use of some land for less than all of the resources; a combination of balanced and diverse resource uses that takes into account the long-term needs of future generations for renewable and nonrenewable resources, including, but not limited to, recreation, range, timber, minerals, watershed, wildlife and fish, and natural scenic, scientific and historical values; and harmonious and coordinated management of the various resources without permanent impairment of the productivity of the land and the quality of the environment with consideration being given to the relative values of the resources and not necessarily to the combination of uses that will give the greatest economic return or the greatest unit output." (U.S. Code, Title 43, Chapter 35, Subchapter I, § 1702 (c)) Contrast with *dominant use*
National Marine Fisheries Service	A federal agency under the United States Department of Commerce that is responsible for working with others to conserve, protect, and enhance anadromous fish and their habitats.
natural fire regime class	A general classification of how fire would behave over time in the absence of human intervention.
nonpoint source pollution	Water or air pollutants where the source of the pollutant is not readily identified and is diffuse, such as the runoff from urban areas, agricultural lands, or forest lands. Also see *point source*.
Northwest Forest Plan	A 1994 common management approach for the 19 national forests and 7 BLM districts located in the Pacific Northwest ecological region and jointly approved by the Secretary of Agriculture and the Secretary of the Interior.
overstory	That portion of trees forming the uppermost canopy layer in a forest stand which consists of more than one distinct layer.

partial harvesting	For the purpose of defining management action in alternative three, partial harvest is a timber harvesting method that removes a substantial portion of the stand basal area (50-70%) on a harvest interval that mimics the historic average return interval for a moderate or mixed-severity fire
physiographic province	A region of the landscape with distinctive geographical features. When physiographic provinces subdivide sustained yield units (i.e., BLM districts), assessment areas are created.
plan conformance	The determination that a management action is consistent with the terms, conditions, decisions, and within the anticipated environmental consequences of an approved resource management plan.
point source	An origin of water or air pollutants that is readily identified, such as the discharge or runoff from an individual industrial plant or cattle feedlot. Also see *nonpoint source*.
preferred alternative	A National Environmental Policy Act term that denotes the alternative, in a draft Environmental Impact Statement, that is preferred by the proposing agency.
proper functioning condition	The state of a riparian wetland area having the vegetation, landform, and large woody debris that are necessary for the species, habitat, and natural processes of an area.
public domain lands	Original holdings of the United States that were never granted or conveyed to other jurisdictions or never reacquired by exchange for other public domain lands.
public land	Land that is owned and controlled by some governmental entity (federal, state, county, or other municipality).
record of decision (ROD)	A document required by the National Environmental Policy Act, that is separate from, but associated with, an environmental impact statement. The ROD publicly and officially discloses the responsible official's decision on which alternative assessed in the EIS will be implemented.
recovery plan	A plan for the conservation and survival of an endangered species or a threatened species listed under the Endangered Species Act for the purpose of improving the status of the species to the point where listing is no longer required.
recruitment habitat	A stand that is capable of becoming habitat for a designated species within a designated period of time.
regeneration	(*n.*) Tree seedlings or saplings existing in a stand. (*v.*) The process of re-establishing trees on a tract of forest land where harvest or some natural event has removed the existing trees.
regeneration harvesting	Any removal of trees intended to assist regeneration already present or make regeneration possible.
replacement habitat	A stand of equivalent habitat value to a designated species that is made available as a replacement for habitat that is lost within the same population boundary.
resource management plan (RMP)	A BLM planning document, prepared in accordance with Section 202 of the Federal Land Policy and Management Act that presents systematic guidelines for making resource management decisions for a resource area. An RMP is based on an analysis of an area's resources, their existing management, and their capability for alternative uses. RMPs are issue oriented and developed by an interdisciplinary team with public participation. Also see *adaptive management*.
riparian area	A geographic area containing an aquatic ecosystem and adjacent upland areas that directly affect it. This includes floodplain, woodlands, and all areas within a horizontal distance of approximately 100 feet from the normal line of high water of a stream channel or from the shoreline of a standing body of water.
road decommissioning	The act of removing a road that is no longer needed for management purposes. There are five levels of road decommissioning practices. Decommissioning of roads always includes blocking vehicular access (Level 1) and may also include any combination of the following: removing cross drains (Level 2), seeding and mulching the road surface (Level 3), tilling the road surface (Level 4), and recontouring the road structure (Level 5).

salmonid	Fish that are born and reared in freshwater, move to the ocean to grow and mature, and return to freshwater to reproduce. Includes species such as salmon and steelhead. Also see *anadromous fish.*
salvage cutting	The removal of dead trees or trees damaged or dying because of injurious agents other than competition, to recover economic value that would otherwise be lost.
short term	A period of time that is used as an analytical time frame and is within the first 10 years of the implementation of a resource management plan. Also see *long term*.
silvicultural system	A planned series of treatments for tending, harvesting, and re-establishing a stand. The system name is based on the number of age classes managed within a stand, e.g., *even-aged, two-aged, uneven-aged*.
site potential tree height	The average height of dominant and co-dominant trees on a given geographical area, expressed in terms of average tree height at a specified index or base age
sold timber sales	Timber a sale for which there has is a qualified purchaser has been established through auction or negotiation, but where the BLM has yet to approve and consummate the timber sale contract. See *awarded timber sales>*
special forest products	Those plant and fungi resources that are harvested, gathered, or collected by permit, and have social, economical, or spiritual value. Common examples include mushrooms, firewood, Christmas trees, tree burls, edibles and medicinals, mosses and lichens, floral and greenery, and seeds and cones, but not soil, rocks, fossils, insects, animal parts, or any timber products of commercial value.
special status species	Those species that are listed by the Endangered Species Act as threatened or endangered (including proposed and candidate species), listed by a state as being of special concern (state listed species), and listed by the BLM as sensitive or needing assessment (i.e., Bureau sensitive species and Bureau assessment species).
stand	An aggregation of trees occupying a specific area and sufficiently uniform in composition, age, arrangement, and condition so that it is distinguishable from the forest in adjoining areas.
stand establishment stage	The developmental stage extending from stand initiation until stands have reached canopy closure and density-dependent tree mortality begins.
standards and guidelines	Northwest Forest Plan rules for managing the different land use allocations. For the purpose of this draft environmental impact statement, this term will apply only to the No Action alternative.
structurally complex stage	Stage at which stands develop characteristics approximating “old-growth” stands described in many analyses associated with the Northwest Forest Plan.
structural legacies	The large trees, down logs, snags, and other components of a forest stand that are left after harvesting for the purpose of maintaining site productivity and providing structures and ecological functions in subsequent stands.
structural stage classifications of forests	A scheme that is used to define the structural stages of forests. It uses four broad classifications (stand establishment, young, mature, and structurally complex) and multiple subclassifications to distinguish the differences within classifications.
suitable habitat	A stand that has the structures (physical and biological features) necessary to meet the biological requirements of a particular species.
sustainability	Sustainability can be defined as using, developing and protecting resources in a manner that enables people to meet current needs and provides that future generations can also meet future needs, from the joint perspective of environmental, economic and community objectives.
sustained yield	The volume of timber that a forest can produce continuously at a given intensity of management. The achievement and maintenance in perpetuity of a high-level annual or regular periodic output of the various renewable resources without impairment of the productivity of the land.
sustained yield capacity	The volume of timber that can be offered for sale each year from an area based upon the consistent volume of timber that a forest can produce continuously. Also see *annual productive capacity*.

Sustained yield unit	A BLM district.
take	An Endangered Species Act term that denotes the act of or the attempt to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect a species listed as threatened or endangered. Also see *incidental take*.
thinning	A cultural treatment made to reduce stand density of trees primarily to improve growth, enhance forest health, or recover potential mortality.
timber	Forest crops or stands, or wood that is harvested from forests and is of a character and quality suitable for manufacture into lumber and other wood products rather than for use as fuel.
timberland	Forested land that is capable of producing crops of industrial wood at a rate of at least 20 cf/ac per year and has not been withdrawn from timber production. (Some forest lands are not classified by the FIA (US Forest Service Inventory and Analysis) as timberland because they are unproductive and some-such as national parks and wildernesses-because by law, they are off limits to harvesting.)
timber production capability classification (TPCC)	An analytical tool that inventories and identifies sites that are capable of sustaining intensive timber management without it degrading their productive capacity. This tool evaluates a site's soil depth, available moisture, slope, drainage, and stability to determine a site's capacity for timber management activity. Sites that prove incapable of sustaining intensive timber management are typically not included in the harvest land base. Also see *harvest land base*.
uncharacteristic wildfires	Those fires that are not typical for an area in terms of frequency, size, or intensity. An example would be fires that burn bigger and hotter in areas where natural fires have been suppressed and combustibles have been allowed to accumulate.
uneven-aged management	A combination of actions that simultaneously maintains continuous tall forest cover, recurring regeneration of desirable species, and the orderly growth and development of trees through a range of diameter or age classes.
United States Bureau of Land Management (BLM)	A federal agency under the United States Department of the Interior that is responsible for administrating the nation's public lands.
United States Fish and Wildlife Service (USFWS)	A federal agency under the United States Department of the Interior that is responsible for working with others to conserve, protect, and enhance fish, wildlife, plants, and their habitats.
United States Forest Service (USFS)	A federal agency under the United States Department of Agriculture that is responsible for administrating the nation's national forests.
watershed	All of the land and water within the boundaries of a drainage area that is separated by land ridges from other drainage areas. Larger watersheds can contain smaller watersheds that all ultimately flow their surface water to a common point. Also see *fifth-field watershed* and *key watershed*.
wildfire	Any nonstructural fire, other than prescribed burns, that occurs on wildland.
wildland	Lands that are not dedicated to such uses as agricultural, urban, mining, or parks.
Wildland/Urban Interface	The area in which structures and other human development meet or intermingle with undeveloped wildland.
young stage	Characterized by the predominance of density-dependent tree mortality, and, in high density stands, a small range of tree diameters.

References

This chapter provides a list of literature and references cited in this environmental impact statement.

References

Aber, J., N. Christensen, I. Fernandez, J. Franklin, L. Hidinger, M. Hunter, J. MacMahon, D. Mladenoff, J. Pastor, D. Perry, R. Slangen, H. van Miegroet. 2000. Applying ecological principles to management of U.S. national forests. Issues in Ecology No. 6.

Adams, Darius and Greg Latta. 2007. Timber Trends on Private Lands in Western Oregon and Washington: A New Look. Western Journal of Applied Forestry 22(1) pp 8-14

Adams, Paul. 2005. Research & Policies to Address Concerns about Soil Compaction from Ground-Based Timber Harvest in the Pacific Northwest: Evolving Knowledge & Needed Refinements. A paper presented at Council on Forest Engineering Conference on Soil, Water, and Timber Management: Forest Engineering Solutions in Response to Forest Regulation.

Adair, Craig. 12 February 2007. American Panel Association, pers.com. Spreadsheet of North American structural panel production.

Agee, James, K. 1993. "Fire Ecology of Pacific Northwest Forests." Island Press. Washington D.C.

Agee and Skinner. 2005. Basic Principles of Forest Fuel Reduction.

Ahlgren, Clifford E. 1979. Emergent seedlings on soil from burned and unburned red pine forest. Minnesota Forestry Research Notes No. 273, 4 p. [16910]. University of Minnesota, College of Forestry. St. Paul, MN.

Alig, R.J., D. Zheng, T.A. Spies and B.J. Butler. 2000. Forest cover dynamics in the Pacific Northwest west side: regional trends and projections. Research Paper PNW-RP-522. Pacific Northwest Research Station, U.S. Department of Agriculture, U.S. Forest Service. Portland, OR

Allen, Karen and Katherine Hansen. 1999. Geography of exotic plants adjacent to campgrounds, Yellowstone National Park, USA. The Great Basin Naturalist. 59(4): 315-322. [33975]

Altman, B. 1999. Conservation strategy for landbirds in coniferous forests of western Oregon and Washington, Version 1.0. Oregon-Washington Partners in Flight.

Altman, B. 2000a. Conservation strategy for landbirds of the east-slope of the Cascade Mountains in Oregon and Washington, Version 1.0. Oregon-Washington Partners in Flight.

Altman, B. 2000b. Conservation strategy for landbirds in lowlands and valleys of western Oregon and Washington, Version 1.0. Oregon-Washington Partners in Flight.

American Wind Energy Association. 2007. Installed & Projected MW, Oregon Wind Energy Development.

Andersen Hal E. 1982. "Aids to Determining Fuel Models For Estimating Fire Behavior." General Technical Report INT-122. Intermountain Forest and Range Experiment Station, U.S. Department of Agriculture, U.S. Forest Service. Ogden, UT.

Anderson, A.E. and O.C. Wallmo. 1984. Odocoileus hemionus. No. 219. in Mammalian Species. Lawlor, T.E, editor. The American Society of Mammalogists.

Anderson, D.R., J. Bart, T.C. Edwards, Jr., C.B. Kepler, and E.C. Meslow. 1990. Status Review, Northern spotted owl *Strix occidentalis caurina*. 95pp. U.S. Fish and Wildlife Service, Portland, OR.

Anderson, P.G., B.R. Taylor, and G.C. Balch. 1996. Quantifying the effects of sediment release on fish and their habitats. Canadian Manuscript Report of Fisheries and Aquatic Sciences No. 2346, Vancouver, British Columbia.

Anderson, P.D., D.J. Larson, and S.S. Chan. *in press*. Riparian buffer and density management influences on microclimate of young headwater forests of western Oregon. Forest Science 53(2)

Andrews, H.J., and R.W.Colwin. 1940. Forest Resources of the Douglas-fir Region. Miscellaneous Publication No. 389. U.S. Department of Agriculture, U.S. Forest Service.

Anthony, R.G., R.L. Knight, G.T. Allen, B.R. McCelland, and J.I. Hodges. 1982. Habitat use by nesting and roosting bald eagle in the Pacific Northwest. *In*: Transactions of the 47th North American Wildlife and Natural Resources Conference. pp. 332-342. Wildlife Management Institute. Washington, D.C.

Anthony, R.G., E.D. Forsman, A.B. Franklin, D.R. Anderson, K.P. Burnham, G.C. White, C.J. Schwarz, J. Nichols, J. Hines, G.S. Olson, S.H. Ackers, S. Andrews, B.L. Biswell, P.C. Carlson, L.V. Diller, K.M. Dugger, K.E.Fehring, T.L. Fleming, R.P. Gerhardt, S.A. Gremel, R.J. Gutiérrez, P.J. Happe, D.R. Herter, J.M. Higley, R.B. Horn, L.L. Irwin, P.J. Loschl, R.R. Reid, and S.G. Sovern. 2006. Status and Trends in Demography of Northern Spotted Owls, 1985-2003. Wildlife Monographs No. 163.

Arora, D. 1997. *Mushrooms Demystified*. 2nd edition. 959 pp. Ten Speed Press. Berkeley, CA.

Ashton, D.T., S.B. Marks, and H.H. Welsh, Jr. 2006. Evidence of continued effects from timber harvesting on lotic amphibians in redwood forest of northwestern California. Forest Ecology and Management 221(2006):183-193.

Aubry, K.B. and C.M. Raley. June 2002. Ecological characteristics of fishers in the southern Oregon Cascade Range Final Progress Report. Pacific Northwest Research Station, U.S. Department of Agriculture, U.S. Forest Service,. Olympia, WA.

Aubry, K.B. and J.C. Lewis. 2003. Extirpation and reintroduction of fishers (Martes pennanti) in Oregon: implications for their conservation in the Pacific states. Biological Conservation 114:79-90.

Aubry, K.B., S.M. Wisely, C.M. Raley, and S.W. Buskirk. 2004. Zoogeography, spacing patterns, and dispersal in fishers: insights gained from combining field and genetic data. *In* Proceedings of the 3rd International Martes Symposium: Martens and fishers (Martes) in human-altered environments: an international perspective. pp. 211-230. D.J. Harrison and A.K. Fuller, editors. Springer Academic Publishers. New York, NY.

Bailey, John D. and John C. Tappeiner. 1998. Effects of Thinning on Structural Development in 40 to 100 years-old Douglas-fir Stands in Western Oregon. Forest Ecology and Management 108(1998): 99-113.

Bailey, John D., Cheryl Mayrsohn, Paul S. Doescher, [and others]. 1998. Understory vegetation in old and young Douglas-fir forests of western Oregon. Forest Ecology and Management 112(3): 289-302. [30086]

Bailey, V. 1936. The Mammals and Life Zones of Oregon. North American Fauna. 55:1-416.

Baker, P.J. and J.S. Wilson. 2000. A quantitative technique for the identification of canopy stratification in tropical and temperate forests. Forest Ecology and Management 127: 77-86.

Baker, D. and C. Palmer. [in press]. The Northwest Forest Plan – The first 10 years (1994-2003): implementation monitoring: accomplishments and compliance with plan requirements. U.S. Department of Agriculture, U.S. Forest Service, Pacific Northwest Region. Portland, OR.

Banci V. 1989. A Fisher Management Strategy for British Columbia. British Columbia Ministry of Environment, Wildlife Branch. Wildlife Bulletin No. B-63.

Barrows, C.C. 1980. Feeding ecology of the spotted owl in California. Journal of Raptor Research 14:73-77.

Beechie, T.J. and T.H. Sibley. 1997. Relationships between channel characteristics, woody debris, and fish habitat in northwestern Washington streams. Transactions of the American Fisheries Society 126:217-229.

Beissinger, S.R. 1995. Population trends of the marbled murrelet projected from demographic analyses. *In*: Ecology and conservation of the marbled murrelet (C.J. Ralph, G.L. Hunt, M.G. Raphael and J. F. Piatt, editors). pp. 385-393. Pacific Southwest Research Station, U.S. Department of Agriculture, U.S. Forest Service. Albany, CA.

Beissinger, S.R., and N. Nur. 1997. Appendix B: Population trends of the marbled murrelet projected from demographic analysis. *In*: Recovery plan for the threatened marbled murrelet (Brachyramphus marmoratus) in Washington, Oregon and California. pp. B1-B35. U.S. Fish and Wildlife Service. Portland, OR.

Beissinger, S.R. 2002. Analysis of the effect of a 10% reduction of population size on marbled murrelet population dynamics in northern California. Unpublished report. 10pp. University of California. Berkeley, CA.

Benda, L., D. Miller, J. Sias, D. Martin, B. Bilby, C. Veldhuisen and T. Dunne. 2003. Wood Recruitment Processes and Wood Budgeting. pp. 49-73. *In* The Ecology and Management of Wood in World Rivers. S. V. Gregory, K. Boyer, and A. M. Gurnell, editors. American Fisheries Society.

Bender, L.C., G.A. Schirato, R.D. Spencer, K.R. McAllister, and B.L. Murphie. 2004. Survival, cause-specific mortality, and harvesting of male black-tailed deer in Washington. Journal of Wildlife Management 68(4):870-878.

Bennett, M., Fitzgerald, S. Mechanical Fuels Reduction. Reducing Hazardous Fuels on Woodland Properties. Oregon Forest Resource Institute and Oregon State University. Corvallis, OR.

Bentivoglio, N., J. Baldwin, T. Max, S. Miller, C.J. Ralph, M. Raphael, C.S. Strong and C.W. Thompson. 2002. Marbled murrelet population monitoring program for Northwest Forest Plan effectiveness monitoring. Annual report. 47 pp. U.S. Fish and Wildlife Service. Portland OR.

Beschta, R., R. Bilby, G. Brown, L. Holtby and T. Hofstra. 1987. Stream temperature and aquatic habitat: Fisheries and forestry interaction. pp. 191-232. University of Washington, Institute of Forest Resources, Contribution No. 57.

Beschta, R. 1997. Riparian shade and stream temperature: An alternative perspective. *Rangelands* 19(2):25-28. Oregon State University. Corvallis, OR.

Beschta, R., M. Pyles, A. Skaugset and C. Surfleet. 2000. Peakflow responses to forest practices in the western cascades of Oregon, USA. Journal of Hydrology, 223 (2000) 102-120.

Beschta, R., J.J. Rhodes, J.B. Kauffman, R.E. Gresswell, G.W. Minshall, J.R. Karr, D.A. Perry, F.R. Hauer, and C.A. Frissell. 2004. Postfire management on forested public lands of the Western United States. Conservation Biology 18: 957-967.

Bevis, K.R., G.M. King, and E.E. Hanson. 1997. Spotted owls and 1994 fires on the Yakama Indian Reservation. *In*: International Association of Wildland Fire Proceedings - Fire Effects on Rare and Endangered Species Habitats Conference, pp. 117-22. Nov 13-16, 1995. J.M. Greenlee, editor. Coeur D'Alene, ID.

Bilby, R.E. and J.W. Ward. 1989. Changes in characteristics and function of woody debris with increasing size of streams in western Washington. Transactions of the American Fisheries Society 118: 368-378.

Bilby, R.E. and P.A. Bisson. 1998. Function and distribution of large woody debris. In: Kantor, S., ed. River ecology and management: lessons from the Pacific coastal ecoregion. Springer-Verlag: 324-346, Chapter 13. Washington, D.C.

Bisson, P.A. and R.E. Bilby. 1982. Avoidance of suspended sediment by juvenile coho salmon. North American Journal of Fisheries Management 2: 371-374.

Bisson, P., R. Bilby, M. Bryant, C. Dolloff, G. Grette, R. House, M. Murphy, K. Koski and J. Sedell. 1987. Large woody debris in forested streams in the Pacific Northwest: past, present, and future. *In*: Streamside management: forestry and fishery interactions. E. Salo and T. Cundy, editors. Contribution Number. 57. pp. 143-190. University of Washington, Institute of Forest Resources. Seattle, WA.

Boulanger, J., K. Martin, G. Kaiser and A.E. Derocher. 1999. Evaluating uncertainty in population trends of Marbled Murrelets. In: Biology and Conservation of Forest Birds; Proceedings of the Society of Canadian Ornithologists Special Science Symposium, pp. 53-62. Fredericton, New Brunswick 23-25 August, 1996. Diamond, A.W and D.N. Nettleship, editors. Society of Canadian Ornithologists Special Publication No. 1. Fredericton, New Brunswick, Canada.

Boyd, M.S. 1996. Heat Source: stream temperature prediction. Master's Thesis. Department of Civil and Bioresource Engineering, Oregon State University. Corvallis, OR.

Bradley, R.W. 2002. Breeding ecology of radio-marked marbled murrelets (Brachyramphus marmoratus) in Desolation Sound. 86 pp. Department of Biological Sciences, Simon Fraser University. Burnaby, British Columbia, Canada.

Brake, D.; M. Molnau and J.G. King, J.G. 1997. Sediment transport distances and culvert

spacing on logging roads within the Oregon coast mountain range. 12 pp. ASAE Annual International Meeting, August 10-14, 1997. Minneapolis, MN.

Brandt, J.P., T.A. Morgan, T. Dillon, G.J. Lettman, C.E. Keegan, D.L. Azuma. 2006. Oregon's Forest Products Industry and Timber Harvest, 2003. Gen. Tech. Rpt. PNW-GTR-681. 53 pp. Pacific Northwest Research Station, U.S. Department of Agriculture, U.S. Forest Service. Portland, OR:

Brazier, J. and G. Brown. 1972. Controlling thermal pollution in small streams. U.S. Government Printing Office, EPA-R2-72-083.

Brock, R. and R. Callagan. 2006. Siskiyou Biosurvey LLC. Site Review of *Fritillaria gentneri* on Bureau of Land Management lands. 2006 Internal monitoring report. U.S Department of the Interior, Bureau of Land Management, Medford District. Medford, OR.

Brosofske, K.D., J. Chen, R.J. Naiman, J.F. Franklin. 1997. Harvesting effects on microclimatic gradients from small streams to uplands in western Washington. Ecological Applications 7(4): 1188-1200.

Brown, G.W. 1969. Predicting temperatures of small streams. Water Resources Research 5(1):68-75.

Brown, G.W. and J. Krygier. 1970. Effects of Clear-cutting on Stream temperature. Water Resources Research Vol. 6, No. 4, pp. 1133-1139.

Brown, G.W. and J. Krygier. 1971. Clear-cut logging and sediment production in the Oregon Coast Range. Water Resources Research 7:1189-1199.

Brown, G.W. 1983. Forestry and Water Quality. College of Forestry, Oregon State University, Corvallis, OR.

Brown, J.K., E.D. Reinhardt and K.A. Kramer. 2003. Coarse woody debris: managing benefits and fire hazard in the recovering forest. General technical report RMRS-GTR-105. Rocky Mountain Research Station, U.S. Department of Agriculture, U.S. Forest Service. Fort Collins, CO.

Brown, Richard T., James Agee and Jerry Franklin. August 2004. Forest Restoration and Fire: Principles in the Context of Place. Conservation Biology 18: 903-912.

Brunengo, M. J. unpublished. Estimation of snow available for melting during model rain-on-snow events. 46 pp. Washington Department of Natural Resources, Forest Practices Division. Olympia, WA.

Buehler, D.A. 2000. Bald Eagle (Halieaeetus leucocephalus). *In* The Birds of North America, No. 506. A. Poole and F. Gill, editors. The Birds of North America, Inc. Philadelphia, PA.

Burger, A.E. 2001. Using radar to estimate populations and assess habitat associations of marbled murrelets. Journal of Wildlife Management 65:696-715.

Burger, A.E. 2002. Conservation assessment of marbled murrelets in British Columbia, a review of biology, populations, habitat associations and conservation. 168 pp. Pacific and Yukon Region, Canadian Wildlife Service.

Burnett, Kelly M., Gordon H. Reeves, Daniel J. Miller, Sharon Clarke, Ken Vance-Borland, and Kelly Christiansen. 2003. A first step toward broad-scale identification of freshwater protected areas for Pacific salmon and trout in Oregon, USA. *In*: Aquatic protected areas: What works best and how do we know? J.P. Beumer, A.Grant and D.C. Smith, editors. Proceedings of the world congress on aquatic protected areas, Cairns, Australia and North Beach, WA. Australian Society for Fish Biology.

Burnett, Kelly M., Gordon H. Reeves, Daniel J. Miller, Sharon Clarke, Ken Vance-Borland and Kelly Christiansen. 2007. Distribution of salmon-habitat potential relative to landscape characteristics and implications for conservation. Pacific Northwest Research Station, U.S. Department of Agriculture, U.S. Forest Service. Corvallis, OR.

Burnett, K.M. and D.J. Miller. (2007). Streamside policies for headwater channels: an example considering debris flows in the Oregon Coastal Province. Forest Science, 53: 239-253.

Burroughs, E.R., G.R. Chalfant and M.A. Townsend. 1976. Slope Stability in Road Construction. A Guide to the Construction of Stable Roads in Western Oregon and Northern California. United States Department of the Interior, Bureau of Land Management, Oregon State Office. Portland, OR.

Burroughs, E. and J. King. 1989. Reduction of soil erosion on forest roads. General Technical Report INT-264. Intermountain Research Station, U.S. Department of Agriculture, U.S. Forest Service,

Bury, R.B. and C.A. Pearl. 1999. Klamath-Siskiyou herpetofauna: Biogeographic patterns and conservation strategies. Natural Areas Journal 19:341-350.

Bury, B. 2005. Stream Amphibians. *in* Riparian zone forest mangement and the protection of biodiversity: a problem analysis. pp. 23-27. Sarr, D.A., D.C. Odion, D.E. Hibbs, J.Weikel, R.E. Gresswell, R.B. Bury, N.M. Czarnomski, R.J. Pabst, J. Shatford, and A.R. Moldenke (editors.) National Council for Air and Stream Improvement, Technical Bulletin No. 908. Research Triangle Park, NC. 107+ pages.

Buskirk, S.W. and R.A. Powell. 1994. Habitat ecology of fishers and American martens. *In*: Martens, Sables and Fishers: Biology and Conservation. pp. 283-296. S.W. Buskirk, A.S. Harestad, M.G. Raphael, and M.G. Powell, editors. Cornell University Press. Ithaca, NY.

Busse, M.D., K.R. Hubbert, G.O. Fiddler, C.J. Shestak and R.F. Powers. 2005. Lethal soil temperatures during burning of masticated forest residues. International Journal of Wildland Fire 14(3).

Bustard, D.R. and D.W. Narver. 1975. "Preferences of juvenile coho salmon (Oncorhynchus kisutch) and cutthroat trout (Salmo clarki) relative to simulated alteration of winter habitat." Journal of Fisheries, Resource Board Canada 32:681-687.

Cafferata, P. 1992. Soil Compaction Research. *In*: Forest Soils & Riparian Zone Management: The Contributions of Dr. Henry A. Froehlich to Forestry. Skaugset A., editor. Forest Engineering Department, Oregon State University. Corvallis, OR.

Callihan, Robert H., Timothy S. Prather and Francis E. Northam. 1993. Longevity of yellow starthistle (Centaurea solstitialis) achenes in soil. Weed Technology 7: 33-35. [24469]

Carey, A.B., S.P. Horton and B.L. Biswell. 1992. Northern spotted owls: influence of prey base and landscape character. Ecological Monographs 62(2): 223-250.

Carey, A.B. 2000. Effects of new forest management strategies on squirrel populations. Ecological Applications 10:248-257.

Carroll, C., W.J. Zielinski, and R.F. Noss. 1999. Using presence-absence data to build and test spatial habitat models for the fisher in the Klamath Region, U.S.A. Conservation Biology 13(6):1344-1359.

Carson, Sue D. 2003. Modeling genetic gain in growth in New Zealand: 1 986-2003. *In:* Cherry, Marilyn L., and Glenn T. Howe. editors. Genetics and growth modeling workshop: Pacific Northwest Tree Improvement Cooperative. Proceedings of a workshop; 2003 November 496. Vancouver, WA.

Castellano, M.A., E. Cazares, B. Fondrick, and T. Dreisbach. 2003. Handbook to Additional Fungal Species of Special Concern in the Northwest Forest Plan . General Technical Report PNW-GTR-572. Pacific Northwest research station. USDA, U.S. Forest Service and USDI, Bureau of Land Management.

Cederholm, C.J., L.M. Reid and E.O. Salo. 1981. "Cumulative effects of logging road sediment on salmonid populations in the Clearwater River, Jefferson County, Washington." *In:* Proceedings, Conference on Salmon Spawning Gravel: A Renewable Resource in the Pacific Northwest? Water Research Center Report 39. Washington State University. Pullman, WA.

Cederholm, C.J., R.E., Bilby, P.A. Bisson, T.W. Bumstead, B.R. Fransen, W.J. Scarlett,and J.W. Ward. 1997. Response of juvenile coho salmon and steelhead to placement of large woody debris in a coastal Washington stream. North American Journal of Fisheries Management 17:947–963.

Chamberlin, T.W., R.D. Harr and F.H. Everest. 1991. "Timber harvesting, silviculture, and watershed processes." American Fisheries Society Special Publication 19:181-205.

Chan, S., P. Anderson, J. Cissel, L. Larsen and C. Thompson. 2004. Variable density management in Riparian Reserves: lessons learned from an operational study in managed forests of western Oregon, USA. Forest Snow and Landscape Research 78(1/2):151-172.

CH2MHill; Western Watershed Analysts. 1999. FEMAT riparian processes effectiveness curves: What is science-based and what is subjective judgment? Prepared for the Oregon Forest Industries Council by: CH2MHill, Portland OR. and Western Watershed Analysts, Lewiston, ID.

Chapman, D. and K. McLeod. 1987. Development of criteria for fine sediment in the Northern Rockies ecoregion. 279 pp. U.S. Environmental Protection Agency. Seattle, WA.

Charnley, S. 2006. Socioeconomic Monitoring Results, Volume II: Timber and Nontimber Resources. Northwest Forest Plan-The First Ten Years (1994-2003). General Technical Report PNW-GTR-649 Vol. II: 29-33. Pacific Northwest Research Station, U.S. Department of Agriculture, U.S. Forest Service. http://www.treesearch.fs.fed.us/pubs/22374

Chen, J., J.F. Franklin and T.A. Spies. 1995. Growing-season microclimatic gradients from clearcut edges into old-growth Douglas-fir forests. Ecological Applications 5: 74-86.

Chen, Jiquan; Gordon Smith, [and others]. 1996. Initial response of understory plant diversity and overstory tree diameter growth to a green tree retention harvest. Northwest Science 70(1): 24-35. [26579].

Cissel, J. H., F. J. Swanson and P. J. Weisberg. 1999. Landscape management using historical fire regimes: Blue River, Oregon. Ecological Applications 9:1217–1231.

Clark, R. N. and G. H. Stankey. December 1979. The Recreation Opportunity Spectrum: A Framework for Planning, Management, and Research. General Technical Report PNW-98. Pacific Northwest Forest and Range Experiment Station, U.S. Department of Agriculture, U.S. Forest Service.

Clarke, S. E., K. M. Burnett and D. J. Miller. *In review*. Modeling streams and hydrogeomorphic attributes in Oregon from digital and field data. Journal of the American Water Resources Association.

Climate Impacts Group. 2004 (updated August 2004). Overview of Climate Change Impacts in the U.S. Pacific Northwest. University of Washington. Seattle, WA. Available online at: http://www.ef.org/westcoastclimate/D_PNW%20impacts.pdf

Coastal Landscape Analysis and Modeling Study (CLAMS) website: http://www.fsl.orst.edu/clams/download/posters/ip_poster3.pdf

Cockle, K.L. and J.S. Richardson. 2003. Do riparian buffer strips mitigate the impacts of clearcutting on small mammals? Biological Conservation 113(2003):133-140.

Cohen, W.B., T.A. Spies, R.J. Alig, D.R. Oetter, T.K. Maiersperger, and M. Fiorella. 2002. Characterizing 23 years (1972-95) of stand replacement disturbance in western Oregon forests with Landsat imagery. Ecosystems 5:122–137.

Cole, E.K. 1996. Influence of limited access roads on Roosevelt elk in the Oregon Coast Range. M.S. Thesis. Oregon State University. Corvallis, OR.

Cole, E.K., M.D. Pope and R.G. Anthony. 1997. Effects of road management on movement and survival of Roosevelt elk. Journal of Wildlife Management 61(4):1115-1126.

Compton, J.E., M.R. Church, S.T. Larned and W.E. Hogsett. 2003. Nitrogen export from forested watersheds in the Oregon Coast Range: the role of N2-fixing red alder. Ecosystems 6: 773-785.

Connelly, J.W., S.T. Knick, M.A. Schroeder and S.J. Stiver. 2004. Conservation assessment of greater sage-grouse and sagebrush habitats. Western Association of Fish and Wildlife Agencies. Cheyenne, WY.

Cook, J.G., L.L. Irwin, L.D. Bryant, R.A. Riggs and J.W. Thomas. 1998. Relations of forest cover and condition of elk: a test of the thermal cover hypothesis in summer and winter. Wildlife Monographs No. 141.

Cook, J.G., L.L. Irwin, L.D. Bryant, R.A. Riggs, and J.W. Thomas. 2004. Thermal cover needs of large ungulates: a review of hypothesis tests. *In*: Transaction of the Sixty-ninth North American and Natural Resources Conference. March 16-20, 2004. Spokane, Washington. J. Rahm, editor. Wildlife Management Institute, Washington, D.C.

Coombs, Eric M., Janet K. Clark, Gary L. Piper and Alfred F. Cofrancesco, Jr. 2004. Biological Control of Invasive Plants in the United States. Oregon State University Press. Corvallis, OR.

Copeland, S. 2005. Fire Effects on Selected Rare Plants of the Siskiyou Mountains, Oregon. A Senior Thesis submitted to the Department of Biology, The Colorado College.

Cordone, A.J. and D.W. Kelley. 1961. The influences of inorganic sediment on the aquatic life of streams. Reprint from California Fish and Game. Vol. 47, No. 2. 41 pp. [155k]. California Department of Fish and Game, Inland Fisheries Branch. Sacramento, CA.

Council on Environmental Quality. 1997. Environmental Justice Guidance Under the National Environmental Policy Act.

Courtney, S.P., J.A. Blakesley, R.E. Bigley, M.L. Cody, J.P. Dumbacher, R.C. Fleischer, A.B. Franklin, J.F. Franklin, R.J. Gutierrez, J.M. Marzluff and L. Sztukowski. 2004. Scientific evaluation of the status of the northern spotted owl. Sustainable Ecosystems Institute. Portland, OR.

Cram, Douglas, S., Terrell T. Baker and Jon C. Boren. 2006. "Wildland Fire Effects in Silviculturally Treated Vs. Untreated Stand of Arizona and New Mexico. Research Paper RMRS-RP-55. Rocky Mountain Research Station, U.S. Department of Agriculture, U.S. Forest Service. Fort Collins, CO.

Cullen, S.A. 2002. Using radar to monitor populations and assess habitat associations of marbled murrelets within the Sunshine Coast Forest District. 25 pp. Ministry of Water, Land and Air Protection. Surrey, British Columbia, Canada.

Curtis, Robert O. 1982. A simple index of stand density for Douglas-fir. Forest Science (28)1: 92-94.

Davis, Kevin Q. 17 August 2006. Association of O&C Counties to County Board of Commissioners. Portland, OR.

Deal, R.L. 2006. Red alder stand development and dynamics. *in*: Red alder-a state of knowledge. pp. 44-54. Deal, R.L. and C.A. Harrington, editors. 2006. General Technical Report PNW-GTR-669. Pacific Northwest Research Station, U.S. Department of Agriculture U.S. Forest Service. Portland, OR.

DellaSala, D., S. Reid, T. Frest and J. Strittholt. 1999. A Global Perspective on the Biodiversity of the Klamath-Siskiyou Ecoregion. Natural Areas Journal 19:300-319.

De Santo, T.L. and M.F. Willson. 2001. Predator abundance and predation of artificial nests in natural and anthropogenic coniferous forest edges in southeast Alaska. Journal of Field Ornithology 72(1): 136-149.

Dewey, Steven A. 1991. Weedy thistles of the western United States. In: Noxious range weeds. Westview Special Studies in Agricultural Science and Policy. pp. 247-253. [23552]. James, Lynn F., John O. Evans, Michael H. Ralphs, and Dennis R. Child, editors. Westview Press. Boulder, CO:

Di Lucca, M.C., J.W. Goudie and S.C. Stearns-Smith. 2004. Variable retention yield adjustment factors for TIPSY. Extension Note No. 69. British Columbia Ministry of Forests, Forest Science Program. Victoria, British Columbia, Canada.

DiTomaso, Joseph M. and Kohn D. Gerlach, Jr. 2000. Centaurea solstitialis. *In*: Invasive plants of California's Wildlands. 101-106. [40301]. Bossard, Carla C., John M. Randall, and Marc. C. Hoshovsky, editors. University of California Press. Berkeley, CA.

Dixon, G.E. (compiler). 2003. Essential FVS: *A user's guide to the forest vegetation simulator*. Internal Report, 193 p. Forest Management Service Center, U.S. Department of Agriculture, U.S. Forest Service. Fort Collins, CO.

Dolloff C. A. 1986. Effects of stream cleaning on juvenile coho salmon and Dolly Varden in southeast Alaska. Transactions of the American Fisheries Society 115:743–755.

Dolloff, C.A. and M.L. Warren, Jr. 2003. Fish relationships with large wood in small streams. *In*: The ecology and management of wood in world rivers. pp. 179-193. Gregory, S.V.; Boyer, K.L.; Gurnell, A.M. editors. American Fisheries Society. Bethesda, MD.

Donald, William W. 1994. The biology of Canada thistle (Cirsium arvense). Reviews of Weed Science 6: 77-101. [37298].

Donato, D.C., J.B. Fontaine, J.L. Campbell, W.D. Robinson, J.B. Kauffman and B.E. Law. 2006. Post-wildfire logging hinders regeneration and increases fire risk. Science 311: 352.

Doyle, Kathleen M., D.H. Knight, D.L. Taylor [and others]. 1998. Seventeen years of forest succession following the Waterfalls Canyon Fire in Grand Teton National Park, Wyoming. International Journal of Wildland Fire 8(1): 45-55.

Dugger, K.M., F. Wagner, R.G. Anthony and G.S. Olson. 2005. The relationship between habitat characteristics and demographic performance of northern spotted owls in southern Oregon. The Condor 107:863-878.

Dunbar, D.L., B.P. Booth, E.D. Forsman, A.E. Hetherington and D.J. Wilson. 1991. Status of the spotted owl, *Strix occidentalis*, and barred owl, *Strix varia*, in southwestern British Columbia. Canadian Field Naturalist 105:464-468.

Duncan, S. 2002. Postfire Logging: Is it beneficial to a forest? Science Findings Issue 47. Pacific Northwest Research Station, U.S. Department of Agriculture, U.S. Forest Service.

Dunne, T. and L. B. Leopold. 1978. Water in environmental planning. 818 pp. W.H. Freeman and Co. San Francisco, CA.

Dunne, T., J. Agee, S. Bessinger, W. Dietrich, D. Gray, M. Power, V. Resh and K. Rodriques. 2001. A scientific basis for the prediction of cumulative watershed effects. The University of California Committee on Cumulative Watershed Effects. Report No. 46. University of California Wildland Resource Center.

Ehinger, Paul F. & Associates. 2006. Forest Products Industry, Western Oregon: Analysis of Industry by Log Processing Capabilities, Species, Log Diameter Requirements and Constraints Limited by Mill Equipment and Mill Configuration.

Ellestrand, N and D. Elam. 1993. Population Genetic Consequences of Small Population Size: Implications for Plant Conservation. Annual Review. Ecological Systems: 24:217-42.

Energy Information Administration. 2007. Annual Energy Outlook 2006 with Projections to 2030, Release Date December 2005. http://www.eia.doe.gov/oiaf/aeo/pdf/aeotab_13.pdf

Environmental Protection Agency. 1998. Final Guidance for Incorporating Environmental Justice Concerns in EPA's NEPA Compliance Analyses.

Espinosa, R. 2007. USDI, BLM, Roseburg District. personal communication with Christopher Foster.

Everest, F.H., F.B. Lotspeich and W.R. Meehan. 1982. New perspectives on sampling, analysis, and interpretation of spawning gravel quality. In Acquisition and utilization of aquatic habitat inventory information, editor N.B. Armantrout, pp. 325-333. Western Division, American Fisheries Society. Portland, OR.

Everest, F.H., R.L. Beschta, J.D. Scrivener, K.V. Koski, J.R. Sedell and C.J. Cederholm. 1987. Fine sediment and salmonid production - a paradox. *In*: Streamside management and forestry and fishery interactions. pp. 98-142. E. Salo and T. Cundy editors. College of Forestry Resources, University of Washington, Cont. 57. Seattle, WA.

False-brome Working Group. (n.d.). Retrieved January 25, 2007 from: http://www.appliedeco.org/FBWG.htm

False-brome Working Group Newsletter. January 2004. Retrieved January 25, 2007 from: http://www.appliedeco.org/BRSYweb/finalJan2004newsletter.pdf

Federal Register. 1980. U.S. Fish and Wildlife Service. Listing the Oregon Silverspot Butterfly as a Threatened Species with Critical Habitat. Vol. 45, No. 129: 44935-44938.

Federal Register. 1990. U.S. Fish and Wildlife Service. Endangered and threatened wildlife and plants; determination of threatened status for the northern spotted owl; final rule. Vol. 55, No. 123: 26114-26194.

Federal Register. 1992a. U.S. Fish and Wildlife Service. Endangered and threatened wildlife and plants; determination of critical habitat for the northern spotted owl; final rule. Vol. 57, No. 10: 1796-1835.

Federal Register. 1992b. U.S. Fish and Wildlife Service. Endangered and threatened wildlife and plants; determination of threatened status for the Washington, Oregon and California population of the marbled murrelet. Vol. 57, No. 191: 45328-45337.

Federal Register. 1993. U.S. Fish and Wildlife Service. Endangered and Threatened Wildlife and Plants; Determination of Threatened Status of the Pacific Coast Population of the Western Snowy Plover; Final Rule. Vol. 58, No. 42: 12864-12874.

Federal Register. 1996a. U.S. Fish and Wildlife Service. Endangered and threatened wildlife and plants; final designation of critical habitat for the marbled murrelet. Vol. 61, No. 102: 26256-26330.

Federal Register. 1999b. Endangered and Threatened Wildlife and Plants; Proposed Rule to Remove the Bald Eagle in the Lower 48 States from the Federal List of Endangered and Threatened Wildlife. U.S. Fish and Wildlife Service. Vol. 64, No. 128: 36454-36464.

Federal register. 1999d. National Marine Fisheries Service. Designated Critical Habitat; Central California Coast and Southern Oregon/Northern California Coasts Coho Salmon. 64(86):24049.

Federal Register. 10 December 1999c. U.S. Fish and Wildlife Service. Final rule on listing *Fritillaria gentneri*, Vol. 64, No. 237: 69195-69203.

Federal Register. 25 January 2000a. U.S. Fish and Wildlife Service. Endangered and threatened wildlife and plants; endangered status for *Erigeron decumbens* var. *decumbens* (Willamette daisy) and Fender's blue butterfly (*Icaricia icarioides fenderi*) and threatened status for *Lupinus sulphuerus* ssp. *kincaid* ; Final Rule. Vol. 65, No. 16: 3875-3890.

Federal Register. 2003. U.S. Fish and Wildlife Service.Endangered and Threatened Wildlife and Plants; Final Rule to Remove the Douglas County Distinct Population Segment of Columbian White-Tailed Deer from the Federal List of Endangered and Threatened Wildlife. Vol. 68, No. 142: 43647-43659.

Federal Register. 2004. U.S. Fish and Wildlife Service.Endangered and Threatened Wildlife and Plants; 12-month Finding for a Petition to List the West Coast Distinct Population Segment of the Fisher (Martes pennanti). Vol. 69, No. 68: 18770-18792

Federal Register. 2005a. U.S. Fish and Wildlife Service. Endangered and threatened wildlife and plants; 12-month finding for petitions to list the greater sage-grouse as threatened or endangered; proposed rule. Vol. 70, No. 8: 2244-2282.

Federal Register. 2005b. U.S. Fish and Wildlife Service. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for the Pacific Coast Population of the Western Snowy Plover; Final Rule. Vol. 70, No. 188: 56970-57018.

Federal Register. 2 November 2005c. U.S. Fish and Wildlife Service. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for the Fender's Blue Butterfly (*Icaricia icarioides fenderi*), *Lupinus sulphureus* ssp. *kincaidii* (Kincaid's Lupine), and *Erigeron decumbens* var. *decumbens* (Willamette Daisy). Proposed Rule. 70:66492-66539.

Federal Register. 2005d. National Marine Fisheries Service. Endangered and Threatened Species; Designation of Critical Habitat for 12 Evolutionarily Significant Units of West Coast Salmon and Steelhead in Washington, Oregon, and Idaho. 70(170):52630.

Federal Register. 2006a. U.S. Fish and Wildlife Service. Endangered and threatened wildlife and plants; removing the bald eagle in the lower 48 states from the list of endangered and threatened wildlife. Washington, D.C. Vol. 71, No. 32: 8238-8251.

Federal Register. 2006b. U.S. Fish and Wildlife Service. Endangered and Threatened Wildlife and Plants; 12-Month Finding on a Petition to Delist the Pacific Coast Population of the Western Snowy Plover. Vol. 71, No. 77: 20607-20624.

Federal Register. 2006c. U.S. Fish and Wildlife Service. Endangered and Threatened Wildlife and Plants; Designation of Critical habitat for Four Vernal Pool Crustaceans and Eleven Vernal Pool Plants, Final Rule. Vol. 71, No. 28: 7118-7166.

Ferns, M.L. and D.F. Huber. 1984, Mineral Resources Map of Oregon: State of Oregon Department of Geology and Mineral Industries Geological Map Series GMS-36, Map.

(FEMAT) USDA Forest Service, USDC National Oceanic and Atmospheric Administration, USDC National Marine Fisheries Service, USDI Bureau of Land Management, USDI Fish and Wildlife Service, USDI National Park Service, and Environmental Protection Agency. 1993. Forest Ecosystem Management: An Ecological, Economic, and Social Assessment. Report of the Forest Ecosystem Management Team.

Findholt, S.L., B.K. Johnson, D.Damiran, T. DelCurto and J.G. Kie. 2004. Diet composition, dry matter intake and diet overlap of mule deer, elk and cattle. *In*: Transaction of the Sixty-ninth North American and Natural Resources Conference, March 16-20, 2004, Spokane, Washington. J. Rahm, editor. Wildlife Management Institute, Washington, D.C.

Findlay, S., G.E. Likens, L. Hedin, S.G. Fisher, and W.H. McDowell. 1977. Organic Matter Dynamics in Bear Brook, Hubbard Brook Experimental Forest, New Hampshire, USA. *Journal of the North American Benthological Society*, Vol. 16, No. 1 [43-46]. doi:10.2307/1468230

Fitzgerald, Stephen A. 2002. "Fire in Oregon's Forests: Risks, Effects, and Treatment Options." Extension Forestry Program, Oregon State University. Corvallis, OR.

Ford, R.G., G.K. Himes Boor, B.E. Sharp and J.L. Casey. 2002. Estimates of bird impacts resulting from the M/V Kure/Humboldt Bay oil spill of November 5, 1997. Final draft report prepared for California Department of Fish and Game. 71pp. Office of Spill Prevention and Response.

Forest Health Technology Enterprise Team *Update Team*. Spring 1997. Killing them softly: Using natural enemies to combat exotic weeds. Forest Health Technology Enterprise Team *Update Team*. *Spring 1997.* Retrieved January 26, 2007: http://www.fs.fed.us/foresthealth/technology/news/Spring97.html

Forman, R.T.T. 1995. Land Mosaics: The Ecology of Landscapes and Regions. Cambridge University Press, New York, NY.

Forsight. 2006. How to handle non-uniform stand density (clumpiness) in ORGANON. The FORsight Resource (3)3: 1-2. FORsight Resources LLC. Vancouver, WA

Forsman, E.D., E.C. Meslow and H.M. Wight. 1984. Distribution and biology of the spotted owl in Oregon. Wildlife Monographs 87:1-64.

Forsman, E.D., I.A. Otto, S.G. Sovern, M. Taylor, D.W. Hays, H. Allen, S.L. Roberts and D.E. Seaman. 2001. Spatial and temporal variation in diets of spotted owls in Washington. Journal of Raptor Research 35(2):141-150.

Forsman, E.D., R.G. Anthony, J.A. Reid, P.J. Loschl, S.G. Sovern, M.Taylor, B.L. Biswell, A. Ellingson, E.C. Meslow, G.S. Miller, K.A.Swindle, J.A. Thrailkill, F.F. Wagner, and D. E. Seaman. 2002. Natal and breeding dispersal of northern spotted owls. Wildlife Monographs No. 149.

Forsman, E.D., R.G. Anthony, E.C. Meslow and C.J. Zabel. 2004. Diets and foraging behavior of northern spotted owls in Oregon. Journal of Raptor Research 38(3):214-230.

Foster, S.C., C.H. Stein and K.K. Jones. 2001. A guide to interpreting stream survey reports. P.A. Bowers, editor. Information Reports 2001-06. Oregon Department of Fish and Wildlife. Portland, OR.

Franklin, Jerry F., H.H. Shugart and Mark E. Harmon. 1987. Tree death as an ecological process. Bioscience, Vol. 17, pp. 550-556.

Franklin, J.F. and C.T. Dyrness. 1988. *Natural Vegetation of Oregon and Washington*. 452 pp. Oregon State University Press. Corvallis, OR.

Franklin, J.F., T.A. Spies, R. Van Pelt, A.B. Carey, D.A. Thornburgh, D. Rae Berg, D.B. Lindenmayer. M.E. Harmon, W.S. Keeton, D.C. Shaw, K. Bible and J. Chen. 2002. Disturbances and structural development of natural forest ecosystems with silvicultural implications, using Douglas-fir forests as an example. Forest Ecology and Management 155: 399-423.

Franklin, A.B. and R.J. Guitierrez. 2002. Spotted owls, forest fragmentation, and forest heterogeneity. Studies in Avian Biology. 25: 203-220.

Franklin, J.F. 2004. Sudden Oak Death. Appendix 8 *In:* Scientific evaluation of the status of the northern spotted owl. Courtney, S.P., J.A. Blakesley, R.E. Bigley, M.L. Cody, J.P. Dumbacher, R.C. Fleischer, A.B. Franklin, J.F. Franklin, R.J. Gutierrez, J.M. Marzluff, and L. Sztukowski. Sustainable Ecosystems Institute. Portland, OR.

Franklin, J.F. and R. Van Pelt. 2004. Spatial aspects of structural complexity in old-growth forests. Journal of Forestry, April/May: pp. 22-28.

Franklin, J.F., D.R. Berg, A.B. Carey and R.A. Hardt. 2006. Old-growth conifer forests. *In*: Restoring the Pacific Northwest: the Art and Science of Ecological Restoration in Cascadia. pp. 97-121. D. Apostol and M. Sinclair, editors. Island Press. Washington, D.C.

Freidman. 2007. Personal communication with Douglas Kendig. USDI, BLM. Medford, OR.

Froehlich, H.E. and D.H. McNabb. 1984. Minimizing Soil Compaction in Pacific Northwest Forests. In: Forest Soils and Treatment Impacts. Stone, E.L., editor. Proceedings of Sixth North American Forest Soils Conference. June 1983. University of Tennessee Conferences. Knoxville, TN.

Frost, E.J. and R. Sweeney. 2000. Fire Regimes, Fire History and Forest Conditions in the Klamath-Siskiyou Region: An Overview and Synthesis of Knowledge. World Wildlife Fund. Ashland, OR.

Furniss, R.L. and V.M. Carolin. 1977. Western Forest Insects. Miscellaneous Publication No. 1339. 654 pp. U.S. Department of Agriculture, U.S. Forest Service.

Furniss, M., T. Ledwith, M. Love, B. McFadin and S. Flanagan. 1988. Response of road-stream crossings to large flood events in Washington, Oregon and northern California. Six Rivers National forest, Pacific Southwest Region, San Dimas Technology and Development Center, U.S. Department of Agriculture, U.S. Forest Service. San Dimas, CA.

Furniss, M. J., T. D. Roelofs and C. S. Yee. 1991. Road construction and maintenance. *In*: Influences of forest and rangeland management on salmonid fishes and their habitats. American Fisheries Society Special Publication 19: 297-323

Gallo, Kirsten, Steven H. Lanigan, Peter Eldred, Sean N. Gordon and Chris Moyer. 2005. Northwest Forest Plan - the first 10 years (1994–2003): preliminary assessment of the condition of watersheds. General Technical Report PNW-GTR-647. 133 pp. Pacific Northwest Research Station, U.S. Department of Agriculture, U.S. Forest Service. Portland, OR:

Global Invasive Species Database. Issg Database: Ecology of *Euphorbia esula*. June 26, 2005. Retrieved July, 2006 from: http://www.issg.org/database/species/ecology.asp?si=83&fr=1&sts

Goheen, E.M., E.M. Hansen, A. Kanaskie, M.G. Williams, N. Oserbauer and W. Sutton. 2002. Sudden oak death caused by Phytophthora ramorum in Oregon. Plant Disease 86:441.

Golightly, R.T., P.N. Hebert and D.L. Orthmeyer. 2002. Evaluation of human-caused disturbance on the breeding success of marbled murrelets (Brachyramphus marmoratus) in Redwood National and State Parks, California. 61 pp. Bureau of Land Management, National Park Service, U.S. Fish and Wildlife Service, U.S. Geological Survey, California Department of Fish and Game, and California Department of Parks and Recreation. Arcata, CA.

Gomez, D.M. and R.G. Anthony. 1996. Amphibian and reptile abundance in riparian and upslope areas of five forest types in western Oregon. Northwest Science 70(2):109-119.

Good, T.P., R.S. Waples and P. Adams (editors). 2005. Updated status of federally listed ESUs of West Coast salmon and steelhead. U.S. Department of Commerce, National Oceanic and Atmospheric Administration. Technical Memo. NMFS-NWFSC-66, 598 p.

Gottlieb, S. 1993. Habitat Utilization and Population Characteristics of the Pokegama Wild Horse Herd. B.S. Thesis. State University of New York, Purchase.

Graham, R.T, Sarah McCaffrey and T.B. Jain. 2004. “Science Basis for Changing Forest Structure to Modify Wildfire Behavior and Severity.” General Technical Report RMRS-GTR-120. Rocky Mountain Research Station, U.S. Department of Agriculture, U.S. Forest Service.

Grant, G.E., and S. Lewis, F. Swanson and J. McDonnell. 2007. *In Review.* Effects of forest practices on peak flows and consequent channel response in western Oregon: a state-of-science report. Pacific Northwest Research Station, U.S. Department of Agriculture, U.S. Forest Service. Corvallis, OR.

Greenberg, Joanne and K.F.Welch. 1988. Hydrologic Process Identification for Western Oregon. 18 pp. Hydrologic Services Co. *prepared for* Boise Cascade Corporation.

Gregg, MA., J.A. Crawford, M.S. Drut and A.K. DeLong. 1994. Vegetational cover and predation of sage grouse nests in Oregon. Journal of Wildlife Management 58(1):162-168.

Gremel, S. 2000. Spotted owl monitoring in Olympic National Park: 2000 annual report. U.S. Department of the Interior, National Park Service, Olympic National Park. Port Angeles, WA.

Guitierrez, R., M. Cody, S. Courtney and D. Kennedy. 2004. Assessment of the potential threat of the northern barred owl. Chapter 7. *In*: Scientific evaluation of the status of the northern spotted owl. Courtney, S.P., J.A. Blakesley, R.E. Bigley, M.L. Cody, J.P. Dumbacher, R.C. Fleischer, A.B. Franklin, J.F. Franklin, R.J. Gutierrez, J.M. Marzluff, and L. Sztukowski, editors. Sustainable Ecosystems Institute. Portland, OR.

Gurevitch, J., S. Scheiner and G. Fox. 2006. The Ecology of Plants. Second Edition. Sinauer Associates Inc.

Haerter, J. 23 February 1997. Personal Communications with Jim Haerter, Oil and Gas Program Lead, Bureau of Land Management, California State Office.

Haerter, J. 2007. Personal Communications with Jim Haerter, Oil and Gas Program Lead, Bureau of Land Management, California State Office, February 23, 2007.

Hagen, C.A. 2005. Greater sage-grouse conservation assessment and strategy for Oregon: a plan to maintain and enhance populations and habitat. Oregon Department of Fish and Wildlife. Salem, OR.

Halferty, M. 20 February 2007. Personal Communications with Peggy Halferty, PE, Environmental Manager, Methane Energy Corporation.

Haggerty, S.M., D.P. Batzer, and C.R. Jackson. 2004. Macroinvertebrate response to logging in coastal headwater streams of Washington, U.S.A. Canadian Journal of Fisheries and Aquatic Science: 61: 529-537.

Hamer, T.E., S.G. Seim and K.R. Dixon. 1989. Northern spotted owl and northern barred owl habitat use and home range size in Washington: preliminary report. Washington Department of Wildlife. Olympia, WA.

Hamer, T.E. and S.K. Nelson. 1995. Characteristics of marbled murrelet nest trees and nesting stands. *In*: Ecology and conservation of the marbled murrelet. C.J. Ralph, G.L. Hunt, Jr., M.G. Raphael, and J.F. Piatt, editors. Gen. Tech. Rep. PSW-GTR-152, Pacific Southwest Research Station, U.S. Department of Agriculture, U.S. Forest Service. Albany, CA.

Hamer, T.E., D.L. Hays, C.M. Senger and E.D. Forsman. 2001. Diets of northern barred owls and northern spotted owls in an area of sympatry. Journal of Raptor Research 35(3):221-227.

Hann, David W. and John A. Scrivani. 1987. Dominant-Height growth and site-index equations for Douglas-fir and Ponderosa pine in southwest Oregon. Forest Resource Lab Research Bulletin 59. Oregon State University, College of Forestry. Corvallis,OR..

Hann, David W. 6 July 1992. Letter to Robert Lewis, BLM Medford District. On file at the Roseburg BLM District.

Hann, David W. 1998. Extending southwest Oregon's dominant height growth equation to older ages. Research Contribution 18. 16 pp. Oregon State University, Forest Research Laboratory. Corvallis,OR.

Hann, David W. 2005. ORGANON user's manual: Edition 8.0. 130 pp. Department of Forest Resources, Oregon State University. Corvallis, OR.

Hann, Wendel, Doug Havlina and Ayn Shlisky. 2003. Interagency and The Nature Conservancy fire regime condition class website. U.S. Department of Agriculture, U.S. Forest Service, U.S. Department of the Interior; The Nature Conservancy; and Systems for Environmental Management [frcc.gov].

Hanley, T.A. 1984. Habitat patches and their selection by wapiti and black-tailed deer in a coastal montane coniferous forest. Journal of Applied Ecology 21:423-436.

Hansen, Malin J., and Anthony P. Clevenger. 2005. The influence of disturbance and habitat on the presence of non-native plant species along transport corridors. Biological Conservation 125 (2): 249-259.

Hardy, Colin C. and Stephen F. Arno. 1996. "The Use of Fire in Forest Restoration." General Technical Report INT-GTR-341. Inter Mountain Research Station, U.S. Department of Agriculture, U.S. Forest Service. Ogden, UT.

Harr, R., W. Harper, J. Krygier and F. Hsieh. 1975. Changes in Storm Hydrographs after Road Building and Clear-Cutting in the Oregon Coast Range. Water Resources Research, 11(3): 436-444.

Harr, R. D. 1976. Hydrology of Small Forest Streams in Western Oregon. General Technical Report PNW-55. Denver Service Center, U.S. Department of Agriculture, U.S. Forest Service. Denver, CO.

Harr, R., R. Fredriksen and J. Rothacher. 1979. Changes in Streamflow Following Timber Harvest in Southwestern Oregon. Research Paper PNW-249. 22 pp. Pacific Northwest Research station, U.S. Department of Agriculture, U.S. Forest Service.

Harr, R.D. 1981. Some characteristics and consequences of snowmelt during rainfall in western Oregon. Journal of Hydrology 53: 277-304

Harr, R. and B. Coffin. 1992. Influence of timber harvest on rain-on-snow runoff: a mechanism for cumulative watershed effects: Interdisciplinary approaches to hydrology and hydrogeology. American Institute of Hydrology. pp. 455-469.

Harrington, C.A. 2006. Biology and ecology of red alder. *In*: Red alder-a state of knowledge. pp. 21-43. General Technical Report PNW-GTR-669. Deal, R.L. and C.A. Harrington, editors. Pacific Northwest Research Station, U.S. Department of Agriculture, U.S. Forest Service. Portland, OR.

Harris, D.D., L.L Hubbard and L.E. Hubbard. 1979. Magnitude and Frequency of Floods in Western Oregon. Open-File Report 79-553. 35 pp. U.S. Geological Survey.

Harris, C.C., W. McLaughlin, G. Brown and D. Becker. 2000. Rural communities in the inland Northwest, an assessment of small communities in the interior and upper Columbia River basins. General Technical Report NPW-GTR-477. 120 pp. Pacific Northwest Research Station, U.S. Department of Agriculture, U.S. Forest Service. Portland, OR.

Hartman, G.F. and T.G. Brown. 1987. "Use of small, temporary, floodplain tributaries by juvenile salmonids in a West Coast rain-forest drainage basin, Carnation Creek, British Columbia." Canadian Journal of Fisheries and Aquatic Sciences 44:262-270.

Hartman, G.F., J.C. Scrivener and M.J. Miles. 1996. Impacts of logging in Carnation Creek, a high-energy coastal stream in British Columbia, and the implication for restoring fish habitat. Canadian Journal of Fisheries and Aquatic Sciences 53(Supplement 1):237-251.

Hayden et al. 1991 *In*: Washington Forest Practices Board. 1997. Standard methodology for conducting watershed analysis, Ver. 4.0. Washington State Department of Natural Resorces. Olympia, WA. Online: [http://www.dnr.wa.gov/forestpractices/watershedanalysis/manual/hydrology.pdf]

Hayner, personal communication. 2007

Hayes, J.P., J.M. Weikel and M.P. Huso. 2003. Response of birds to thinning young Douglas-fir forests. Ecological Applications 13:1222-1232.

Haynes, Richard W., Bernard T. Bormann, Danny C. Lee and Jon R. Martin, Jon R., technical editors. 2006. Northwest Forest Plan - the first 10 years (1994-2003): synthesis of monitoring and research results. General Technical Report PNW-GTR-651. 292 pp. Pacific Northwest Research Station, U.S. Department of Agriculture, U.S. Forest Service. Portland, OR.

Haynes, R.W., D.M. Adams, R.J. Alig, R.J., P.J. Ince, J.R. Mills and X. Zhou. 2006. (Draft) *The 2005 RPA Timber Assessment Update*. http://www.fs.fed.us/pnw/about/programs/hnri/index.shtml

Healy, Evelyn and Joseph DiTomaso. Febraury 20, 2002. Yellow starthistle information, Weed Research and Information Center (producer). University of California. Davis, CA. Retrieved January 29, 2007 from http://wric.ucdavis.edu/yst/biology/yst_fact_sheet.html

Hebert, P.N. and R.T. Golightly. 2003. Breeding biology, and human-caused disturbance to nesting of marbled murrelets (Brachyramphus marmoratus) in Northern California: progress report 2002. Unpublished draft report. Department of Wildlife, Humboldt State University. Arcata, CA.

Heckman, Charles W. 1999. The encroachment of exotic herbaceous plants into the Olympic National Forest. Northwest Science 73(4): 264-276. [36188]

Herter, D.R. and L.L. Hicks. 2000. Barred owl and spotted owl populations and habitat in the central Cascade Range of Washington. Journal of Raptor Research 34(4): 279-286.

Hessburg, Agee, and Franklin. 2005. Dry forests, & Wildland Fires of the Inland Northwest USA: Contrasting the landscape ecology of the pre-settlement and modern eras

Hibbs, D.E. and A.L. Bower. 2001. Riparian forests in the Oregon Coast Range. Forest Ecology and Management 154: 201-213.

Hicks, B. J., J. D. Hall, P. A. Bisson and J. R. Sedell. 1991. Responses of salmonids to habitat changes. American Fisheries Society Special Publication 19:483-518.

Hickman, J., editor. 1993. The Jepson Manual: Higher Plants of California. University of California Press. Berkeley and Los Angeles, CA.

Hitchcock, C.L. and A. Cronquist. 1973. Flora of the Pacific Northwest. University of Washington Press. Seattle, WA.

Hogan, C. 1991. Snowy plover and human activities at Damon Point, Washington, May 1 to June 10, 1991. 10 pp. Unpublished report to the Washington Department of Wildlife. Olympia, WA.

Holaday, S. 1992. Summertime water temperature trends in Steamboat Creek Basin, Umpqua National Forest. MS thesis. Oregon State University. Corvallis, OR.

Holloran, M.J. and S.H. Anderson. 2005. Spatial distribution of greater sage-grouse nests in relatively contiguous sagebrush habitats. The Condor 104:742-752.

Hoshovsky, Marc. 1986. Element Stewardship Abstract for *Cystisus scoparius* and *Genista monspessulamus*: Scotch broom and French broom. The Nature Conservancy. 1815 North Lynn Street, Arlington, VA. 22209. http://tncweeds.ucdavis.edu/esadocs/documnts/cytisco.rtf

Houston, R.A. 1997. Bedrock Geology of Bacona 7.5 Min. Quadrangle, Columbia County, Oregon, Senior Thesis. 36 pp. Unpublished. Advising Professor Dr. Alan Niem. Department of Geosciences, Oregon State University. Corvallis, OR.

Houston, R. 14 December 2005. Personal Communications with Bob Houston, Petroleum-Geothermal Geologist, Oregon Department of Geology and Mineral Industries. Interagency Tour of Drill Sites, Coos Bay, OR.

Houston, R. February 2007. Personal Communications with Bob Houston, Petroleum-Geothermal Geologist, Oregon Department of Geology and Mineral Industries.

Huff, M. 1995. Historical and current forest landscapes in eastern Oregon and Washington part ii: linking vegetation characteristics to potential fire behavior and related smoke production. General Technical Report PNW-GTR-355. Pacific Northwest Research Station, U.S. Department of Agriculture, U.S. Forest Service,. Portland, OR

Huff, M., P. Jodice, J. Baldwin, S. Miller, R. Young, K. Ostrom, C.J. Ralph, M. Raphael, C. Strong and C. Thompson. 2003. Draft Marbled murrelet effectiveness monitoring northwest forest plan 2002 annual summary report. 29pp.

Huff, M.H., M.G. Raphael, S.L. Miller, S.K. Nelson and J. Baldwin (technical coordinators). 2006. Northwest Forest Plan - The first 10 years (1994-2003): status and trends of populations and nesting habitat for the marbled murrelet. General Technical report PNW-GTR-650. Pacific Northwest Research Station, U.S. Department of Agriculture, U.S. Forest Service. Portland, OR.

Hutchison, Max. 1992. Vegetation management guideline: Canada thistle (Cirsium arvense (L) Scop.). Natural Areas Journal 12(3): 160-161. [19441]

Hutto, R.L. 2006. Toward meaningful snag-management guidelines for postfire salvage logging in North American conifer forests. Conservation Biology 20(4): 984-993.

Hyatt ,Timothy L.and Robert J. Naiman . February 2001. The Residence Time of Large Woody Debris in the Queets River, Washington, USA. Ecological Applications, Vol. 11, No. 1: 191-202.

Ice, G. 1978. Reaeration in a turbulent stream system. 174 pp. PhD thesis. Department of Forest Engineering, Oregon State University.

Ice, G. 1985. Catalog of landslide inventories for the northwest. 78 pp. Technical Bulletin Number 456, National Council of the Paper Industry for Air and Stream Improvement. New York, NY.

Ice, G.G., D.G. Neary, and P.W. Adams. 2004. Effects of wildfire on soils and watershed processes. Journal of Forestry 102(6): 16-20.

Independent Multidisciplinary Science Team (IMST). 1999. Recovery of Wild Salmonids in Western Oregon Forests: Oregon Forest Practices Act Rules and the Measures in the Oregon Plan for Salmon and Watersheds. Technical Report 1999-1 to the Oregon Plan for Salmon and Watersheds. Governor's Natural Resources Office. Salem, OR.

Isaacs, F.B. and R.G. Anthony. 2005. Bald eagle nest location and history of use in Oregon and the Washington portion of the Columbia River Recovery Zone, 1971 through 2005. Oregon Cooperative Fish and Wildlife Research Unit, Oregon State University. Corvallis, OR.

Isaacs, F.B. and R.G. Anthony. 2007. Bald eagle nest locations and history of use in Oregon and the Washington portion of the Columbia River recovery zone, 1971 through 2006. Oregon Cooperative Fish and Wildlife Research Unit, Oregon State University, Corvallis, OR

Jensen, Mark E. 1991. Ecological classification and cumulative soil effects. In: Proceedings--management and productivity of western-montane forest soils. Harvey, Alan E. and Leon F. Neuenschwander, compilers. 1990. April 10-12; Boise, ID. Gen. Tech. Rep. INT-280. 218-223. [15985]. Intermountain Research Station, U.S. Department of Agriculture, U.S. Forest Service. Ogden, UT.

Johnson, D.H. and T.A. O'Neil. 2001. Wildlife-habitat Relationships in Oregon and Washington. Oregon State University Press. Corvallis, OR.

Johnston, A. 2002. Northern spotted owl survey and monitor report. U.S. Department of the Interior, National Park Service, Crater Lake National Park. Crater Lake, OR.

Johnson, Randy and David Marshall. 18 January 2005 (unpublished). Modeling genetic gain in established Douglas-fir plantations. Pacific Northwest Research Station, U.S. Department of Agriculture, U.S. Forest service. Corvallis, OR.

Jones, J. and G. Grant. 1996. Peak Flow Responses to Clear-Cutting and Roads in Small and Large Basins, Western Cascades, Oregon. Water Resources Research, 32(4):959-974.

Jones, J.A., F.J. Swanson, B.C. Wemple and K.U. Snyder. 2000. Effects of roads on hydrology, geomorphology, and disturbance patches in stream networks. Conservation Biology 14(1):76-85.

Jules, E.S. 1998. Habitat fragmentation and demographic change for a common plant: trillium in old-growth forest. Ecology 79(5):1645-1656.

Jull, Mike. 2001. Wind damage and related risk factors for interior Douglas-fir leave trees in Central B.C. *In*: Windthrow assessment and management in British Columbia; Proceedings of the windthrow researchers workshop in Richmond, British Columbia, Canada. January 31-February 1, 2001. Compiled by S.J. Mitchell and J. Rodney.

Kadrmas, Tina and W. Johnson. 2002. Managing Dyer's Woad. Fact sheet FS-02-097, University of Nevada Cooperative Extension.

Kanaskie, A., M. McWilliams, K. Sprengel and D. Overhulser. 2005. Swiss needle cast aerial surveys, 1996 to 2005. *In* Swiss Needle Cast Cooperative: Annual Report 2005. pp. 9-11 Oregon State University. Corvallis, Oregon. http://www.cof.orst.edu/coops/sncc/sncc05.pdf

Kanaskie, A., E. Goheen, N. Osterbauer, E. Hansen, M. McWilliams and B. Woosley. 2006. *Phytophthora ramorum* in Oregon forests. Spring 2006 Meeting of the California Oak Mortality Task Force: *Phytophthora ramorum* - A Management and Research Update. Carmel, CA. http://nature.berkeley.edu/comtf/html/2006_meeting_agenda.html

Karraker, N.E., and H.H. Welsh, Jr. 2006. Long-term impacts of even-aged timber management on abundance and body condition of terrestrial amphibians in northwestern California. Biological Conservation 131(2006):132-140

Karr, J.R., J.J. Rhodes, G.W. Minshall, F.R. Hauer, R.L. Beschta, C.A.Frissell and D.A. Perry. 2004. The effects of postfire salvage logging on aquatic ecosystems in the American west. BioScience 54: 1029-1033.

Kaye, T. and M. Kirkland. 1994. Population biology of *Lomatium bradshawii*. Unpublished report for the Eugene District, Bureau of Land Management and the Oregon Department of Agriculture. Eugene, OR.

Kaye, T.N., R.J. Meinke, J. Kagan, S. Vrilakas, K.L. Chambers, P.F. Zika and J.K. Nelson. 1997. Patterns of rarity in the Oregon flora: implications for conservation and management. In: Conservation and management of native plants and fungi. Kaye, T.N., A. Liston, R.M. Love, D. Luoma, R.J. Meinke, and M.V. Wilson, editors. Native Plant Society of Oregon. Corvallis, OR.

Kaye, T. 2002. *Lomatium cookii*, Population monitoring in the Illinois Valley, Josephine County, Oregon. Annual progress report prepared for the Medford Bureau of Land Management on long term monitoring. Bureau of Land Management, Medford, Oregon.

Kaye, Thomas, 2003. Invasive Plant Alert: False-brome (*Brachypodium sylvaticum*). False-brome Working Group. Institute For Applied Ecology. Retrieved January 25, 2007 from: http://www.appliedeco.org/Reports/BRSYbrochureSmall.PDF

Kaye, T. and Thorpe, A. 2006. *Lupinus sulphureous ssp. kincaidii (Kincaid's lupine) and Icaricia icarioides fenderi (Fender's blue butterfly) in the Eugene Wetlands*: Population monitoring, reintroduction success, and an evaluation of experimental treaments. Annual Progress Report. U.S. Department of the Interior, Bureau of Land Management, Eugene District. Eugene, OR.

Kaye, T. personal communication. 2007

Kellman, M. C. 1969. Plant species interrelationships in a secondary succession in coastal British Columbia. Syesis 2: 201-212. [6589].

Kelly, E.G., E.D. Forsman and R.G. Anthony. 2003. Are barred owls replacing spotted owls? The Condor 105:45-53.

Kelly, E.G. and E.D. Forsman. 2004. Recent records of hybridization between barred owls (*Strix varia*) and northern spotted owls (*S. occidentalis caurina*). Auk 121:806-810.

Kelly, M., D. Shaari, Q. Guo and D. Liu. 2005. Modeling risk for SOD nationwide: what are the effects of model choice on risk prediction? General Technical Report PSW-GTR. Pacific Southwest research Station, U.S. Department of Agriculture, U.S. Forest Service. http://nature.berkeley.edu/comtf/pdf/KellyetalSOD2-22-05.pdf

Kennedy, R.S.H. and T.A. Spies. 2005. Dynamics of hardwood patches in a conifer matrix: 54 years of change in a forested landscape in Coastal Oregon, USA. Biological Conservation 122: 363-374.

Keppeler, E. and R. Ziemer. 1990. Logging effects on streamflow: water yield & summer low flows at Caspar Creek in northwest California. Water Resources Research 26(7): 1669-1679.

King, James E. 1966. Site index curves for Douglas-fir in the Pacific Northwest. Weyerhaeuser Forestry Paper No. 8. Weyerhaeuser Company, Forestry Research Center. Centralia, WA.

Knighton, David. 1984. *Fluvial Forms and Processes*. Edward Arnold, Baltimore, Maryland.

Knorr, J. and E. Martin. 2003. Forest Plan Effectiveness monitoring. Klamath National Forest sensitive plant program, FY03. Unpublished Results. U.S. Department of Agriculture, U.S. Forest Service, Klamath National Forest. Yreka, CA.

Kochendorfer, J. N. and J. D. Helvey. 1984. *In*: Washingtion Forest Practices Board. 1997. Standard methodology for conducting watershed analysis, Ver. 4.0. Washington State Department of Natural Resources. Olympia, WA. Online: [http://www.dnr.wa.gov/forestpractices/watershedanalysis/manual/hydrology.pdf]

Kremsater, L.L. and F.L. Bunnell. Testing responses to forest edges: the example of black-tailed deer. Canadian Journal of Zoology 20:2426-2435,

Kruckeberg, A.R. 1984. California serpentines: flora, vegetation, geology, soils and management problems. University of California publications in Botany, vol. 78. University Press. Berkeley, CA.

Lamarche, J. and F.Lettenmaier. 2001. Effects of forest roads on flood flows in the Deschutes River, WA. Earth Surface Processes and Landforms 26:115-134.

Lank, D.B., N. Parker, E.A. Krebs and L. McFarlane-Tranquilla. 2003. Geographic distribution, habitat selection, and population dynamics with respect to nesting habitat characteristics of Marbled murrelets (Brachyramphus marmoratus). Center for Wildlife Ecology, Simon Fraser University. Vancouver, British Columbia, Canada.

Landres, P.B., P. Morgan and F.J. Swanson. 1999. Overview of the use of natural variability concepts in managing ecological systems. Ecological Applications 9: 1179–1188.

Larson, W.E. and F.J. Pierce. 1996. Conservation and Enhancement of Soil Quality. *In*: The Soil Quality Concept. The Soil Quality Institute, editors. United States Department of Agriculture, Natural Resources Conservation Service.

Lauten, D. J., K. A. Castelein, E. Seckinger and E. P. Gaines. 2006. The Distribution and Reproductive Success of the Western Snowy Plover Along the Oregon Coast – 2005. The Oregon Natural Heritage Information Center. Corvallis, OR.

Lawson, P. W., E. Bjorkstedt, M. Chilcote, C. Huntington, J. Mills, K. Moore, T. E. Nickelson, G. H. Reeves, H. A. Stout and T. C. Wainwright. 2004. Identification of Historical Populations of Coho Salmon (*Onchorhynchus kisutch*) in the Oregon Coast Evolutionarily Significant Unit. Review Draft. Oregon - Northern California Coast Technical Recovery Team. 129 p.

Lee, P., C. Smyth and S. Boutin. 2004. Quantitative review of riparian buffer width guidelines from Canada and the United States. Journal of Environmental Management 70:165-180.

Lemieux, Paul M., C Lutes and D.A. Santioanni. 2004. "Emissions of organic air toxics from open burning: a comprehensive review. Progress in Energy and Combustion Science 30: 32 Http:// www.sciencedirect.com

Lennartsson, T. 2002. Extinction Threshholds and Disrupted Plant-Pollinator Interactions in Fragmented Plant Populations, Ecology, 83(11),2002, pp. 3060-3072.

Leopold, L.B., M.G. Wolman and J.P Miller. 1964. *Fluvial Processes in Geomorphology*. W.H. Freeman. San Francisco, CA.

Leppig, G. and J. White. 2006. Conservation of Peripheral Plant Populations in California. Madrono Vol. 53, No3, pp 264-274.

Leskiw, T. and R.J. Gutiérrez. 1998. Possible predation of a spotted owl by a barred owl. Western Birds 29:225–226.

Lewis, Robert A. and Robert Pierle. 1991. Adoption of an ORGANON mortality adjustment for green tree retention and for long rotations. Unpublished Internal Report. U.S. Department of the Interior, BLM, Medford District Office. Medford, OR.

Lewis, J.C. and G.E. Hayes. 2004. Feasibility assessment for reintroducing fishers to Washington. 70 pages. Washington Department of Fish and Wildlife. Olympia, WA.

Lindell 2006. USDI, BLM, Medford, OR. personal communication.

Lindenmayer, D.B., D. Foster, J.F. Franklin, M. Hunter, R. Noss, F. Schiemegelow and D. Perry. 2004. Salvage harvesting after natural disturbance. Science 303: 1303.

Lindenmayer, D.B. and R.F. Noss. 2006. Salvage logging, ecosystem processes, and biodiversity conservation. Conservation Biology 20(4): 949-958.

Lindsey, W. 2006. Rangeland Management Specialist, USDI Bureau of Land Management, Klamath Falls Resource Area. personal Ccmmunication.

Lint, J., B. Noon, R. Anthony, E. Forsman, M. Raphael, M. Collopy and E. Starkey. 1999. Northern spotted owl effectiveness monitoring plan for the Northwest Forest Plan. PNW-GTR-440. Pacific Northwest Research Station, U.S. Department of Agriculture, U.S. Forest Service. Portland, OR.

Lint, J. (technical coordinator) 2005. Northwest Forest Plan – the first 10 years (1994-2003): Status and trends of northern spotted owl populations and habitat. General Technical Report PNW-GTR-648. Pacific Northwest Research Station, U.S. Department of Agriculture, Forest Service. Portland, OR.

Lisle. 1981. *In*: Streamside Management: Forestry and Fishery Interactions. Contribution 57. 1987. pp. 39-97. Salo, E.O and T.W. Cundy editors. University of Washington, Institute of Forest Resources. Seattle, WA.

Lloyd, D., J. Koenigs and J. LaPerriere. 1987. Effects of turbidity in fresh waters of Alaska. North American Journal of Fisheries Management. 7:18-33.

Log Lines Log Price Reporting Service. 2006. Log Price Reports. Mount Vernon, WA.

Long, C. J., C. Whitlock, P. J. Bartlein and S. H. Millspaugh. 1998. A 9000-year fire history from the Oregon Coast Range, based on a high-resolution charcoal study. Canadian Journal of Forest Research 28: 774–787.

Luce, C. 2002. Hydrological processes and pathways affected by forest roads: what do we still need to learn? Hydrol. Process. **16**: 2901–04.

Luginbuhl, J.M., John M. Marzluff, Jeffrey E. Bradley, Martin G. Raphael and Daniel E. Varland. 2001. Corvid survey techniques and the relationship between corvid relative abundance and nest predation. Journal of Field Ornithology 72(4): 556-572.

Magnusson, Mark, U., Donald L. Wyse and Joseph M. Spitzmueller. 1987. Canada thistle (Cirsium arvense) propagation from stem sections. Weed Science 35: 637-639.

Maguire, D., D. Waring, K. Cromack and J. Boyle. 2000. Trends in soil and foliar nutrients across a range in Swiss Needle Cast severity. *In:* Annual Report to the Swiss Needle Cast Cooperative. pp. 79-84. Oregon State University. Corvallis, OR. http://www.cof.orst.edu/coops/sncc/sncc00.pdf

Manley, I.A., A. Harfenist and G. Kaiser. 2001. Marbled murrelet telemetry study on Queen Charlotte Islands/Haida Gwaii. 24 pp. Ministry of Environment, Lands and Parks. Smithers, British Columbia, Canada.

Marshall, D.B., M.G. Hunter and A.L. Contreras. 2003. Birds of Oregon. Oregon State University Press. Corvallis, OR.

Marzluff, J.M. and M. Restani. 1999. The effects of forest fragmentation on rates of avian nest predation and parasitism. Unpublished report. College of Forest Resources, University of Washington. Seattle, WA.

Maser, C. 1998. Mammals of the Pacific Northwest: From the Coast to the High Cascades. Oregon State University Press. Corvallis, OR.

Max, T. A., H. T. Schreuder, J. W. Hazard, D. D. Oswald, J. Teply and J. Alegria. 1996. The Pacific Northwest Region vegetation and inventory monitoring system. Research Paper PNW-RP-493. 19pp. Pacific Northwest Research Station, U.S. Department of Agriculture, U.S. Forest Service.

May, C.L. and R.E. Gresswell. 2003. Large wood recruitment and redistribution in headwater streams of the Oregon Coast Range, U.S.A. Can. J. of Forest Res. 33: 1352-1362.

May, D. 14 December 2005. Personal Communications with David May, Geologist and Vice President, Methane Energy Corporation. Interagency Tour of Drill Sites, Coos Bay, OR.

McComb, W.C., K. McGarigal, and R.G. Anthony. 1993. Small mammal and amphibian abundance in streamside and upslope habitats of mature Douglas-fir stands, western Oregon. Northwest Science 67(1):17-15.

McComb, W.C., M.T. McGrath, T.A. Spies and D. Vesely. 2002. Models for mapping potential habitat at landscape scales: an example using northern spotted owls. Forest Science 48(2): 203-216.

McCullough, D.R. 1960. An ecological study of the Columbian black-tailed deer in a logged environment. M.S. Thesis. 63pp. Oregon State College. Corvallis, OR.

McCune B. and L. Geiser. 1997. *Macrolichens of the Pacific Northwest*. 386 pp. Oregon State University Press. Corvallis, OR.

McDade, M.H. 1987. Source area of coarse woody debris in small streams in western Oregon and Washington. M.S. thesis. Oregon State University. Corvallis OR.

McDade, M.H.; F.J. Swanson, W.A. McKee, J.F Franklin and J. Van Sickle. 1990. Source distances for coarse woody debris entering small streams in western Oregon and Washington. Canadian Journal of Forest Research 20: 326-330.

McDonald, Philip M. 1976. Shelterwood cutting in a young-growth, mixed-conifer stand in north central California. Research Paper PSW-117. Pacific Southwest Forest and Range Experimental Station, U.S. Department of Agriculture, U.S. Forest Service. Berkeley, CA.

McGarigal, K. and B.J. Marks. 1995. FRAGSTATS: spatial pattern analysis program for quantifying landscape structure. General Technical Report PNW-351. Pacific Northwest Research station, U.S. Department of Agriculture, U.S. Forest Service. http://www.umass.edu/landeco/research/fragstats/fragstats.html

McIver, J. D. and L. Starr, technical editors. 2000. Environmental effects of postfire logging: literature review and annotated bibliography. General Technical Report PNW-GTR-486. Pacific Northwest Research Station, U.S. Department of Agriculture, U.S. Forest Service. Portland, OR.

McLain, Rebecca J. and Eric T. Jones. 2005. Nontimber forest products management on national forests in the United States. PNW-GTR-655. Pacific Northwest Research Station, U.S. Department of Agriculture, U.S. Forest Service. Portland, OR. http://www.treesearch.fs.fed.us/pubs/21091

McLendon, Terry. 1992. Factors controlling the distribution of Canada thistle (Cirsium arvense) in montane ecosystems: Rocky Mountain National Park, Colorado. Annual Report: NPS Contract Number CA 1268-1-9002; Reporting period 17 April 1991 - 30 April 1992. 36 pp. Unpublished report on file with: Rocky Mountain Research Station, Fire Sciences Laboratory, U.S. Department of Agriculture, U.S. Forest Service. Missoula, MT.

McShane, C., T. Hamer, H.Carter, G. Swartzman, V. Friesen, D. Ainley, R. Tressler, k. Nelson, A. Burger, L. Spear, T. Mohagen, R. Martin, L. Henkel, K. Prindle, C. Strong and J. Keany. 2004. Evaluation report for the 5-year status review of the marbled murrelet in Washington, Oregon, and California. Unpublished report, EDAW, Inc. Seattle, WA. Prepared for the U.S. Fish and Wildlife Service, Region 1. Portland, OR.

Meehan, William R. 1991. Influences of Forest and Rangeland Management on Salmonid Fishes and Their Habitats. United States Department of Agriculture. American Fisheries Society Special Publication 19. Bethesda, MD.

Megahan, W. and W. Kidd. 1972. Effects of logging and logging roads on erosion and sediment deposition from steep terrain. Journal of Forestry 70:136-141.

Megahan W. 1972. Subsurface road interception by a logging road in mountains of central Idaho. *In:* Watersheds in Transition: [350-356]. S. C. Csallany, T. G. McLaughlin and W. D. Striffler, editors. Colorado State University. Fort Collins, CO.

Megahan W. and D. Molitor. 1975. Erosional effects of wildfire and logging in Idaho. In: Watershed Management Symposium; 1975 August. Logan, UT: American Society of Civil Engineers Irrigation and Drainage Division: 423- 444.

Megahan, W., J.Ptoyondy and K. Seyedbagheri. 1992. Best management practices and cumulative effects from sedimentation in the South Fork Salmon River: an Idaho case study. *In*: Watershed Management: Balancing Sustainability and Environmental Change. [401-414]. R.J. Naiman, editor. Springer-Verlag. New York, NY.

Meier, Gretchen, and T. Weaver. 1997. Desirables and weeds for roadside management – a northern Rocky Mountain catalogue. Report No. RH WA/MT-97-8115. Final Report: July 1994 – December 1997. 145 p. [29135]. State of Montana Department of Transportation, Research, Development, and Technology Transfer program. Helena, MT.

Meleason, M. A., S. V. Gregory and J. Bolte. 2002. Simulation of stream wood source distance for small streams in the western Cascades, Oregon. General Technical Report PSW-GTR-181. Pacific Southwest Research Station, U.S. Department of Agriculture, U.S. Forest Service.

Menges E., 2000. Population viability Analyses in Plants: Challenges and Opportunities.Tree vol.15, no. 2 Feb. 2000.

Menke, C. and Kaye, T. 2006. Population Monitoring and Effects of Grazing on *Calochortus greenei* on the Cascade-Siskiyou National Monument. Annual Progress Report. Bureau of Land Management, Medford District. Medford, OR.

Methane Energy Corporation. 14 December 2005. Interagency Tour of Drill Sites, Coos Bay, OR.

Meyer, C.B., S.L. Miller, and C.J. Ralph. 2002. Multi-scale landscape and seascape patterns associated with marbled murrelet nesting areas on the U.S. west coast. Landscape Ecology 17:95-115.

Meyer, J.M. March 2007. Personal Communications with Jack Meyer, Geologist, Northwest Natural Company.

Michigan Department of Environmental Quality. 28 December 2001. Land and Water Management Division, Hydrologic Studies Unit.

Miles, Patrick D. 14 July 2006. Forest inventory mapmaker web-application version 2.1. North Central Research Station, U.S. Department of Agriculture, U.S. Forest Service. St. Paul, MN. [Available only on internet: www.ncrs2.fs.fed.us/4801/fiadb/index.htm]

Millar, C.I. and W.B. Woolfenden. 1999. The role of climate change in interpreting historical variability. Ecological Applications 9:1207–1216.

Miller, G.S., R.J. Small and E.C. Meslow. 1997. Habitat selection by spotted owls during natal dispersal in western Oregon. Journal of Wildlife Management 61(1):140-150.

Miller, R.E., W.I. Stein, R.L. Heninger, W. Scott, S.N. Little, and D.J. Goheen. 1989. Maintaining and Improving Site Productivity in the Douglas-Fir Region. *In*: Proceedings of a symposium, Maintaining the Long-Term Productivity of Pacific Northwest Forest Ecosystems. March, 1987. Perry, D.A. and others, editors.

Miller, R.E., W. Scott, and J.W. Hazard. 1996. Soil Compaction and conifer growth after tractor yarding at three coastal Washington locations. Canadian Journal of Forest Research 26: 225-236.

Miller, R.F., and R.J. Tausch. 2001. The role of fire in juniper and pinyon woodlands: a descriptive analysis. pp. 15-30. *in*: Proceedings invasive species workshop: the role of fire in the control and spread of invasive species. Galley, K.E.M. and T.P. Wilson (editors). Miscellaneous Publication 11. Tall Timbers Research Station, Tallahassee, FL.

Miller, D. 2003. Programs for DEM analysis. Landscape dynamics and forest management. General Technical Report RMRSGTR-101CD [CD-ROM]. Rocky Mountain research Station, U.S. Department of Agriculture, U.S. Forest Service. Fort Collins,CO.

Miller, D. and L. Benda. 2005. Terrain resource inventory and analysis database: Landscape analysis tools for watershed scientists and planners. Earth Systems Institute, Ver. 1.1. Seattle, WA.

Miller, D.J. and K.M. Burnett. 2007. A probabilistic model of debris-flow delivery to stream channels, demonstrated for the Coast Range of Oregon, USA, Geomorphology

Moeur, M., T.A. Spies, M. Hemstorm, J.R. Martin, J. Alegriaa, J. Browning, J. Cissel, W.B. Cohen, T.E. Demeo, S. Healey and R. Warbington. 2005. Northwest Forest Plan - The first 10 years (1994-2003): status and trend of late-successional and old-growth forest. General Technical Report PNW-GTR-646. Pacific Northwest Research Station, U.S. Department of Agriculture, U.S. Forest Service. Portland, OR.

Montgomery, D. R., J. M. Buffington, R. D. Smith, K. M. Schmidt and G. Pess. 1995. Pool spacing in forest channels. Water Resources Research 31:1097-1105.

Montgomery, D. and J. Buffington. 1997. Channel reach morphology in mountain drainage basins. Geological Society of America Bulletin 109: 596-611. From: Stillwater Sciences/NCASI.

Montgomery, D. R., B.D. Collins, T.B. Abbe and J.M. Buffington. 2003. Geomorphic effects of wood in rivers, *In:* The Ecology and Management of Wood in World Rivers, edited by S. V. Gregory, K. L. Boyer, and A. Gurnell. American Fisheries Society Symposium 37, [21-47]. Bethesda, MD.

Morken, I. and R. Ziemer. 1998. Publications related to Caspar Creek. *In*: Proceedings of the conference on coastal watersheds: the Caspar Creek story, 6 May 1998; Ukiah, California. Robert R. Ziemer, technical coordinator. General Technical Report PSW GTR-168. [137-149]. Pacific Southwest Research Station, U.S. Department of Agriculture, U.S. Forest Service. Arcata, CA.

Muir, P.S., R.L. Mattingly, J.C. Tappeiner II, J.D. Bailey, W.E. Elliott, J.C. Hagar, J.C. Miller, E.B. Peterson and E.E. Starkey. 2002. Managing for biodiversity in young Douglas-fir forests of western Oregon. Biological Science Report USGS/BRD/BSR-2002-006. 76 pp. U.S. Geological Survey, Biological Resources Division,

Muir, Patricia S. 2004. An Assessment of Commercial "Moss" Harvesting from Forested Lands in the Pacific Northwestern and Appalachian Regions of the United States: How Much Moss is Harvested and Sold Domestically and Internationally and Which Species are Involved? 80 pp. Department of Botany and Plant Pathology, Oregon State University. Corvallis, OR,

Murphy, M.L., et al. 1986. "Effects of clear-cut logging with and without buffer strips on juvenile salmonids in Alaskan streams." Canadian Journal of Fisheries and Aquatic Sciences 43:1521-1533.

Murphy M.L. and K.V. Koski. 1989. Input and Depletion of Woody Debris in Alaska Streams and Implications for Streamside Management. North American Journal of Fisheries Management 9:427-436.

Myers, J. M., C. Busack, D. Rawding and A. Marshall. 10 May 2002. Identifying historical populations of Chinook and chum salmon and steelhead within the Lower Columbia River and Upper Willamette River evolutionarily significant units. Draft report to the comanagers from the Willamette/Lower Columbia River Technical Recovery Team, Northwest Fisheries Science Center, 2725 Montlake Blvd. E., Seattle, WA 98112.

Naiman, R.J., T.J Beechie, L.E. Benda, D.R. Berg, P.A. Bisson, L.H. McDonald, M.D. O'Conner, P.A. Olson and E.A. Steel. 1992. Fundamentals of ecologically healthy watersheds in the Pacific Northwest coastal region. *In*: Watershed management: balancing sustainability and environmental change, pp. 127-188. Naiman, R.J., editor. Springer-Verlag. New York, NY

Naiman, R.J and R.E. Bilby, editors. 1998. River Ecology and Management: Lessons From the Pacific Coastal Ecoregion. Springer-Verlag. New York, NY.

Naiman, Robert J., C.A. Johnston and J.C. Kelley. December 1998. Alterations of North American Stream by Beaver: How Animals Shape Their Ecosystems. *BioScience.* Vol. 38, No. 11, pp. 753-762.

Naiman R.J., R.E. Bilby and P.A. Bisson. 2000. Riparian ecology and management in the Pacific Coastal rain forest. BioScience 50:996–1011.

National Wildfire Coordination Group. 2001. Smoke Management Guide for Prescribed and Wildland Fire" PMS 420-2. National Wildfire Coordinating Group, National Interagency Fire Center

NatureServe. 2006. NatureServe Explorer: An online encyclopedia of life [web application]. Version 4.7. NatureServe. Arlington, VA. Available http://www.natureserve.org/explorer. (Accessed: July 12, 2006).

Naugle, D. E., C. L. Aldridge, B. L. Walker, T. E. Cornish, B. J. Moynahan, M. J. Holloran, K. Brown, G. D. Johnson, E. T. Schmidtmann, R. T. Mayer, C. Y. Kato, M. R. Matchett, T. J. Christiansen, W. E. Cook, T. Creekmore, R. D. Falise, E. T. Rinkes, and M. S. Boyce. 2004. West Nile virus: pending crisis for greater sage-grouse. Ecology Letters 7: 704-713.

Neary, D.G., K.C. Ryan, and L.F. DeBano, editors. 2005. Wildland fire in ecosystems: effects of fire on soils and water. General Technical Report RMRS-GTR-42-vol.4. Rocky Mountain Research Station, U.S. Department of Agriculture, U.S. Forest Service. Ogden, UT:

Neiland, Bonita J. 1958. Forest and adjacent burn in the Tillamook Burn area of northwestern Oregon. Ecology 39(4): 660-671.

Nelson, S.K., M.H. Huff, S.L. Miller and M.G. Raphael. 2006. Marbled murrelet biology: habitat relations and populations. Chapter 2 in Huff, M.H., M.G. Raphael, S.L. Miller, S.K. Nelson, and J. Baldwin (technical coordinators). Northwest Forest Plan---The first 10 years (1994-2003): status and trends of populations and nesting habitat for the marbled murrelet. General Technical Report PNW-GTR-650. Pacific Northwest Research Station, U.S. Department of Agriculture, U.S. Forest Service. Portland, OR.

Newton, V.C. Jr. and R.E. Stewart. 1965. Oil and Gas Exploration in Oregon: State of Oregon Department of Geology and Mineral Industries. Miscellaneous Paper 6, 32p. and maps.

Newton, V.C. Jr. 1969. Subsurface Geology of the Lower Columbia and Willamette Basins, Oregon: State of Oregon Department of Geology and Mineral Industries Oil and Gas Investigations No. 2, 121pp. Cross-sections and Maps.

Newton, V. C. Jr. 1980. Prospects for Oil and Gas in the Coos Basin, Western Coos, Douglas, and Lane Counties, Oregon: Oil and Gas Investigation Number 6. 74pp. State of Oregon Department of Geology and Mineral Industries.

Nickelson, T. E., J.W. Nicholas, A.M. McGie, R.B. Lindsay, D.L. Bottom, R.J. Kaiser and S.E. Jacobs. 1992. Status of anadromous salmonids in the Oregon coastal basins. 83pp. Oregon Department of Fish and Wildlife. Portland, OR.

Nickelson, Thomas E. 2001. Population Assessment: Oregon Coast Coho Salmon ESU. Oregon Department of Fish and Wildlife Information Report 2001-02. 47 pp. Northwest Region Research and Monitoring Program.

Niem, A.R. W.A. Niem, M.W. Martin, M.M. Kadri and D.R. McKeel. 1985. Correlation of Exploration Wells, Astoria Basin, Oregon: State of Oregon Department of Geology and Mineral Industries Oil and Gas Investigations No. 14, 8p. and Maps.

Niem, A.R. and W.A. Niem. 1990. Geology and Oil, Gas, and Coal Resources, Southern Tyee Basin, Southern Coast Range, Oregon. Open-File Report O-89-3. 44 pp. State of Oregon Department of Geology and Mineral Industries.

Nierenberg, T. and D. Hibbs. 2000. A characterization of unmanaged riparian areas in the central Coast Range of western Oregon. Forest Ecology and Management 129(2000): 195-206.

Noggle, C. C. (1978). Behavioral, physiological and lethal effects of suspended sediment on juvenile salmonids. Zoology. University of Washington. Seattle, WA.

Nonaka, E. and T.A.Spies. 2005. Historical range of variability in landscape structure: a simulations study in Oregon, USA. Ecological Applications 15(5): 1727-1746.

Norris, D. and J. Shevock. 2004a. Contributions Toward a Bryoflora of California: I. A Specimen-Based Catalogue of Mosses. Madrono, Volume 51, No. 1, pp. 1-131.

Norris, D. and J. Shevock. 2004b. Contributions Toward a Bryoflora of California: I. A Specimen-Based Catalogue of Mosses. Madrono, Volume 52, No. 2 pp. 133-269.

Noss, Reed F., Jerry Franklin, William Baker, Tania Schoennagel and Peter B. Moyle. February 2006. Ecological Science Relevant to Management Policies for Fire-Prone Forests of the Western United States. Society for Conservation Biology Scientific panel on Fire in Western U.S. Forests.

Nuzzo, Victoria. (2000). Element stewardship abstract: *Cirsium arvense*. *In*: Weeds on the web: The Nature Conservancy wildland invasive species program. Retrieved September 2006 from http://tncweeds.ucdavis.edu/esadocs/cirsarve.html [2001, July 01].

Ohmann, J.L., M.J. Gregory and T.A. Spies. 2007. Influence of environment, disturbance, and ownership on forest vegetation of coastal Oregon. Ecological Applications 17:18–33.

Olmstead, D.L. and M.P. Alger. 1985. Mist Gas Field: Exploration and Development 1979-1984: Oil and Gas Investigation 10, 36pp. Oregon Department of Geology and Mineral Industries.

Olmstead, D.L., V.C. Newton Jr. and R.E. Stewart. 1989. Hydrocarbon Exploration and Occurrences in Oregon: Oil and Gas Investigation 15, 74 pp. Oregon Department of Geology and Mineral Industries.

Olson, D.H., J.C. Hagar, A.B. Carey, J.H. Cissel and F.J. Swanson. 2001. Wildlife of Westside and High Montane Forests. pp. 187-212. *In:* Wildlife-habitat Relationships in Oregon and Washington, Johnson, D.H. and T.A. O'Neil (managing directors). Oregon State University Press. Corvallis, OR.

Olson, G.S., E.M. Glenn, R.G. Anthony, E.D. Forsman, J.A. Reid, P.J. Loschl and W.J. Ripple. 2004. Modeling demographic performance of northern spotted owls relative to forest habitat in Oregon. Journal of Wildlife Management 68(4):1039-1053.

Olson, G.S., R.G. Anthony, E.D. Forsman, S.H. Ackers, P.J. Loschl, J.A. Reid, K.M Dugger, E.M. Glenn and W.J. Ripple. 2005. Modeling of site occupancy dynamics for northern spotted owls, with emphasis on the effects of barred owls. Journal of Wildlife Management 69(3):918-932.

Oregon Department of Agriculture. 2001. Reintroduction of the Red Root Yampah (Perideridia erythrorhiza). Final Report to the BLM: Roseburg, Medford, and Lakeview Districts, Klamath Resource Area and Winema National Forest. 41 pp.

Oregon Department of Agriculture, Noxious Weed Control, French broom. Retrieved 1/26/2007. http://egov.oregon.gov/ODA/PLANT/WEEDS/profile_frenchbroom.shtml

Oregon Department of Environmental Quality (ODEQ). 2004a. Web page for temperature limited water-bodies in Oregon. www.deq.state.ok.us/WQDnew/305b_303d/

ODEQ. 2004b. Water Quality Assessment. Section 305(b) Report.

Oregon Department of Environmental Quality. 2006. Water quality assessment- Oregon's 2004/2006 integrated report database. [Online: http://www.deq.state.or.us/wq/assessment/rpt0406/search.asp]

Oregon Department of Forestry. 1999. Storm impacts and landslides of 1996: Final report. Forest technical report No.4.

Oregon Department of Forestry. 2005. Swiss needle cast and the H [harvest] & H [habitat] Model (Draft 3/3/05). Unpublished Internal Report.

Oregon Department of Forestry. 2006. 2005 Timber harvest reports. November 2006. http://egov.oregon.gov/ODF/STATE_FORESTS/FRP/2005MENU.shtml#Harvest_Data

Oregon Department of Fish and Wildlife (ODFW). 2003a. Oregon's Mule Deer Management Plan. Portland, OR.

ODFW. 2003b. Oregon's Elk Management Plan. Portland, OR.

ODFW. 2005a. Oregon Conservation Strategy. Salem OR.

ODFW. 2005b. The Importance of Beaver (*Castor Canadensis*) to Coho Habitat and Trend in Beaver Abundance in the Oregon Coast Coho ESU. ODFW (7) Beaver Final Report Part 4.

ODFW. 2006. Oregon Conservation Strategy. Salem, OR.

Oregon Employment Department. Oregon Labor Market Information System (OLMIS) http://www.olmis.org/olmisj/OlmisZine

Oregon Department of Geology and Mineral Industries. 1985. Oregon Administrative Regulations (OAR): http://arcweb.sos.state.or.us/rules/OARS_600/OAR_632/632_010.html; accessed March 2007.

Oregon Department of Geology and Mineral Industries. 1999. Oregon Administrative Regulations (OAR): http://arcweb.sos.state.or.us/rules/OARS_600/OAR_632/632_010.html; accessed March 2007.

Oregon Department of Geology and Mineral Industries. 2003. Mist Gas Field Production Figures 2002 and Mist Gas Field Map 2003: Open-File Report O-03-01, Tables and Maps.

Oregon Department of Geology and Mineral Industries. 7 February 2006, Unpublished, Oil and Gas Program and Geothermal Program Draft Report Submitted to Governing Board. 14pp.

Oregon Department of Geology and Mineral Industries. 2007. Mist Gas Field Production, 2006. http://www.oregongeology.com/sub/oil/MistProduction2006.xls

Oregon Department of Geology and Mineral Industries: 2007. Mist Gas Field Production, 2006 and Historic. http://www.oregongeology.com/sub/oil/oilhome.htm

Oregon Natural Heritage Information Center. 2004. Rare, Threatened and Endangered Species of Oregon. 105 pp. Portland, OR.

Oregon Natural Heritage Information Center. Sept. 2006. Database. Portland, OR.

Oregon Parks and Recreation Department (OPRD). 2003. Oregon Statewide Comprehensive Outdoor Recreation Plan, 2003-2007.

OPRD. 2004. Draft Habitat Conservation Plan for the Western Snowy Plover. Salem, OR.

Oregon State University. 2000 Online: http://www.ocs.orst.edu/pub/maps/Precipitation/Total/States/OR/or.gif]

Oregon Watershed Enhancement Board (OWEB). 1999. Oregon watershed assessment manual. Available from Oregon Watershed Enhancement Board, 775 Summer St. NE, Suite 360, Salem, OR. 97301.

Orr, E.L. and W.N. Orr. 2000. Geology of Oregon, 5th Edition: 254 pp. Kendall/Hunt Publishing Company.

Outcalt, Kenneth Wayne and Edwin H. White. 1981. Phytosociological changes in understory vegetation following timber harvest in northern Minnesota. Canadian Journal of Forest Research. 11: 175-183.

Packer, P. 1967. Criteria for designing and locating logging roads to control sediment. Forest Science 13(1): 1-18.

Page, G.W., J.S. Warriner, J.C. Warriner and P.W.C. Paton. 1995. Snowy Plover (*Charadrius alexandrinus*). *In* The Birds of North America, No. 154 (A. Poole and F. Gill, eds.). The Academy of Natural Sciences, Philadelphia, PA, and The American Ornithologists' Union, Washington, D.C.

Pappajohn, S. 27 August 2002. Personal Communication with Steven Pappajohn, Principal of Geo Trends-Hampton International, Incorporated. Interagency Meeting. Salem, OR.

Pappajohn, S. 14 December 2005. Personal Communication with Steve Pappajohn, President and Director of Methane Energy Corporation, Director of Cascadia Energy Corporation. Interagency Tour of Drill Sites. December 14, 2005. Coos Bay, OR.

Pappajohn, S. 21 March 2007. Personal Communication with Steve Pappajohn, President and Director of Methane Energy Corporation, Director of Cascadia Energy Corporation.

Parendes, Laurie A. and Julia A. Jones. 2000. Role of light availability and dispersal in exotic plant invasion along roads and streams in the H. J. Andrews Experimental Forest, Oregon. Conservation Biology. 14(1): 64-75.

Park, C.S. 1993. SHADOW stream temperature management program. U.S. Department of Agriculture, U.S. Forest Service, Pacific Northwest Region.

Park, C.S. 2005. *Personnel communication* with Dan Carpenter.

Pashley, D.N., C.J. Beardmore, J.A. Fitzgerald, R.P. Ford, W.C. Hunter, M.S. Morrison and K.V. Rosenberg. 2000. Partners in Flight Conservation of the Land Birds of the United States. American Bird Conservancy. The Plains, VA.

Pearson, R.R. and K.B. Livezey. 2003. Distribution, numbers, and site characteristics of spotted owls and barred owls in the Cascade Mountains of Washington. Journal of Raptor Research 37(4):265-276.

Peck, M.E. 1941. A manual of the higher plants of Oregon. Binfords and Mort, Portland, OR. Illustrated Flora of the Pacific States, Abrams,1960

Peery, M.Z., S.R. Beissinger, B.H. Becker and S.H. Newman. 2002. Marbled murrelet (Brachyramphus marmoratus) demography in Central California: 2001 Progress Report. Prepared for the California Department of Fish and Game, U.S. Fish and Wildlife Service, and California State Parks.

Peery, M.Z., S.R. Beissinger, S.H. Newman, E.B. Burkett and T.D. Williams. 2004 Applying the declining population paradigm: diagnosing causes of poor reproduction in the marbled murrelet. Conservation Biology 18(4):1088-1098.

Pellant, M., P. Shaver, D.A. Pyke and J.E. Herrick. 2005. Technical Ref. 1734-6 (Version 4). Interpreting Indicators of Rangeland Health. USDI, BLM

Perakis, S.S., D.A. Maguire, T.D. Bullen, K. Cromack, R.H. Waring and J.R. Boyle. 2006. Coupled Nitrogen and Calcium Cycles in Forests of the Oregon Coast Range. Ecosystems 9: 63-74.

Perry, D.A. 1998. The scientific basis of forestry. Annual Review of Ecology and Systematics 29:435-466.

Peterson, D.L., M.C. Johnson, J.K. Agee, T.B. Jain. D. McKenzie and E Reinhardt. 2005. "Forest Structure and Fire Hazard in Dry Forests of the Western United States" General Technical Report PNW-GTR-628. Pacific Northwest Research Station, U.S. Department of Agriculture, U.S. Forest Service.

Petzet, A. 22 January 2007. Special Report: Water Issues Overshadow Powder River Coal Gas Play. Oil and Gas Journal Online, Volume 105, Issue 4. http://www.ogj.com/currentissue/index.cfm?p=7&v=105&i=4

Pilz, D., R. Molina and J. Mayo. 2006. Effects of Thinning Young Forests on Chanterelle Mushroom Production. Journal of Forestry.

Poage, N.J. *unpublished*. BLM Western Oregon Late-Successional and Old-Growth Conifer Data (1983 - 1991). On file at Eugene District, BLM. Eugene, OR.

Poage, N.J. 2000. Structure and development of old-growth Douglas-fir in central western Oregon. Ph.D. dissertation. 164 pp. Oregon State University. Corvallis, OR.

Poage, N.J. and J.C. Tappeiner. 2002. Long-term patterns of diameter and basal area growth of old-growth Douglas-fir trees in western Oregon. Canadian Journal of Forest Research 32 (7): 1232-1243.

Poggi, D., A. Porporato, L. Ridolfi, J. Albertson and G. Katul. 2004. The effect of vegetation density on canopy sub-layer turbulence. Boundary-Layer Meteorology 111: 565-587

Pollock, M.M., M. Heim and R.J. Naiman. 2003. Hydrologic and geomorphic effects of beaver dams and their influence on fishes. pp. 213-234. *In*: The ecology and management of wood in world rivers. Gregory, S.V., K. Boyer, and A. Gurnell, editors. American Fisheries Society, Bethesda, MD.

Poole, A. and F. Gill, editors. 2002. The Birds of North America. Nos. 1-716. Philadelphia, PA

Powell, R.A. and W. J. Zielinski. 1994. The Scientific Basis for Conserving Forest Carnivores: American Marten, Fisher, Lynx, and Wolverine in the Western United States (Chapter 3 Fisher). General Technical Report GTR RM-254. Rocky Mountain Forest and Range Experiment Station, U.S. Department of Agriculture, U.S. Forest Service.

Proctor, Bernadette D. and Joseph Dalaker. 2002. Current Population Reports, P60-219, Poverty in the United States: 2001. U.S. Census Bureau.

Ralph, C.J. and S.L. Miller. 1995. Offshore population estimates of marbled murrelets in California. pp. 353-360. *In*: Ecology and Conservation of the Marbled murrelet. Ralph, C.J., G.L. Hunt, Jr., M. G. Raphael, and J.F. Piatt, editors. General Technical Report PSW-GTR-152. Pacific Southwest Experimental Station, U.S. Department of Agriculture, U.S. Forest Service. Albany, CA.

Ralph, C.J., G.L. Hunt, Jr., M.G. Raphael and J.F. Piatt. 1995. Ecology and conservation of the marbled murrelet in North America: an overview. pp. 3-22. *In*: Ecology and conservation of the marbled murrelet. General Technical Report PSW-GTR-152. Pacific Southwest Experimental Station, U.S. Department of Agriculture, U.S. Forest Service. Albany, CA.

Raphael, M.G., D.E. Mack and B.A. Cooper. 2002. Landscape-scale relationships between abundance of marbled murrelets and distribution of nesting habitat. Condor 104(2), 331-342.

Raphael, M.G., D.E. Mack, J.M. Marzluff, and J.M Luginbuhl. 2002b. Effects of forests fragmentation on populations of the marbled murrelet. Studies in Avian Biology 25:221-235.

Raphael, M.G., B.M. Galleher, J.H. Huff, S.L. Miller, S.K. Nelson and R.D. Young. 2006. Chapter 5: Spatially explicit estimates of potential nesting habitat for the marbled murrelet. *In*: Northwest Forest Plan---The first 10 years (1994-2003): status and trends of populations and nesting habitat for the marbled murrelet. Huff, M.H., M.G. Raphael, S.L. Miller, S.K. Nelson and J. Baldwin (technical coordinators). PNW-GTR-650. Pacific Northwest Research Station, U.S. Department of Agriculture, U.S. Forest Service. Portland, OR.

Rapp, Valerie. 2004. Western Forests, Fire Risk and Climate Change, PNW Science Update, Issue 6. Http://www.fs.fed.us/pnw

Rashin, E., C. Clishe, A. Loch and J. Bell. 2006. Effectiveness of timber harvest practices for controlling sediment related water quality impacts. Journal of the American Water Resources Association. Paper No. 01162.

Rasmussen, M.C. and W.J. Ripple. 1998. Retrospective analysis of forest landscape patterns in western Oregon. Natural Areas Journal 18(2): 151-163.

Rasmussen, Mark. personal communication. 25 August 2006. Notes of meeting hosted by the American Forest Resources Council. Eugene OR.

Reeves, G.H., F.H. Everest and J.R. Sedell. 1993. "Diversity of juvenile anadromous salmonid assemblages in coastal Oregon basins with different levels of timber harvest." Transactions of the American Fisheries Society 122:309-317.

Reeves, G.H., L.E. Benda, K.M. Burnett, P.A. Bisson and J.R. Sedell. 1995. A Disturbance-Based Ecosystem Approach to Maintaining and Restoring Freshwater Habitats of Evolutionarily Significant Units of Anadromous Salmonids in the Pacific Northwest. American Fisheries Society Symposium 17:334-349.

Reeves, G.H., P. A. Bisson, B.E. Rieman and L.E. Benda. 2006. Postfire logging in riparian areas. Conservation Biology 20(4): 994–1004.

Reid, L. M. 1981. Sediment Production from Gravel-Surfaced Forest Roads, Clearwater Basin, Washington. Fisheries Research Institute. College of Fisheries, University of Washington. Seattle, Washington. FRI-UW-8108.

Reid, Leslie M. and Thomas Dunne. 1984. Sediment production from forest road surfaces. Water Resources Research 20(11):1753-1761.

Reiter, M. and R. Beschta. 1995. Effects of Forest Practices on Water in Cumulative Effects of Forest Practices in Oregon: Literature and Synthesis. 185 pp. Forest Engineering Department, College of Forestry, Oregon State University. Corvallis, OR.

Ricca. M.A. 1999. Movements, Habitat Associations, and Survival of Columbian White-tailed deer in Western Oregon. M.S. Thesis. Oregon State University. Corvallis, OR.

Ricca, M.A., R.G. Anthony, D.H. Jackson and S.A. Wolfe. 2003. Spatial Use and Habitat Associations of Columbian White-tailed Deer Fawns in Southwestern Oregon. Northwest Science 77(1):72-80.

Rich, T.D., C.J. Beardmore, H. Berlanga, and P.J. Blancher. 2004. Partners in Flight North American Landbird Conservation Plan. Cornell Lab of Ornithology. Ithaca, NY.

Richardson, H.W. 1972. *Input-output and regional economics.* John Wiley and Sons: New York, NY.

Ripple, W.J., K.T. Hershey and R. Anthony. 2000. Historical Forest Patterns of the Central Oregon Coast Range. Biological Conservation 93:127-133.

Ritchie, Martin W. 1999. A compendium of forest growth and yield simulators for the Pacific Coast states. General Technical Report PSW-GTR-174. 59 pp. Pacific Southwest Research Station, U.S. Department of Agriculture; U.S. Forest Service. Albany CA:

Ritchie, Martin W. 2006. Users guide and help system for CONIFERS: a simulator for young mixed-conifer stands version 3.00. Pacific Southwest Research Station, U.S. Department of Agriculture, U.S. Forest Service. Albany, CA.

Rizzo, D. M., M. Garbelotto, J.M. Davidson, G.W. Slaughter and S.T. Koike. 2002. *Phytophthora ramorum* as the cause of extensive mortality of *Quercus* spp. and *Lithocarpus densiflorus* in California. Plant Disease 86: 205-214.

Rizzo, D. M. 2003. Sudden Oak Death: Host plants in forest ecosystems in California and

Oregon. Sudden Oak Death Online Symposium. www.apsnet.org/online/SOD

Robichaud, P.R., J.L. Beyers and D.G. Neary. 2000. Evaluating the effectiveness of postfire rehabilitation treatments. General Technical Report RMRS-GTR-63. Rocky Mountain Research Station, U.S. Department of Agriculture, U.S. Forest Service. Fort Collins, CO.

Robison, M. Henry. 1997. Community Input/Output Models for Rural Area Analysis. *Annals of Regional Science*. Vol 31(3), pp 325-351.

Roche, Cindy Talbott and Ben F. Roche, Jr. 1988. Distribution and amount of four knapweed (Centaurea L.) species found in eastern Washington. Northwest Science 62(5): 242-253.

Roloff, Gary J, Stephen P. Mealy, Christopher Clay, Jeff Barry, Curt Yanish and Leon Neuenschwander. 2005. "A Process for modeling short and long term risk in the southern Oregon Cascades" Forest Ecology and Management 211 (2005) 166-190. Http://www.sciencedirect.com

Romero, Nicolas; Roberts E. Gresswell and Judith L. Li. (2005). "Changing patterns in coastal cutthroat trout (*Onchorhynchus clarki clarki*) diet and prey in a gradient of deciduous canopies." Canadian Journal of Fisheries and Aquatic Science. 62: 1797-1807.

Roni, P. 2001. Responses of fishes and salamanders to instream restoration efforts in western Oregon and Washington. Report to Bureau of Land Management on project completion, Interagency Agreement No. 1422H952-A98-3007. 132 pp. National Marine Fisheries Service, Northwest Fisheries Science Center. Seattle, WA.

Rooney, B. 22 June 2006. Oregon's forestry and logging industry: particularly important to rural areas. 6 pp. Oregon Employment Department.

Rosenberg, D.K., K.A. Swindle and R.G. Anthony. 2003. Influence of prey abundance on northern spotted owl reproductive success in western Oregon. Canadian Journal of Zoology 81:1715-1725.

Rothacher, J. 1973. Does harvest in west slope Douglas-fir increase peak flow in small streams? Pacific Northwest Forest and Range Experiment Station, U.S. Department of Agriculture, U.S. Forest Service. Portland, OR.

Rowland, M.M., M.J. Wisdom, B.K. Johnson and J.G. Kie. 2000. Elk distribution and modeling in relation to roads. Journal of Wildlife Management 64(3):672-684.

Rowland, M.M., M.J. Wisdom, B.K. Johnson and J.G. Kie.2004. Effects of roads on elk: implications for management in forested ecosystems. *In*: Transaction of the Sixty-ninth North American and Natural Resources Conference held March 16-20, 2004, in Spokane, Washington. J. Rahm, editor. Wildlife Management Institute, Washington, D.C.

Ryu, I. C., A.R. Niem, W.A. Niem, R.E. Wells and P.O. Hales. 1996. Oil and Gas Potential of the Southern Tyee Basin, Southern Oregon Coast Range. Oil and Gas Investigation 19. Cross Sections and 141pp. State of Oregon Department of Geology and Mineral Industries.

Sandberg, D.V., R.D. Ottmar and J.L. Peterson. 2002. "Wildland Fire in Ecosystems: effects of fire on air" General Technical Report RMRS-GTR-42-Vol. 5. Rocky Mountain Research Station, U.S. Department of Agriculture, U.S. Forest Service. Fort Collins, CO.

Schemske, D., Husband, B., Ruckelshaus, Goodwillie, C., Parker, I., Bishop, J. 1994. Evaluating Approaches to the Conservation of Rare and Endangered Plants. Ecology, 75(3) pp. 584-606.

Schmidt, Karen, J.P. Menakis, C.C. Hardy, W.J. Hann, D.L. Bunnell. 2002 "Development of Coarse-Scale Spatial Data for Wildland Fire and Fuel Management." General Technical Report RMRS-87. Rocky Mountain Research Station, U.S. Department of Agriculture, U.S. Forest Service. Missoula, Montana

Schoenberger, M. D. Meyer and A. Perry. 1982. The effect of soil disturbance on growth and ectomycorrhizae of Douglas-fir and western hemlock seedlings: a greenhouse bioassay. Canadian Journal of Forest Research 12: 343-353.

Scientific Consensus Statement on the Likely Impacts of Climate Change on the Pacific Northwest. Oregon State University, October 12, 2004. Available online at: http://www.ef.org/westcoastclimate/E_OSU%20Consensus%20Statement.pdf

Seaber, P., F. Kapinos and G. Knapp. 2007. Hydrologic Unit Maps. U.S. Geological Survey, Water Supply Paper 2294. Online: [http://pubs.usgs.gov/wsp/wsp2294/]

Sedell, J.R. and K.J. Luchessa. 1981. Using the historical record as an aid to salmonid habitat enhancement. pp. 210-223. *In*: Acquisition and utilization of aquatic habitat inventory information. N.B. Armantrout, editor. Proceedings of symposium, 28-30 October 1981. 376 pp. Portland, OR.

Sedell, James R. and Judith L. Froggatt. 1984. Importance of streamside forests to large rivers: the isolation of the Willamette River, Oregon, U.S.A., from its floodplain by snagging and streamside forest removal. Verhandlungen International Verein Limnologie 22: 1828-1834.

Sedell, J. R. and K. J. Luchessa. 1984. Using the historical record as an aid to salmonid habitat enhancement. *In*: Acquisition and Utilization of Aquatic Habitat Inventory Information. [210-222]. N.B. Armantrout, editor. American Fisheries Society, Western Division. Bethesda, MD.

Sedell, J.R. and C.N. Dahm. 1984. "Catastrophic disturbances to stream ecosystems: Volcanism and clear-cut logging." *In:* Current Perspectives in Microbial Ecology. M.J. Klug and C.A. Reddy, editors. Michigan State University, East Lansing, MI. and American Society of Microbiology, Washington, DC.

Seiger, Leslie. 1991. Element Stewardship Abstract for Polygonum cuspidatum: Japanese knotweed, Mexican bamboo. The Nature Conservancy. 1815 North Lynn Street, Arlingon, VA. 22209. http://tncweeds.ucdavis.edu/esadocs/documnts/polycus.rtf Retrieved September, 2006.

Sensenig, T.S. 2002. Development, Fire History and Current and Past Growth, of Old-Growth and Young-Growth Forest Stands in the Cascade, Siskiyou and Mid-Coast Mountains of Southwestern Oregon. Ph.D. Dissertation. Oregon State University. Corvallis, OR.

Sessions, J., P. Bettinger, R. Buckman, M. Newton and J. Hamann. 2004. Hastening the return of complex forests following fire: the consequences of delay. Journal of Forestry 102: 38–45.

Sheley, Roger L.; James S. Jacobs and Michael F. Carpinelli. 1998. Distribution, biology, and management of diffuse knapweed (Centaurea diffusa) and spotted knapweed (Centaurea maculosa). Weed Technology. 12(2): 353-362.

Shelton, J. M. and R. D. Pollock. 1966. Siltation and egg survival in incubation channels. Transactions of the American Fisheries Society 95(2):183-187.

Sigler, John. W., T. C. Bjornn and Fred H. Everest. 1984. "Effects of chronic turbidity on density and growth of steelheads and coho salmon." Transactions of the American Fisheries Society. 113: 142-150.

Skaugset, Arne. 1997. Review of Earlier Soil Compaction Studies: A paper presented at a Society of American Foresters Conference on Understanding and Managing Soil Compaction to Maintain Ecosystem Productivity. Bend, OR.

Smith, W.P. 1987. Dispersion and Habitat Use by Sympatric Columbian White-Tailed Deer and Columbian Black-Tailed Deer. Journal of Mamma logy 68(2):337-347.

Smith, J. 2004. A Synthesis of Potential Climate Change Impacts on the U.S. Pew Center on Global Climate Change. Arlington, VA.

Smith, W.P. 1987. Dispersion and Habitat Use by Sympatric Columbian White-Tailed Deer and Columbian Black-Tailed Deer. Journal of Mammalogy 68(2):337-347.

Soll, Jonathon; D. Kruezer, K. Strauss, and J. Dumont. 2007. Sandy River Riparian Habitat Protection Project Report 2006. The Nature Conservancy. The Global Invasive Species Initiative. Retrieved January, 2007 from http://tncweeds.ucdavis.edu/moredocs/polspp03.pdf

Sorenson, D. L., M. M. McCarth, E.J. Middlebrooks and D.B. Porcella. 1977. Suspended and dissolved solids effects on biota: A review. EPA-600/3-77-042. 64 pp. U.S. Environmental Protection Agency, Environmental Research Laboratory. Corvallis, OR.

Speich, S.M. and T.R. Wahl. 1995. Marbled murrelet populations of Washington – marine habitat preferences and variability of occurrence. pp. 313-326 *In*: Ecology and conservation of the marbled murrelet. C.J. Ralph, G.L. Hunt, Jr., M.G. Raphael, and J.F. Piatt, editors. General Technical Report PSW-GTR-152. Pacific Southwest Research Station, U.S. Department of Agriculture, U.S. Forest Service. Albany CA.

Spies, T.A. and J.F. Franklin. 1988. Old-growth and forest dynamics in the Douglas-fir region of western Oregon and Washington. Natural Areas Journal 8:190–201.

Spies, T.A. and J.F. Franklin. 1991. The structure of natural young, mature, and old-growth Douglas-fir forests in Oregon and Washington. *In:* Ruggiero, L.F., K.B. Aubrey, A.B. Carey, and M.H. Huff, technical coordinators. Wildlife and Vegetation of Unmanaged Douglas-fir Forests. pp. 91-109. General Technical Report PNW-285. Pacific Northwest Research Station, U.S. Department of Agriculture, U.S. Forest Service. Portland, OR.

Spies, T.A. and W.B. Cohen. 1992. An index of canopy height diversity. COPE Report 5(3): 5-7.

Spies, T.A. 2004. Ecological concepts and diversity of old-growth forests. Journal of Forestry April/May: 14-20.

Spies, T.A. 2006. Maintaining old-growth forests. Chapter 6 *in* R.W. Haynes, B.T. Bormann, D.C. Lee, J.R. Martin, tech. eds. Northwest Forest Plan - The First 10 Years (1994-2003): Synthesis of Monitoring and Research Results. General Technical Report PNW-GTR-651. Pacific Northwest Research Station, U.S. Department of Agriculture, U.S. Forest Service. Portland, OR.

Sproule Associates, Inc. 2004. Letter Report to John Carlson, Geo Trends-Hampton International from Leslie S. O'Connor, U.S. Manager and John P. Seidle, Senior Reservoir Engineer; date May 3, 2004. 8pp. (Used with written permission of Methane Energy Corporation, February 14, 2007).

Sproule Associates, Inc. 2005. Letter Report to John Carlson, Director, Torrent Energy Corporation from Leslie S. O'Connor, U.S. Manager and John P. Seidle, Senior Reservoir Engineer; date June 17, 2005. 26p. (Used with written permission of Methane Energy Corporation, February 14, 2007).

Sproule Associates, Inc., 2006, Letter Report to John Carlson, Director, Torrent Energy Corporation from Leslie S. O'Connor, U.S. Manager and John P. Seidle, Senior Reservoir Engineer; date April 12, 2006. 4p. (Used with written permission of Methane Energy Corporation, February 14, 2007).

Stallman, J., R. Bowers, N. Cabrera, R. Real de Asus and J. Wooster. 2005. Sediment dynamics in the upper McKenzie River Basin, central Oregon coast range. American Geophysical Union #H51E-0411.

Stephens, Scott Lewis. 1998. "Evaluation of the effects of silvicultural and fuels treatments on potential fire behavior in Sierra Nevada mixed conifer forests" Forest Ecology and Management 105(1998) 21-35)

Sterns, M.A., J.S. McIVer and G.A. Rosenberg. 1990. Investigations of the western snowy plover at the Coos Bay North Spit and adjacent sites in Coos and Curry Counties, Oregon. 33pp. Report to the Oregon Department of Fish and Wildlife, Nongame Program.

Steventon, J.D. and N.L. Holmes. 2002. A radar-based inventory of marbled murrelets (Brachyramphus marmoratus), northern Mainland Coast of British Columbia. 40 pp. Prince Rupert Forest Region, British Columbia Ministry of Forests.

Storck, P., T. K. Kern and S. Bolton. 1997. Measurement of differences in snow accumulation, melt, and micrometeorology between clearcut and mature forest stands. University of Washington, Department of Civil Engineering. Presented at the Western Snow Conference. Banff, Alberta, Canada.

Strang, R. M.; K.M. Lindsay and R.S, Price. 1979. Knapweeds: British Columbia's undesirable aliens. Rangelands 1(4): 141-143.

Strathers, R.J., T.P. Rollerson and S.J. Mitchell. 1994. Windthrow handbook for British Columbia forests. Working Paper 9401. British Columbia Ministry of Forests. Victoria, British Columbia, Canada.

Strong, C.S. and T.M. Carten. 2000. Marbled murrelets at sea in Oregon: status of abundance and reproduction during 1999. Draft final report to the Oregon Department of Fish and Wildlife. 17 pp. Portland, OR.

Strong, C.S. 2003a. Decline of the marbled murrelet population on the central Oregon coast during the 1990's. Northwestern Naturalist 84: 31-37.

Strong, C.S. 2003b. Marbled murrelet abundance and reproductive indices in Oregon during 2002. Unpublished report. 14 pp. Oregon Department of Fish and Wildlife, and U.S. Fish and Wildlife Service. Portland, OR.

Sullivan, K.; T. Lisle, C. Dollof, G. Grant and L. Reid. 1987. Stream channels: the link between forests and fish. *In*: Streamside management: forestry and fishery interactions. Contribution Number 57. E.O. Salo and T.W. Cundy, editors. University of Washington, Institute of Forest Resources. 39-97. Seattle, WA.

Sullivan, K. and S. Duncan. 1980. Sediment yield from road surfaces in response to truck traffic and rainfall. Weyerhaeuser Technical Report 042-4402/80. Weyerhaeuser Company, Technical Center. Tacoma, WA.

Suring, L.H. 1975. Habitat use and activity patterns of the Columbian white-tailed deer along the lower Columbia River. M.S. Thesis. 59pp. Oregon State University. Corvallis, OR.

Suring, L.H. and P.A. Vohs, Jr. 1979. Habitat use by Columbian white-tailed deer. Journal of Wildlife Management 43:610-619.

Swanson, F. 1981. Fire and geomorphic process. *In*: Proceedings, fire regimes and ecosystems conference. Dec. 11-15, 1979. Honolulu, HI. General Technical Report WO-26. U.S. Department of Agriculture, U.S. Forest Service. Washington, D.C.

Swanson, F., R. Fredriksen and F. McCorison. 1982. Material Transfer in a Western Oregon Forested Watershed. *In*: Analysis of coniferous forest ecosystems in western United States. [233-266]. R. Edmonds, editor. US/IBP Synthesis Series 14. Hutchinson Ross Publishing Co. Stroudsburg, PA.

Swanson, F., R. Graham and G. Grant. 1985. Some effects of slope movements on river channels. *In*: International symposium on erosion, debris flow and disaster prevention: Proceedings: [273-278]. 3-5 September 1985. Tsukuba, Japan.

Swanston, D. and F. Swanson. 1976. Timber harvesting, mass erosion, and steepland forest geomorphology in the Pacific Northwest. *In*: Geomorphology and engineering: [199-221]. D.R. Coates, editor. Dowden, Hutchinson, and Ross, Inc. Stroudsburg, PA.

Swift, L. 1986. Filter strip widths for forest roads in the southern Appalachians. Southern Journal of American Forestry 10 (1986): 27-34.

Tappeiner, J.C., D. Huffman, D. Marshall, T.A. Spies and J.D. Bailey. 1997. Density, ages, and growth rates in old growth and young forests in coastal Oregon. Canadian Journal of Forest Research 27: 638–648.

Taylor, A.H. and C.N. Skinner. 2003. Spatial patterns and controls on historical fire regimes and forest structure in the Klamath Mountains. Ecological Applications 13(3): 704-719.

The Nature Conservancy; U.S. Department of Agriculture, U.S. Forest Service; and the U.S. Department of the Interior. 2005. LANDFIRE Rapid Assessment Modeling Manual, Version 2.1. Boulder, CO.

The Nature Conservancy. The Global Invasive Species Initiative. Weed Alert!: *Brachypodium sylvaticum* (Huds.) P. Beauv. (slender false-brome, false brome). Retrieved January 25, 2007 from: http://tncweeds.ucdavis.edu/alert/alrtbrac.html

Theirrault, Shannon. 2001.” Wildfire Smoke a Guide for Public Officials”

Thomas, J.W., E.D. Forsman, J.B. Lint, E.C. Meslow, B.R. Noon and J. Verner. 1990. A conservation strategy for the northern spotted owl. A report by the Interagency Scientific Committee to address the conservation of the northern spotted owl. U.S. Department of Agriculture, U.S. Forest Service and U. S. Department of the Interior, U.S. Fish and Wildlife Service, Bureau of Land Management, and National Park Service. Portland, OR.

Thomas, R. and W. Megahan. 1988. Peak flow responses to clear-cutting and roads in small and large basins, western Cascades, Oregon: A second opinion. Water Resources Research Vol. 34, No. 12, [3393-3403].

Thomas, J., J. Franklin, J. Gordon and N. Johnson. 2006. The Northwest Forest Plan: Origins, Components, Implementation Experience, and Suggestions for Change. Conservation Biology, Vol. 20, No 2, pp. 277-287.

Thorpe, A.S. and T.N. Kaye. 2006. Experimental habitat manipulation of wayside aster (Aster vialis). Institute for Applied Ecology, Corvallis, Oregon and USDI Bureau of Land Management, Eugene District.

Titus, Jonathan H.; Scott Moore, Mildred Arnot and Priscilla J. Titus. 1998. Inventory of the vascular flora of the blast zone, Mount St. Helens, WA. Madrono. 45(2): 146-161.

Torrent Energy Corporation. 2005. Coos Bay Basin Project: Webpage: http://www.torrentenergy.com/s/CoosBayBasin.asp

Toth, S. 1991. A road damage inventory for the upper Deschutes River basin. Timber-Fish-Wildlife Report. TFW-SH14-91-007.

Tschaplinski, P.J. and G.F. Hartman. 1983. "Winter distribution of juvenile coho salmon (Oncorhynchus kisutch) before and after logging in Carnation Creek, British Columbia, and some implications for overwinter survival." Canadian Journal of Fisheries and Aquatic Sciences 40:452-461.

Turner, Monica G., William H. Romme, Robert H. Gardner and William W. Hargrove. 1997. Effects of fire size and pattern on early succession in Yellowstone National Park. Ecological Monographs 67(4): 411-433.

Turner, Nancy J. 1999. "Time to burn": Traditional use of fire to enhance resource production by aboriginal peoples in British Columbia. *In*: Indians, fire and the land in the Pacific Northwest. pp. 185-218. Boyd, Robert, editor. Oregon State University Press. Corvallis, OR.

Tweten, R.G. 1992. Narratives of final critical habitat units for the northern spotted owl in Oregon. Administrative Record. U.S. Department of the Interior, U.S. Fish and Wildlife Service. Portland, OR.

U.S. Army Corps of Engineers. 1956. Snow hydrology-summary report of the snow investigations. 473 pp. North Pacific Division. Portland, OR.

U. S. Army Corps of Engineers. 1998. Runoff from snowmelt. Engineering Manual EM 1110-2-1406. online: [http://www.usace.army.mil/publications/eng-manuals/em1110-2-1406/c-5.pdf]

U.S. Census Bureau. 2000 -2006. DP 1 Profiles of General Demographic Characteristics and DP 3 Profile of selected economic characteristics.

U.S. Global Change Research Program, National Assessment Synthesis Team. 2001. US National Assessment of the Potential Consequences of Climate Variability and Change Educational Resources. Regional Paper: Pacific Northwest. U.S. Climate Change Science Program/U.S. Global Change Research Program. Washington D.C. Available online at: http://www.usgcrp.gov/usgcrp/nacc/education/pnw/default.htm

U.S. Department of Agriculture (USDA). Soil Conservation Service. 1971. Guide to range condition class and/or forage quality for the Siskiyou and Klamath Land Resource Areas. Jackson County, OR.

USDA, Pacific Northwest Research Station, U.S. Forest Service and Oregon Department of Forestry. 2002. Land Conservation and Development, and Agriculture: Forests, Farms and People - Land Use Change on non-Federal Land in Western Oregon, 1973-2000.

USDA, U.S. Forest Service. 1988. Final supplement to the environmental impact statement for an amendment to the Pacific Northwest Regional Guide. Pacific Northwest Region. Portland, OR.

USDA, U.S. Forest Service. 2005a. Pacific Northwest Region Invasive Plant Program: Preventing and Managing Invasive Plants. Final Environmental Impact Statement. Volume 1.

USDA, U.S. Forest Service. 28 July 2005b. Letter from L.E. Friedman, Director, Resource Planning and Monitoring to Forest Supervisor, Colville National Forest and Forest Supervisor, Okanogan and Wenatchee National Forests.

USDA, U.S. Forest Service. 2006a. Northwest Forest Plan: The First Ten Years. Socioeconomic Monitoring Results. General Technical Report PNW-GTR-649, Vol. III, pp. 37 – 76. Pacific Northwest Research Station.

USDA, U.S. Forest Service. 2006b. Modeling genetic gain in established Douglas-fir plantations. Research proposal; submitted by Randy Johnson, PNW Research Station, Corvallis, OR; Peter Gould, PNW Research Station, Olympia, WA; and David Marshall, Weyerhaeuser Company. http://www.fs.fed.us/pnw/about/programs/rmp/Agenda2020-collaboration.shtml

USDA, U.S. Forest Service. 2006c. Considering Communities in Forest Management Planning in Western Oregon. Donoghue E., N. Sutton and R. Haynes. General Technical report PNW-GTR-693. Pacific Northwest research Station.

USDA, U.S. Forest Service and U.S. Department of the Interior (USDI), Bureau of Land Management (BLM). 1993a. Pacific Yew, Final Environmental Impact Statement, Record of Decision.

USDA, U. S. Forest Service; Umpqua, Willamette, and Rogue-Siskiyou National Forests; and USDI BLM; Medford and Eugene Districts. 1993b. Conservation Strategy *Frasera umpquaensis* (Green Gentian or Umpqua swertis).

USDA, U.S. Forest Service; Mt. Hood and Willamette National Forests; and USDI, BLM; Salem District. 1994a. Conservation Strategy for *Aster gormanii*.

USDA, U.S. Forest Service and USDI, BLM. February 1994b. *Final Supplemental Environmental Impact Statement on Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl.* Washington, D.C.

USDA, U.S. Forest Service; Umpqua National Forest; and USDI, BLM; Roseburg and Medford Districts; and USDI, USFWS. 1995. Conservation Agreement for *Calochortus umpquaensis* (Umpqua Mariposa Lily).

USDA, U.S. Forest Service; Winema, Shasta-Trinity, Modoc and Lassen National forests; USDI, BLM; Lakeview, Burns and Spokane Districts; USDI, USFWS; Klamath Basin National Wildlife Refuge; and California Department of Fish and Game. 1996a. Conservation Strategy for *Rorippa columbiae* (Columbia cress).

USDA, U.S. Forest Service; Umpqua, Mt Hood, Willamette and Rogue River-Siskiyou National Forests; and USDI, BLM, Roseburg, Eugene, Salem and Medford Districts; and U.S. Army Corps of Engineers, Willamette Valley Project. 1996b. Conservation Strategy *Cimicifuga elata* (Tall bugbane).

USDA, U.S. Forest Service and USDI, Bureau of Land Management. 1997. Survey and Manage Draft Management Recommendations – Bryophytes. Installment 1. IM OR1997-027 Transmittal IM. Unpublished report. On file with: Regional Ecosystem Office, P.O. Box 3623, Portland, OR. 97208

USDA, U.S Forest Service and USDI, Bureau of Land Management. 1998. Management recommendations for vascular plants. Unpublished report. On file with: Regional Ecosystem Office, P.O. Box 3623, Portland, OR. 97208.

USDA, U.S. Forest Service and USDI, BLM. Interagency Wild and Scenic Rivers Coordinating Council. December 1999. The Wild and Scenic River Study Process.

USDA, U.S. Forest Service and USDI, Bureau of Land Management. 2000a. Management recommendations for lichens, Version 2.0. IM OR2000-042, Transmittal IM. Unpublished report. On file with: Regional Ecosystem Office, P.O. Box 3623, Portland, OR. 97208

USDA, U.S. Forest Service and USDI, Bureau of Land Management. 2000b. Management recommendations for lichens, Version 2.0. IM OR2000-042, Transmittal IM. Unpublished report. On file with: Regional Ecosystem Office, P.O. Box 3623, Portland, Oregon 97208.

USDA, U.S. Forest Service and USDI, BLM. 2002. Results of landscape level protocol survey of survey zones 1 and 2 for marbled murrelet. A memo from T. Riley, USFS, and R. Wenker, BLM, to K. McMaster, USFWS. March 4, 2002.

USDA, U.S. Forest Service and USDI, BLM. July 2003. *Gerber-Willow Valley Watershed Analysis.* Klamath Falls, OR.

USDA, U.S. Forest Service and USDI, BLM. 2004a. Final Supplemental Environmental Impact Statement to Remove or Modify the Survey and Manage Mitigation Measure Standards and Guidelines in Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl.

USDA, U.S. Forest Service and USDI, BLM. 2004b. Final Supplemental Environmental Impact Statement: Management of Port-Orford-Cedar in Southwest Oregon. Portland, Oregon.

USDA, U.S. Forest Service and USDI, BLM. 2004c. The Healthy Forests Initiative and Healthy Forests Act Interim Field Guide.

USDA, U.S. Forest Service and USDI, BLM. 2004d. Biscuit Fire Recovery Project Final Environmental Impact Statement. Rogue River-Siskiyou National Forest and Medford District, BLM. Medford, OR.

USDA, U.S. Forest Service; Siuslaw National Forest; USDI, BLM; Coos Bay District; USDI, National Park Service; Redwood National Park; and Redwood State Park, CA. 2004. Conservation Strategy for Pink Sand-verbena (*Abronia umbellata* ssp. *breviflora*).

USDA, U.S. Forest Service and USDI, BLM. 2005a. Draft Rapid Assessment Reference Condition Models. Available online at: http://www.reo.gov/ecoshare/news-issues/ram-issues.asp

USDA, U.S. Forest Service and USDI, BLM. 2005b. Northwest Forest Plan Temperature TMDL Implementation Strategies. U.S. Forest Service, R-6 Regional Office and BLM Oregon State Office. Portland, OR.

USDA, U.S. Forest Service, Umpqua National Forest; USDI, BLM, Roseburg District, and U.S. Fish and Wildlife Service. 2006. Programmatic Conservation Agreement for Kincaid's Lupine (*Lupinus sulphureus* spp. *kincaidii*) in Douglas County, OR.

USDA, U. S. Forest Service; Six Rivers and Rogue-Siskiyou National Forests; USDI, BLM; Medford and Coos Bay Districts; and USDI, USFWS; Arcata and Roseburg Field Offices. 2006. Conservation Agreement for *Hastingsia bracteosa, H. atropurpurea, Gentiana setigera, Epilobium oreganum,* and *Viola primulifolia* ssp. *Occidentalis* and serpentine Darlingtonia wetlands and fens from Southwestern Oregon and Northwestern California.

USDA USDI. 2006a. Protecting People and Natural Resources, A Cohesive Fuels Treatment Strategy.

USDA, USDI. 2006b. Surface Operating Standards and Guidelines for Oil and Gas Exploration and Development. BLM/WO.ST-06/021+3071. 84 pp. Denver, CO.

USDA, Natural Resources Conservation Service. August 1995. RCA III Effects of Sediment on the Aquatic Environment: Potential NRCS Actions to Improve Aquatic Habitat Working Paper. No. 6 Janine Castro and Frank Reckendorf. Department of Geosciences, Oregon State University. Corvallis, OR.

U.S. Department of Commerce (USDC), National Oceanic and Atmospheric Administration (NOAA), National Weather Service. 1973. Precipitation-frequency atlas of the western United States, Volume X, Oregon. Atlas 2, 43 plates. Prepared by J.F. Miller, R.H. Frederick and R.J. Tracey. Silver Spring, Md.

USDC, NOAA, National Marine Fisheries Service (NMFS). 1996. *Making Endangered Species Act Determinations of Effect for Individual or Grouped Actions at the Watershed Scale*. August 1996. http://www.nwr.noaa.gov/1habcon/habweb/habguide/matrix_1996.pdf

USDC, NOAA, National Marine Fisheries Service. 18 March 1997. Biological Opinion and Conference Opinion. Implementation of Land and Resource Management Plans and Resource Management Plans. Northwest Region.

USDC, NOAA, Fisheries Office of Protected Resources. Pacific Salmonids: Major Threats and Impacts website: http://www.nmfs.noaa.gov/pr/species/fish/salmon.htm

USDC, Bureau of Economic Analysis. 2006. Regional accounts data. November 2006. www.bea.gov/bea/regional/data.htm.

USDI, BLM. 1960. Statistical Appendix to the Annual Report of the Director, Bureau of Land Management to the Secretary of the Interior for the fiscal year ended June 30, 1960.

USDI, BLM. Manual Handbook H-1741-1 - "*Fencing*."

USDI, BLM. Manual Handbook H-1741-2 - "*Water Developments*."

USDI, BLM. Manual Section 8110.42. "*Management Use Categories*."

USDI, BLM. 1970. Public Land Statistics.

USDI, BLM. April 1979. Wilderness Proposed Initial Inventory. Roadless Areas and Islands Which Clearly Do Not Have Wilderness Characteristics in Oregon and Washington.

USDI, BLM. August 1979. Wilderness Review, Initial Inventory. Final Decision on Public Lands Obviously Lacking Wilderness Characteristics and Announcement of Public Lands to be Intensively Inventoried for Wilderness Characteristics in Oregon and Washington.

USDI, BLM. March 1980. Wilderness Review, Intensive Inventory. Final Decision on 30 Selected Units in Southeast Oregon and Proposed Decisions on other Intensively Inventoried Units in Oregon and Washington.

USDI, BLM. November 1980. Wilderness Inventory. Oregon and Washington. Final Intensive Inventory Decisions.

USDI, BLM. 1986. Timber Productivity Classification - TPCC Handbook 5251-1

USDI, BLM. 1991. Summary of the Analysis of the Management Situation, for the Salem, Eugene & Coos Bay (January, 1991), Roseburg & Medford (February, 1991) District Office Resource Management Plans.

USDI, BLM. 1994a. Salem District Proposed Resource Management Plan/Final Environmental Impact Statement.

USDI, BLM. 1994b. Eugene District Proposed Resource Management Plan/Environmental Impact Statement.

USDI, BLM. 1994c. Roseburg District Proposed Resource Management Plan/Environmental Impact Statement.

USDI, BLM. 1994d. Coos Bay District Proposed Resource Management Plan/Environmental Impact Statement.

USDI, BLM. 1994e. Medford District Proposed Resource Management Plan/Environmental Impact Statement.

USDI, BLM. 1994f. Klamath Falls Resource Area Resource Management Plan/Environmental Impact Statement.

USDI, BLM, Coos Bay District. 1995. Conservation Strategy for *Phacelia argentea*.

USDI, BLM. 1996a. Partners Against Weeds: An Action Plan for the Bureau of Land Management. Washington, D.C.

USDI, BLM. 1996b. Updated 2002. Western Oregon Districts. Transportation Management Plan.

USDI. BLM. 1996c. Topsy/Pokegama Landscape Analysis. Lakeview District, Klamath Falls Resource Area. Klamath Falls, OR.

USDI, BLM. August 12, 1997. Standards for Rangeland Health and Guidelines for Livestock Grazing Management for Public Lands Administered by the Bureau of Land Management in the States of Oregon and Washington.

USDI, BLM. January 16, 2001a. Inventory & Monitoring System: Current Vegetation Survey Field Procedures, Natural Resource Inventory Oregon/Washington. 173pp.

USDI, BLM. Release 6-121. January 19, 2001b. BLM Manual 6840 Regulations - Special Status Species Management.

USDI, BLM. 2001c. North Bank Habitat Management Area/ACEC Record of Decision, Habitat Management Plan and Monitoring Plan. Roseburg District, BLM. Roseburg, OR.

USDI, BLM. 2001d. Reasonably Foreseeable Development Scenario for Oil and Gas Development in the Buffalo Field Office Area, Campbell, Johnson, and Sheridan Counties, Wyoming. 25pp. Wyoming State Office-Reservoir Management Group.

USDI, BLM. 2002. Pokegama Wild Horse Herd Management Area Plan. Lakeview District, Klamath Falls Resource Area. Klamath Falls, OR.

USDI, BLM. March 25, 2003. BLM-Instructional Memorandum No. OR-2003-054. Oregon/ Washington Special Status Species Policy.

USDI, BLM. 2004a. New River Area of Critical Environmental Concern Management Plan. Coos Bay District, BLM. North Bend, OR.

USDI, BLM. 2004b. Timbered Rock Fire Salvage and Elk Creek Watershed Restoration Final Environmental Impact Statement. Medford District, BLM. Medford, OR.

USDI, BLM. 2004c. Implementation of Special Status Species Policies for the Former Survey and Manage Species. BLM-Information Bulletin No. OR-2004-145. 4 pp

USDI, BLM. 2004d. Implementation of Special Status Species Policies for the Former Survey and Manage Species. BLM-Information Bulletin No. OR-2004-145. 4 pp

USDI, BLM. 2004e. Implementation of the 2004 Record of Decision to Remove Survey and Manage Mitigation Measure Standards and Guidelines, BLM-Information Bulletin No. OR-2004-121.

USDI, BLM; Roseburg District and U.S. Fish and Wildlife Service (USFWS); Roseburg Field Office. 2004f. Conservation Agreement for *Calochortus coxii* (Crinite Mariposa Lily).

USDI, BLM; Medford District; USFWS; and The Nature Conservancy of Oregon. 2004g. Draft Conservation Agreement for *Limnanthes floccose* Howell ssp. *pumila* (Dwarf Woolly Meadowfoam).

USDI, BLM. 2005a. Draft Vegetation Treatments Using Herbicides on Bureau of Land Management Lands in 17 Western States Programmatic Environmental Impact Statement. Washington, D.C.

USDI, BLM. 2005b. North Spit Management Plan. Coos Bay District, BLM. North Bend, OR.

USDI, BLM. 2006. County Budget Data for FY2005 - BLM Western Oregon Plan Revision. Portland, OR.

USDI, BLM. 2006a. Unpublished rare plant database: GeoBob. Portland, OR.

USDI, BLM. 2006b. Recreation Management Information System. Data retrieved from http://rmis.blm.gov/

USDI, BLM. 2007. Geographic Information System (GIS) Data Layers. Oregon State Office. Portland, OR.

USDI, USFWS. 1983. Columbian White-Tailed Deer Recovery Plan. Portland, OR.

USDI, USFWS. 1986. Recovery plan for the Pacific bald Eagle. Portland, OR.

USDI, USFWS. 1990. McDonald's Rock-cress, (*Arabis mcdonaldiana* Easwood) Recovery Plan. 40 pp. Portland, OR.

USDI, USFWS. 1992. Draft final recovery plan for the northern spotted owl. Portland, OR.

USDI, USFWS. 1993. *Lomatium bradshawii*, (Bradshaw's lomatium) Recovery Plan. 47 pp. Portland, OR.

USDI, USFWS. 1996. Water Howellia (*Howellia aquatilis*) Recovery Plan. 52 pp. Helena, MT.

USDI, USFWS. 1997. Recovery plan for the threatened marbled murrelet (Brachyramphus marmoratus) in Washington, Oregon and California. Region 1. Portland, OR.

USDI, USFWS. 1998a. Recovery Plan for the Threatened Nelson's Checker-mallow (*Sidalcea nelsoniana*). 61 pp. Portland, OR.

USDI, USFWS. 1998b. Recovery Plan for the Endangered Western Lily (*Lilium occidentale*). 82 pp. Portland, OR.

USDI, USFWS. 1998c. Recovery Plan for the Applegate's Milk-vetch (*Astragalus applegate)*. 41 pp. Portland, OR.

USDI, USFWS. 2000. Recovery Plan for the Golden Paintbrush (*Castilleja levisecta*). 51 pp. Portland, OR.

USDI, USFWS. 2001a. Western Snowy Plover (Charadrius alexandrinus nivosus) Pacific Coast Population Draft Recovery Plan. Region 1. Sacramento, CA.

USDI, USFWS. 2001b. Oregon Silverspot Butterfly (Speyeria zerene hippolyta) Revised Recovery Plan. Region 1. Portland, OR.

USDI, USFWS. 2003a. Recovery Plan for the Rough Popcornflower (*Plagiobothrys hirtus*). 60 pp. Portland, OR.

UDSI, USFWS. 2003b. Recovery plan for *Fritillaria gentneri* (Gentner's fritillary). viii + 89 pp. Portland, OR.

UDSI, USFWS. 2003c. Recovery Outline for *Lomatium cookii* (Cook's Lomatium) and *Limnanthes floccosa* ssp. *grandiflora* (Large-flowered Woolly Meadowfoam). 19 pp. Portland, OR.

USDI, USFWS. 2003d. Website for Lost river and Shortnose suckers. Created by: Oregon Fish and Wildlife Office. http://www.fws.gov/oregonfwo/EndSpp/FactsFish/LRsucker.htm http://www.fws.gov/oregonfwo/EndSpp/FactsFish/Shortnose.htm

USDI, USFWS. 2004a. Northern spotted owl five-year review: summary and evaluation. Portland, OR.

USDI, USFWS. 2004b. Marbled murrelet 5-year review process. Region 1. Portland, OR.

USDI, USFWS. 2005. Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon. Region 1. Portland, OR.

USDI USFWS. 2006a. Recovery Outline for *Lupinus sulphureus* ssp. *kincaidii* (Kincaid's lupine). 23 pp. Portland, OR.

USDI, USFWS. 2006b. Draft Recovery Plan for Listed Species of the Rogue Valley Vernal Pool and Illinois Valley Wet Meadow Ecosystems. Portland, OR.

USDI, USFWS. Roseburg Field Office. 2006. personal communication from Lynn Gemlo, copy of latest state of the species section for the northern spotted owl.

USDI, U.S. Geological Service. USGS web page for suckers: http://wfrc.usgs.gov/research/fish%20populations/STShively2.htm
http://www.fws.gov/pacific/bulltrout/final/pdf/BT_combined_revised100605.pdf

USDI, U.S. Geological Survey. 2007. Mineral Commodity Summaries.

United States Environmental Protection Agency. 2000. The history of drinking water treatment. Office of Water, EPA-816-F-00-006.

United States International Trade Commission. 2006. http://www.usitc.gov/

University of Washington (Salo, E. and T. Cundy, editors). 1997. *In:* Streamside management: forestry and fishery interactions. Institue of Forest Research No. 57-1987, Chapter 2. E. Salo and T. Cundy, editors. College of Forest Resources, University of Washington. Seattle, WA.

Vance, Nan C., Melissa Borsting, David Pilz and Jim Freed. 2001. Special forest products: species information guide for the Pacific Northwest. General Technical Report PNW-GTR-513. 169 pp. Pacific Northwest Research Station, U.S. Department of Agriculture, U.S. Forest Service. Portland, OR. http://www.treesearch.fs.fed.us/pubs/3075

Vander Schaaf, D., M. Schindel, D. Borgias, C. Mayer, D. Tolman, G. Kittel, J. Kagan, T. Keeler-Wolf, L. Serpa, J. Hak and K. Popper. 2004. Klamath Mountains Ecoregional Conservation Assessment. The Nature Conservancey. Portland OR.

Van Sickle, J. and S.V. Gregory. 1990. Modeling inputs of large woody debris from falling trees. Canadian Journal of Forest Research 20: 1593-1601.

Verts, B.J. and L.N. Carraway. 1998. Land Mammals of Oregon. University of California Press. Berkeley, CA.

Vessely, D., W.C. McComb, J.M. Weikel and D. Bigger. 2001. Wildlife and coarse-filter biodiversity assessment. *In*: Umpqua Land Exchange Project Multi-Resource Land Allocation Model Handbook. Umpqua Land Exchange Project. Portland, OR.

Vessely, D.G. and W.C. McComb. 2002. Salamander abundance and amphibian species richness in riparian buffer strips in the Oregon Coast Range. Forest Science 48(2):291-297.

Wagner, E., E. Hansen, S. Leavengood, J. Punches and S. Bowers. 2003. *The Big Log Project.* Wood Science and Engineering. 101 pp. Oregon State University. Corvallis, OR.

Walburger, K., T. DelCurto and M. Vavra. 2005. The effects of herbivory and timber harvest on understory production in northeastern Oregon. Papers presented at Range Field Day. Union, OR.

Walker, G. and P. King. 1969. Geologic map of Oregon: U.S. geological Survey, Map 1-595.

Wallin, D.O., F.J. Swanson and B. Marks. 1994. Landscape pattern response to changes in pattern generation rules: land-use legacies in forestry. Ecological Applications 4:569-580.

Ward, J. W. Jr. 1990. Spotted owl reproduction, diet and prey abundance in northwest California. M.S. Thesis. Humboldt State University. Arcata, CA.

Ward, J. W. Jr., R.J. Gutiérrez and B.R. Noon. 1998. Habitat selection by northern spotted owls: the consequences of prey selection and distribution. The Condor 100:79-92.

Warren, Debra D. 2006. Production, Prices, Employment and Trade in Northwest Forest Industries. Pacific Northwest Research Station, U.S. Department of Agriculture, U.S. Forest Service. Portland, OR.

Washington State Department of Natural Resources. 1997a. Standard methodology for conducting watershed analysis, version 4.0, Appendix C hydrologic change. online: [http://www.dnr.wa.gov/forestpractices/watershedanalysis/manual/]

Washington State Department of Natural Resources. 1997b. Surface Erosion Module vs. 4.0. Online: [http://www.dnr.wa.gov/forestpractices/watershedanalysis/manual/hydrology.pdf]

Washington State Department of Natural Resources. 2005. Definition and Inventory of Old Growth Forests on DNR-Managed State Lands. Olympia, WA.

Watterson, Nicholas A. and J. Jones. 2006. Flood and debris flow interactions with roads promote the invasion of exotic plants along steep mountain streams, western Oregon. Geomorphology 78 (2006) 107-123.

Weaver, W. and D. Hagans. 1996. Aerial reconnaissance evaluation of 1996 storm effects on upland mountainous watersheds of Oregon and southern Washington. Pacific Watershed Associates. Arcata, CA.

WeedMapper Team, Dept. of Rangeland Resources, Oregon State University. Copyright, 2004a. Retrieved July, 2006 from: http://www.weedmapper.org/maps.html

WeedMapper Team, Department of Rangeland Resources, Oregon State University. Copyright, 2004b. Retrieved September 5, 2006 from: http://www.weedmapper.org/eues.html

WeedMapper Team, Dept. of Rangeland Resources, Oregon State University. Copyright, 2004c. Meadow knapweed (*Centaurea pratensis Thuill*., non Salilsb.). Retrieved January 25, 2007: http://www.weedmapper.org/cede5.html

WeedMapper Team, Dept. of Rangeland Resources, Oregon State University. Copyright, 2004d. Spotted knapweed (*Centaurea maculosa* auct. non Lam.). Retrieved January 29, 2007 from: http://www.weedmapper.org/cebi2.html

Weir, R.D. and A.S. Harestad. 2003. Scale-dependent habitat selectivity by fishers in south-central British Columbia. Journal of Wildlife Management 67:73-82.

Weisberg, P.J. and F.J. Swanson. 2003. Regional synchroneity in fire regimes of western Oregon and Washington. Forest Ecology and Management 172:17-28.

Wemple, B.C. 1994. Assessing the role of logging-access roads in two large forested basins in the western cascades of Oregon. M.S. thesis. Oregon State University. Corvallis, OR.

Wemple, B.C., J. Jones and G. Grant. 1996. Channel network extension by logging roads in two basins, western Cascades, Oregon. Journal of the American Water Resources Association 32(6):1195.

Wemple, B.C. 1998. *In*: Jones, J.; F. Swanson, B. Wemple, and K. Snyder. 2000. *Effects of Roads on Hydrology, Geomorphology, and Disturbance Patches in Stream Networks*. Conservation Biology. 14(1):76-85.

Wemple, B.C. and J. Jones. 2003. Runoff production on forest roads in a steep mountain catchment. Water Resources Research 39(8)1220.

Western Wood Products Association. 2006. 2005 Statistical Yearbook of the Western Lumber Industry. Portland, OR.

Whiteaker, personal com. 2007

Whitney, L.W. 2002. Ecological Relationships Between Columbian White-tailed and Black-tailed Deer in Southwest Oregon. M.S. Thesis. Oregon State University. Corvallis, OR.

Wiley, T. 2006. Personal Communications with Tom Wiley, Geologist, State of Oregon Department of Geology and Mineral Industries Southwest Oregon Section Leader.

Willard, E. Earl; Ronald H. Wakimoto and Kevin C. Ryan. 1995. Vegetation recovery in sedge meadow communities within the Red Bench Fire, Glacier National Park. *In*: Fire in wetlands: a management perspective: Proceedings, 19th Tall Timbers fire ecology conference, November 3-6; 1995. pp. 102-110. Cerulean, Susan I.; Engstrom, R. Todd, editors. Tall Timbers Research Station. Tallahassee, FL.

Williamson, Richard L. 1973. Results of shelterwood harvesting of Douglas-fir in the western Cascades. Research Paper PNW-161. Pacific Northwest and Range Experimental Station, U.S. Department of Agriculture, U.S. Forest Service. Portland, OR.

Wimberly, M.C., T.A. Spies, C.J. Long and C. Whitlock. 2000. Simulating historical variability in the amount of old forests in the Oregon Coast Range. Conservation Biology 14(1): 167-180.

Wimberly, M.C. 2002. Spatial simulation of historical landscape patterns in coastal forests of the Pacific Northwest. Canadian Journal of Forest Research 32: 1316–1328.

Wimberly, M.C. and J.L. Ohmann. 2004. A multi-scale assessment of human and environmental constraints on forest land cover change on the Oregon (USA) coast range. Landscape Ecology 19: 631-646.

Wind Energy Resource Atlas of the United States. 2007. Chapter 3: Regional Summaries, the Northwest Region, Oregon and Washington Coast.

Winter, L.E., L.B. Brubaker, J.F. Franklin, E.A. Miller and D.Q. DeWitt. 2002. Initiation of an old-growth Douglas-fir stand in the Pacific Northwest a reconstruction from tree ring records. Canadian Journal of Forest Research 32: 1039-1056.

Wisdom, M.J., N.J. Cimon, B.K. Johnson, E.O. Garton and J.W. Thomas. 2004. Spatial partitioning by mule deer and elk in relation to traffic. *In*: Transaction of the Sixty-ninth North American and Natural Resources Conference held March 16-20, 2004, in Spokane, WA. J. Rahm, editor. Wildlife Management Institute. Washington, D.C.

With, K.A. and T.O. Crist. 1995. Critical thresholds in species' response to landscape structure. Ecology 76(8): 2446-2459.

Witmer, G. and M. Wisdom. 1986. Some important elk-forest habitat relationships for western Oregon and Washington. *In*: Proceedings of the 1986 Western States and Provinces Elk Workshop held March 17-19, 1986 in Coos Bay, Oregon. Eastman, D.L., editor. Oregon Department of Fish and Wildlife. Portland, OR.

Wright, K., K. Sendek, R. Rice and R. Thomas. 1990. Logging effects on streamflow: Storm runoff at Casper Creek in northwestern California. Pacific Southwest Forest and Range Experiment Station, U.S. Department of Agriculture, U.S. Forest Service. Arcata, CA.

Wringler, N.H. and J.D. Hall. 1975. Effects of logging on water temperature and dissolved oxygen in spawning beds. TransAmerican Fisheries Society 104(1):111-121.

Yaeger, J. Scott. 2005. Habitat at Fisher Resting Sites in the Klamath Province of Northern California. Thesis presented to Humboldt University. Arcata, CA.

Young, J.A., D.W. Hedrick and R.F. Keniston. 1967. Forest cover and logging--herbage and browse production in the mixed coniferous forest of northeastern Oregon. Journal of Forestry 65: 807-813.

Zabel, C.J., K.M. McKelvey and J.P. Ward, Jr. 1995. Influence of primary prey on home-range size and habitat-use patterns of northern spotted owls (*Strix occidentalis caurina*). Canadian Journal of Zoology 73:433-439.

Zenner, E. 2000. Do residual trees increase structural complexity in Pacific Northwest coniferous forests? Ecological Applications 10(3): 800–810.

Zenner, E.K. 2005. Development of tree size distributions in Douglas-fir forests under differing disturbance regimes. Ecological Applications 15(2): 701–714.

Zielinski, William J., Neil Duncan, Emma C. Farmer, Richard L. Truex, Anthony P. Clevenger and Reginald Barrett. 1999. *Diet of Fishers (Martes Pennanti) at the Southernmost Extent of their Range*. Journal of Mammalogy 80(3):961-971, 1999.

Zielinski, William J., Richard L. Truex, Gregory A. Schmidt, Frederick V. Schlexer, Kristin N. Schmidt, and Reginald H. Barrett. 2004. Resting Habitat Selection by Fishers in California. Journal of Wildlife Management 68(3):475-492.

Ziemer, R. R. 1981. Storm flow response to road building and partial cutting in small streams of Northern California. Water Resources Research 17(4): 907-917.

Ziemer, R. R. and E.T. Keppeler. 1996. Hydrologic consequences of logging second-growth redwood watersheds. Conference on coast redwood forest ecology and management. Humboldt State University. Arcata, CA.

Ziemer, R. R. 6 May 1998. Proceedings of the conference on coastal watersheds: the Caspar Creek story. 6 May 1998; Ukiah, California. Coastal watersheds: the Casper Creek story. 149 pp. Pacific Southwest Research Station, U.S. Department of Agriculture. U.S. Forest Service. Albany, CA.

Index

Symbols

303(d) listed streams 365

A

Adaptive management 848
Air quality 401
Anadromous fish 335
Areas of concern 294

B

Bald eagle 310, 694
Bald eagle management areas 312
Barred owls 296
Best management practices 57, 761
Biological Assessment 830
Biological Opinion 830
Biomass 31
Bull Run Watershed Management Unit 45

C

Cascade-Siskiyou National Monument 44
Clean Water Act 11, 365
Climate Change 491
Coal bed methane 465
Columbian white-tailed deer 329, 683
Communication sites 43, 446
Conservation needs of the northern spotted owl 292
Cooperating agency 823
Coquille Forest 84
Coquille Tribe 20, 825
Cumulative effects 484

D

Debris-Flow Prone Intermittent Streams 79
Deer management areas 331, 684
Direct and indirect effects 484

E

Early-successional forests 199
Effective shade 368, 750
Elk 329, 689
Elk management areas 333, 689
Endangered Species Act 3, 261, 282, 336, 479, 593, 719, 829
Environmental Justice 554

F

Federal Land Policy and Management Act 10, 13, 4, 417
FEMAT 192, 211
Fire regime 392
Fire resiliency 394, 766
Fire severity 392, 765

Fisher 323, 698
Fish productivity 351, 733
Forest fragmentation 208

G

General landscape area 90
Geothermal energy 465

H

Habitat groups 266, 321, 595, 712
Hardwood stands 207, 510
Harvest land base 476
High intrinsic potential 338, 734
Historic fuel conditions 393

I

Indian tribes 20, 444, 814, 825
Instream restoration 355, 740
Invasive plants 48, 268, 611

J

Jordan Cove Energy Liquid Natural Gas Terminal and Pacific Connector Gas Pipeline 447, 466, 485

L

Land tenure zones 41, 445
Large wood model 348
Late-successional forests 192
Listed fish species 336

M

Marbled murrelet 68, 76, 94, 297, 674
Mature forests 200
Mitigation 492, 610, 632, 689, 694, 743, 758, 772, 788, 697
Monitoring 845
Mt. Hood Corridor 45
Mule deer 329

N

National Energy Policy 466
National Environmental Policy Act 19, 483, 492
National Landscape Conservation System 43, 422, 793
Natural disturbance 201, 211, 259, 283, 370, 392, 487, 510, 634, 512
Nonharvest land base 476
Northwest Forest Plan 10-year monitoring 283, 476

O

O&C Act 3, 9, 12, 15, 226
O&C lands 183, 226, 446
OPTIONS model 480
Oregon listed species 262
Oregon Smoke Management Plan 30, 773
Organon growth and yield model 481
Owl activity centers 93

P

Pacific Crest National Scenic Trail 44
Peak flow 358, 383, 743, 745
Port-Orford cedar root rot 214

R

Rangeland health 34, 430, 800
Reasonably Foreseeable Mineral Development 31, 479
Reference analyses 483
Research natural area 436
Right-of-ways 40

S

Sage Grouse 309, 709
Salvage 69, 81, 371, 489
Secure Rural School and Community Self Determination Act 219, 228, 229, 537
Sediment delivery 356, 372, 741, 758
Settlement agreement 22
Soil compaction 425, 388, 794
Source water watersheds 389, 764
Special status species 47, 257, 316, 335, 712, 598
Stream temperature 366, 357, 743, 745
Structural stage classifications 198
Sudden Oak Death 291, 491
Survey and Manage 265, 322, 485, 596, 716
Swiss needle cast 212

T

Temperature standards for fish species 357
Temporary use permits 42, 447
Timber Production Capability Classification (TPCC) 63, 378, 762, 797, 729
Traditional use sites 30, 439, 811, 814
Travel management plans 50, 777

U

Utility corridors 42

V

Visual resource management 52, 420, 789

W

Water quality 57, 359, 365, 745
Western Snowy Plover 313, 708
West Nile virus 297
Westwide Energy Corridor Project 485
Wildland urban interface 396, 765
Wind energy 465

Y

Yaquina Head Outstanding Natural Area 45

United States Department of the Interior
Bureau of Land Management
Oregon State Office
333 S.W. 1st Avenue
Portland, Oregon 97204

OFFICIAL BUSINESS
PENALTY FOR PRIVATE USE, $300

PRIORITY MAIL
POSTAGE AND FEES PAID
Bureau of Land Management
Permit No. G-76

BLM/OR/WA/PL-07/046+1792

Draft Environmental Impact Statement

for the Revision of the Resource Management Plans of the Western Oregon Bureau of Land Management Districts

of Salem, Eugene, Roseburg, Coos Bay, and Medford Districts, and the Klamath Falls Resource Area of the Lakeview District

Volume III

BLM

Salem, Eugene, Roseburg, Coos Bay, Medford, and Klamath Falls Offices

August 2007

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interest of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

Appendix A. Legal Authorities

This appendix provides the background on the legal authorities and major court rulings that are related to this draft environmental impact statement.

In this appendix:

Settlement Agreement **929**

Major Court Rulings **930**

Major Legal Authorities **933**

Settlement Agreement

In 1997, timber industry groups, county governments, and others filed a lawsuit (*AFRC v. Clarke*, Civil No. 94-1031-TPJ (D.D.C.)) in the United States District Court for the District of Columbia (D.C. District Court). This lawsuit alleged that the O&C Act had not been appropriately considered in applying the Northwest Forest Plan's management direction to the O&C lands. The allegation was that the Northwest Forest Plan's system of large reserves and its standards and guidelines, which restrict timber harvesting for the purpose of achieving conservation principles, differs from the ruling of the United States Court of Appeals for the Ninth Circuit (Ninth Circuit Court) regarding the statutory direction for managing the O&C lands. The ruling from the Ninth Circuit Court (*Headwaters, Inc. v. BLM*, 914 F.2d 1174, 1183 (9th Cir., 1990)) stated that "exempting certain timber resources from harvesting to serve as wildlife habitat … is inconsistent with the principles of sustained yield". The *AFRC v. Clarke* lawsuit also alleged that the specific contribution of the BLM lands to the overall conservation strategy of the Northwest Forest Plan was not sufficiently analyzed in the Northwest Forest Plan's supplemental environmental impact statement to determine whether the extensive reservation of the O&C lands from timber harvesting in the Northwest Forest Plan was required in order to comply with the Endangered Species Act.

To resolve the lawsuit, the Secretary of Interior, the American Forest Resource Council, and the Association of O&C Counties entered into a settlement agreement that was approved by the United States District Court for the District of Columbia (D.C. District Court) on August 28, 2003. At the time of the settlement, the case was pending review in the United States Court of Appeals for the District of Columbia Circuit (D.C. Circuit Court) for the D.C. District Court's dismissal of the case as *res judicata*. Under the settlement agreement, the BLM agreed to revise its resource management plans in western Oregon and in that revision the BLM would consider an alternative that would not create any reserves on the O&C lands, except those reserves required to avoid jeopardy to species listed as threatened or endangered under the Endangered Species Act. The BLM also agreed that all resource management plan revisions shall be consistent with the O&C Act as interpreted by the Ninth Circuit Court.

Res judicata

A rule of civil law that says an issue cannot be relitigated after a final judgment has been rendered.

Major Court Rulings

The following are descriptions of the court rulings that are the most relevant to the decisions that must be made in revising the resource management plans for the BLM lands in western Oregon.

Headwaters, Inc. v. BLM, 914 F.2d 1174 (9th Cir. 1990)

In a 1990 lawsuit by Headwaters, Inc., the plaintiffs argued that the O&C Act requires the BLM to manage the O&C lands for multiple uses, including wildlife conservation, rather than for the dominant use of timber production. There were several issues in this case, including compliance with the National Environmental Policy Act. The issue most relevant to this revision of the resource management plans, however, is the interpretation of the O&C Act's reference to forest production.

In ruling on this case, the United States Court of Appeals for the Ninth Circuit (Ninth Circuit Court) stated that "the primary purpose of the O&C Act lands is for timber production in conformity with the provision of sustained yield." Even more explicitly, the Ninth Circuit Court held that "exempting certain timber resources from harvesting to serve as wildlife habitat is inconsistent with the principle of sustained yield." The court also stated that "[i]t is entirely consistent with these goals to conclude that the O&C Act envisions timber production as a dominant use." The court further stated that "[t]he purposes of the O&C Act were twofold. First, the O&C Act was intended to provide the counties … with [a] stream of revenue … Second, the O&C Act was intended to halt previous practices of clear-cutting without reforestation" (*Headwaters, Inc. v. BLM*, 914 F.2d 1174 (9th Cir. 1990)). Citing the legislative history of the O&C Act, the Ninth Circuit Court explained that "[t]his type of [sustained-yield] management will make for a more permanent type of community, contribute to the local dependent industries, protect watersheds, and aid in regulating streamflow." In other words, protecting watersheds, regulating stream flow, and contributing to the economic stability of local communities and industries were expected outcomes of managing these lands under the principles of sustained-yield management. The Ninth Circuit Court found nothing in the legislative history to "suggest that wildlife habitat conservation or conservation of old growth forest is a goal on a par with timber production, or indeed that it is a goal of the O&C Act at all" *Headwaters, Inc. v. BLM,* 914 F.2d 1183-84 (9th Cir. 1990).

This opinion was not the first to rule on the management of the BLM lands under the O&C Act, however, it is the most explicit. It followed previous rulings of the Ninth Circuit Court on the purposes of the O&C Act, specifically: *O'Neal v. United States*, 814 F.2d 1285, 1287 (9th Cir. 1987); and *Skoko v. Andrus*, 638 F.2d 1154, 1156 (9th Cir.), *cert. denied*, 444 U.S. 927, 62 L. Ed. 2d 183, 100 S. Ct. 266 (1979).

Portland Audubon Society v. Babbitt, 998 F.2d 705 (9th Cir. 1993)

In this case, environmental groups challenged a decision made by the BLM to not supplement timber management plans with new information concerning the plan's effect on the northern spotted owl and asked the court to issue an injunction against logging operations in BLM forests that contained northern spotted owl habitat until a supplemental environmental impact statement was prepared. The BLM argued that the holding of the Ninth Circuit Court in *Headwaters, Inc. v. BLM*, 914 F.2d 1174, 1178-80 (9th Cir. 1990), *reh'g denied*, 940 F.2d 435 (1991), supports the conclusion that the BLM's decision not to supplement the environmental impact statements was reasonable, that the O&C Act requires the BLM to sell 500 million board feet of timber per year, and that relief provided by the court must not conflict with this congressional direction. The court, however, found that the National Environmental Policy Act (passed after the O&C Act) does apply to all government actions having significant environmental impact, even though the actions may be authorized by other legislation. The court also found that the O&C Act did not establish a minimum volume that must be offered every year notwithstanding any other law. Therefore, compliance with the National Environmental Policy Act, or enjoining timber harvests until the BLM complies with the National Environmental Policy Act, is not inconsistent with either the volume requirements of the O&C Act or the management of the lands entrusted to its care.

Seattle Audubon Society v. Lyons, 871 F. Supp. 1291, 1314 (W.D. Wash., 1994)

This case was a challenge to the Northwest Forest Plan and was filed soon after the filing of *AFRC v. Clarke*.[1] In the challenge of the Northwest Forest Plan in the United States District Court for the Western District of Washington (Western Washington District Court), the court found that the management decision made about the O&C lands was a lawful exercise of the discretion of the Secretary of the Interior under the O&C Act because of the broad mandate to manage federal lands to conserve habitat for species listed for protection under the Endangered Species Act. The Western Washington District Court, however, did not identify the Northwest Forest Plan as the *only* decision that would meet the requirements of the Endangered Species Act (*Seattle Audubon Society v. Lyons*, 871 F. Supp. 1291, 1313-1314 (W.D. Wash., 1994)).

[1] *AFRC v. Clarke*, Civil No. 94-1031-TPJ (D.D.C.)

Gifford Pinchot Task Force v. U.S. Fish and Wildlife Service, 378 F.3d 1059 (9th Cir. 2004)

In this case, the Ninth Circuit Court[2] rejected the regulatory definition of "destruction or adverse modification of critical habitat" and directed consulting agencies to consider the effects of an action on the critical habitat network without reference to other conservation programs, such as the late-successional reserves in the Northwest Forest Plan. The court stated that critical habitat must provide for both the survival and the recovery of a listed species and that the analysis of whether there is adverse modification always requires consideration of the impacts on the recovery of a species. This case highlighted the issue that resulted from the difference in the Northwest Forest Plan's late-successional reserves and the designated critical habitat for the northern spotted owl.

[2] United States Court of Appeals for the Ninth Circuit (Ninth Circuit Court)

Major Legal Authorities

The following is a list of the major legal authorities that are relevant to the BLM land use planning process. It is not an inclusive list.

- The Oregon and California Railroad and Coos Bay Wagon Road Grant Lands Act (O&C Act) (43 U.S.C. §1181a, *et seq.*) provides the legal authority for the management of O&C lands by the Secretary of the Interior. The O&C Act requires that the O&C lands be managed "for permanent forest production, and the timber thereon shall be sold, cut, and removed in conformity with the principal of sustained yield for the purpose of providing a permanent source of timber supply, protecting watersheds, regulating stream flow, and contributing to the economic stability of local communities and industries, and providing recreational facilities" (43 U.S.C. §1181a)
- The Federal Land Policy and Management Act of 1976 (FLPMA), as amended, 43 U.S.C. 1701 *et seq*., provides the authority for the BLM land use planning.
  - Sec. 102 (a) (7) and (8) sets forth the policy of the United States concerning the management of the public lands.
  - Sec. 201 requires the Secretary of the Interior to prepare and maintain an inventory of the public lands and their resource and other values, giving priority to areas of critical environmental concern (ACECs), and, as funding and workforce are available, to determine the boundaries of the public lands, provide signs and maps to the public, and provide inventory data to State and local governments.
  - Sec. 202 (a) requires the Secretary, with public involvement, to develop, maintain, and when appropriate, revise land use plans that provide by tracts or areas for the use of the public lands.
  - Sec. 202(c)(1-9) requires that, in developing land use plans, the BLM shall use and observe the principles of multiple use and sustained yield; use a systematic interdisciplinary approach; give priority to the designation and protection of areas of critical environmental concern; rely, to the extent it is available, on the inventory of the public lands; consider present and potential uses of the public lands; consider the relative scarcity of the values involved and the availability of alternative means and sites for realizing those values; weigh long-term benefits to the public against short term benefits; provide for compliance with applicable pollution control laws, including State and Federal air, water, noise, or other pollution standards or implementation plans; and consider the policies of approved State and tribal land resource management programs, developing land use plans that are consistent with State and local plans to the maximum extent possible consistent with Federal law and the purposes of this Act.

  - Sec. 202 (d) provides that all public lands, regardless of classification, are subject to inclusion in land use plans, and that the Secretary may modify or terminate classifications consistent with land use plans.
  - Sec. 202 (f) and Sec. 309 (e) provide that Federal, State, and local governments and the public be given adequate notice and an opportunity to comment on the formulation of standards and criteria for, and to participate in, the preparation and execution of plans and programs for the management of the public lands.
  - Sec. 302 (a) requires the Secretary to manage BLM lands under the principles of multiple use and sustained yield, in accordance with available land use plans developed under Sec. 202 of FLPMA. There is one exception: where a tract of the BLM lands has been dedicated to specific uses according to other provisions of law, it shall be managed in accordance with such laws.
  - Sec. 302 (b) recognizes the entry and development rights of mining claimants, while directing the Secretary to prevent unnecessary or undue degradation of the public lands.

- The National Environmental Policy Act of 1969 (NEPA), as amended, 42 U.S.C. 4321 *et seq.*, requires the consideration and public availability of information regarding the environmental impacts of major Federal actions significantly affecting the quality of the human environment. This includes the consideration of alternatives and mitigation of impacts.
- The Clean Air Act of 1990, as amended, 42 U.S.C. 7418, requires Federal agencies to comply with all Federal, State and local requirements regarding the control and abatement of air pollution. This includes abiding by the requirements of State Implementation Plans.
- The Clean Water Act of 1987, as amended, 33 U.S.C. 1251, establishes objectives to restore and maintain the chemical, physical, and biological integrity of the Nation's water.
- The Federal Water Pollution Control Act, 33 U.S.C. 1323, requires Federal land managers to comply with all Federal, State, and local requirements, administrative authorities, process, and sanctions regarding the control and abatement of water pollution in the same manner and to the same extent as any nongovernmental entity.
- The Safe Drinking Water Act, 42 U.S.C. 201, is designed to make the Nation's waters "drinkable" as well as "swimmable." Amendments in 1996 establish a direct connection between safe drinking water and watershed protection and management.
- The Endangered Species Act (ESA) of 1973, as amended, 16 U.S.C. 1531 *et seq.*:
  - Provides a means whereby the ecosystems upon which endangered and threatened species depend may be conserved and provides a program for the conservation of such endangered and threatened species (Sec. 1531 (b), Purposes).
  - Requires all Federal agencies to seek to conserve endangered and threatened species and utilize applicable authorities in furtherance of the purposes of the Endangered Species Act (Sec. 1531 (c) (1), Policy).

  - Requires all Federal agencies to avoid jeopardizing the continued existence of any species that is listed or proposed for listing as threatened or endangered or destroying or adversely modifying its designated or proposed critical habitat (Sec. 1536 (a), Interagency Cooperation).
  - Requires all Federal agencies to consult (or confer) in accordance with Sec. 7 of the ESA with the Secretary of the Interior, through the Fish and Wildlife Service and/or the National Marine Fisheries Service, to ensure that any Federal action (including land use plans) or activity is not likely to jeopardize the continued existence of any species listed or proposed to be listed under the provisions of the ESA, or result in the destruction or adverse modification of designated or proposed critical habitat (Sec. 1536 (a), Interagency Cooperation, and 50 CFR 402).

- The Wild and Scenic Rivers Act, as amended, 16 U.S.C. 1271 *et seq.*, requires Federal land management agencies to identify potential river systems and then study them for potential designation as wild, scenic, or recreational rivers.
- The Wilderness Act, as amended, 16 U.S.C. 1131 *et seq.*, authorizes the President to make recommendations to the Congress for Federal lands to be set aside for preservation as wilderness.
- The Antiquities Act of 1906, 16 U.S.C. 431-433, protects cultural resources on Federal lands and authorizes the President to designate National Monuments on Federal lands.
- The National Historic Preservation Act (NHPA), as amended, 16 U.S.C. 470, expands protection of historic and archaeological properties to include those of national, State, and local significance and directs Federal agencies to consider the effects of proposed actions on properties eligible for or included in the National Register of Historic Places. It also directs the pro-active management of historic resources.
- The American Indian Religious Freedom Act of 1978, 42 U.S.C. 1996, establishes a national policy to protect and preserve the right of American Indians to exercise traditional Indian religious beliefs or practices.
- The Recreation and Public Purposes Act of 1926, as amended, 43 U.S.C. 869 *et seq.*, authorizes the Secretary of the Interior to lease or convey BLM lands for recreational and public purposes under specified conditions.
- The Federal Coal Leasing Amendments Act of 1976, 30 U.S.C. 201 (a) (3) (A) (i), requires that coal leases be issued in conformance with a comprehensive land use plan.
- The Surface Mining Control and Reclamation Act of 1977, 30 U.S.C. 1201 *et seq.*, requires application of unsuitability criteria prior to coal leasing and also to proposed mining operations for minerals or mineral materials other than coal.
- The Mineral Leasing Act of 1920, as amended, 30 U.S.C. 181 *et seq.,* authorizes the development and conservation of oil and gas resources.
- The Onshore Oil and Gas Leasing Reform Act of 1987, 30 U.S.C. 181 *et seq.*, provides that a study be conducted by the National Academy of Sciences and the Comptroller General that results in recommendations for improvements which may be necessary to

ensure the following are adequately addressed in Federal land use plans:

  - Potential oil and gas resources are identified;
  - The social, economic, and environmental consequences of exploration for and development of oil and gas resources are determined; and
  - Any stipulations to be applied to oil and gas leases are clearly identified.

- The General Mining Law of 1872, as amended, 30 U.S.C. 21 *et seq.*, allows the location, use, and patenting of mining claims on sites on public domain lands of the United States.
- The Mining and Mineral Policy Act of 1970, 30 U.S.C. 21a, establishes a policy of fostering the orderly development of economically stable mining and minerals industries and studying methods for reclamation and the disposal of waste.
- The Taylor Grazing Act of 1934, 43 U.S.C. 315, authorizes the Secretary of the Interior "to establish grazing districts, or additions thereto and/or to modify the boundaries thereof of vacant, inappropriate and unreserved lands from any part of the public domain . . . which in his opinion are chiefly valuable for grazing and raising forage crops[.] . . ." The Act also provides for the classification of lands for particular uses.
- Executive Orders 11644 (1972) and 11989 (1997) establish policies and procedures to ensure that off-road vehicle use shall be controlled so as to protect public lands.
- Executive Order 12898 (Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations), 49 *Fed. Reg.* 7629 (1994), requires that each Federal agency consider the impacts of its programs on minority and low-income populations.
- Executive Order 13007 (Indian Sacred Sites), 61 *Fed. Reg.* 26771 (1996), requires Federal agencies to the extent practicable, permitted by law, and not clearly inconsistent with essential agency functions to:
  - Accommodate access to and ceremonial use of Indian sacred sites by Indian religious practitioners; and
  - Avoid adversely affecting the physical integrity of such sacred sites.
- Executive Order 13084 (Consultation and Coordination with Indian Tribal Governments) provides, in part, that each Federal agency shall establish regular and meaningful consultation and collaboration with Indian tribal governments in developing regulatory practices on Federal matters that significantly or uniquely affect their communities.
- Executive Order 13112 (Invasive Species) provides that no Federal agency shall authorize, fund, or carry out actions that it believes are likely to cause or promote the introduction or spread of invasive species unless, pursuant to guidelines that it has prescribed, the agency has determined and made public its determination that the benefits of such actions clearly outweigh the potential harm caused by invasive species; and that all feasible and prudent measures to minimize risk or harm will be taken in conjunction with the actions.

- Secretarial Order 3175 (incorporated into the Departmental Manual at 512 DM 2) requires that if Department of the Interior (DOI) agency actions might impact Indian trust resources, the agency must explicitly address those potential impacts in planning and decision documents, as well as consult with the tribal government whose trust resources are potentially affected by the Federal action.
- Secretarial Order 3206 (American Indian Tribal Rights, Federal-Tribal Trust Responsibilities, and the Endangered Species Act) requires DOI agencies to consult with Indian tribes when agency actions to protect a listed species, as a result of compliance with ESA, affect or may affect Indian lands, tribal trust resources, or the exercise of American Indian tribal rights.
- Secretarial Order 3215 (Principles for the Discharge of the Secretary's Trust Responsibility) guides DOI officials by defining the relatively limited nature and extent of Indian trust assets, and by setting out the principles that govern the Trustee's fulfillment of the trust responsibility with respect to Indian trust assets.

Appendix B. Ecology

This appendix provides background on the analysis of forest ecological conditions.

In this appendix:

Structural Stage Classification.....941
Interagency Vegetation Mapping Project Data.....946
Average Historical Conditions and the Historic Range of Variability 947
FRAGSTATS.....949

Structural Stage Classification

Conifer forests within the planning area are classified in this analysis by a four-stage structural classification:

Stand Establishment
Young
Mature
Structurally Complex.

These four structural classes are further sub-divided by additional structural divisions and by tree species composition groupings.

Vegetation Series (by plant series)

- **Western Hemlock and Tanoak**: Western Hemlock, Sitka Spruce, Pacific Silver Fir, Tanoak
- **Douglas-fir**: Douglas-fir, Grand Fir, White Fir, Shasta Red Fir, Mountain Hemlock, Ponderosa Pine
- **Non-forest**: Jeffrey Pine, Oregon White Oak, Juniper, Sagebrush, Grassland, Water

These vegetation series are groupings that have been made for this analysis based on plant series and do not exactly correspond to mapped plant series or plant association groupings. The data on plant series was modeled at a very fine scale and has been coarsened in scale for this analysis. Adjustments have been made to the geographic boundaries of these vegetation series grouping to provide explicit boundaries without interspersion.

Classification

Each class appended with Vegetation Series:

- Western Hemlock and Tanoak
- Douglas-fir

1) Stand Establishment
<200 years old in current Forest Operations Inventory
Average tree height <50 feet

1a.) Without Structural Legacies
<6 trees per acre ≥20 inches diameter breast height

1b.) With Structural Legacies
≥6 trees per acre ≥20 inches diameter breast height

The Stand Establishment stage extends from stand initiation until stands have reached canopy closure and density-dependent tree mortality begins. Average tree height reflects the influence of site productivity on tree growth. At an average tree height of 50 feet, stands have passed the point at which they are typically pre-commercial thinned. The minimum density of structural legacies is set at 6 trees per acre to maintain consistency with the minimum green tree requirements in the No Action alternative.

2) Young

<200 years old in current Forest Operations Inventory
Average tree height ≥50 feet

Western Hemlock and Tanoak
<24 trees per acre ≥20 inches diameter breast height

Douglas-fir
<12 trees per acre ≥20 inches diameter breast height

2a.) Young High Density
relative density ≥ 25

2a1.) Without Structural Legacies
Descended from Stand Establishment without Structural Legacies

2a2.) With Structural Legacies
Descended from Stand Establishment with Structural Legacies

2b.) Young Low Density
relative density < 25

2b1.) Without Structural Legacies
Descended from Stand Establishment without Structural Legacies

2b2.) With Structural Legacies
Descended from Stand Establishment with Structural Legacies

The Young stage is characterized by the predominance of density-dependent tree mortality, and, in high density stands, a small range of tree diameters. Young stands have not yet acquired the density of large diameter trees that characterize Mature stands. Young Low Density stands are those with a tree density sufficiently low to largely eliminate the influence of density-dependent tree mortality.

3) Mature

<200 years old in current Forest Operations Inventory

Western Hemlock and Tanoak
≥24 trees per acre ≥20 inches diameter breast height

Douglas-fir
≥12 trees per acre ≥20 inches diameter breast height

3a.) Single Canopy

Western Hemlock and Tanoak
Coefficient of Variation of tree diameters > 10 inches diameter breast

height (CVgt(10)) < 0.35

Douglas-fir
CVgt(10) < 0.34

3b.) Multiple Canopy

Western Hemlock and Tanoak
CVgt(10) ≥ 0.35
<4.7 trees per acre ≥40 inches diameter breast height

Douglas-fir
CVgt(10) ≥ 0.34
<2.1 trees per acre ≥40 inches diameter breast height

The Mature stage generally begins as tree growth rates stop increasing (after culmination of mean annual increment), as tree mortality shifts from density-dependent mortality to density-independent mortality. The threshold values for the Mature stage are derived from Poage (*unpublished*), which comprises BLM timber cruise data for timber sales in the late 1980s and early 1990s. This data presents a precise and accurate sample of the population of trees in timber sale areas. Because timber harvest during that period was predominately in Mature and Structurally Complex forest, this data set, described in Poage (2000), provides a characterization of Mature and Structurally Complex forest on BLM-administered lands.

The thresholds presented here for Mature forest are intended to establish a threshold that represents the structural conditions of most Mature forests, but not necessarily absolute minimum conditions found in all Mature forests. Therefore, the density of large trees (greater than 20 inches in diameter) was derived from the 66th percentile of sample values from the Poage dataset, separating the data for the Western Hemlock and Tanoak, and Douglas-fir vegetation series.

The threshold for canopy layering was derived from the coefficient of variation in tree diameters, inferring that variation in tree diameters is reflected by variation in tree heights. The threshold here was derived by the mean coefficient of variation of tree heights minus one standard deviation from the Poage dataset.

This analysis initially examined other measures of canopy layering, included a Canopy Height Diversity index (Spies and Cohen 1992), a Diameter Diversity Index (McComb et al. 2002), and a canopy classification technique in Baker and Wilson (2000).

The Canopy Height Diversity index uses data on tree heights directly, but classified most existing stands over 200 years old in this analysis as "single canopy," and therefore would be too restrictive.

The Diameter Diversity Index infers canopy height diversity from weighted values of tree diameters. The weighting values produce results that may be more effective at classifying existing stands than evaluating modeled stands. The Diameter Diversity Index results do not appear to accurately reflect future changes in canopy layering resulting from thinning or partial disturbance and would classify relatively young, even-aged stands as "multiple canopy."

The technique in Baker and Wilson (2000) uses tree height and canopy measurements, but would classify almost all stands in this analysis as "multiple canopy."

Coefficient of variation in tree diameters provides greater discrimination among the stands in this analysis than the other measures and appears to be sensitive to future changes in stand conditions. Coefficient of variation in tree diameters could provide misleading results in strongly bi-modal stands (i.e., very large trees and very small trees), which would be a concern if this analysis were attempting to provide continuous values of canopy layering. But this analysis is only attempting to classify stands as either single canopy layered or multiple canopies.

4) Structurally Complex

4a.) Existing Structurally Complex

4a1.) Existing Old Forest

200-399 years old in current Forest Operations Inventory

4a2.) Existing Very Old Forest

≥400 years old in current Forest Operations Inventory

4b.) Developed Structurally Complex

<200 years old in current Forest Operations Inventory

Western Hemlock and Tanoak

CVgt(10) ≥0.35

≥24 trees per acre ≥20 inches diameter breast height

≥4.7 trees per acre ≥40 inches diameter breast height

Douglas-fir

CVgt(10) ≥0.34

≥12 trees per acre ≥20 inches diameter breast height

≥2.1 trees per acre ≥40 inches diameter breast height

This analysis assumes that stands identified as 200 years old or older in the current stand inventory are Structurally Complex forest. In addition, stands that are not 200 years old or older but meet threshold values for Developed Structurally Complex described above are identified as Structurally Complex forest. Threshold values for Developed Structurally Complex include

density of very large trees (greater than 40 inches in diameter) derived from the 66th percentile of sample values from the Poage dataset, separating data for the Western Hemlock and Tanoak and Douglas-fir vegetation series.

Structurally Complex stands approximate "old-growth" stands described in many analyses (see, e.g., District RMP/EISs), "Medium/large Conifer Multi-story" stands described in the FEMAT Report, and "Large, Multi-storied Older Forest" stands described in the LSOG Monitoring Report. In this analysis, "late-successional forest" encompasses both Mature and Structurally Complex stands, similar to how the Northwest Forest Plan FSEIS used "late-successional forest" to encompass mature and old-growth forests (p. Glossary-9). The LSOG Monitoring Report summarized the difficulties in describing and classifying older forest conditions (pp. 9-10).

Table 238. Comparison of different stand classification schemes and the structural stage classification used in this RMP/EIS. A more extensive comparison of classification schemes can be found in Franklin et al. 2002.

Typical stand age[1] (years)	Oliver (1981) stand development stages	Franklin et al. (2002) structural stage	1994 RMP/EIS Seral stage	Structural stages (This RMP/EIS)
0		Disturbance and legacy creation		
20	Stand Initiation	Cohort establishment	Early seral	Stand Establishment
			Mid seral	
30	Stem Exclusion	Canopy Closure		Young
50		Biomass accumulation/ competitive exclusion	Late seral	
80	Understory Reinitiation	Maturation		Mature
150	Old Growth	Vertical diversification	Mature seral	Structurally Complex
300		Horizontal diversification		
800-1200		Pioneer cohort loss	Old-growth	

[1] Stand ages are provided as references. However, stands can achieve structural classes at different stand ages, depending on disturbance and site conditions

Interagency Vegetation Mapping Project Data

Existing vegetation mapping for the planning area was based on the Interagency Vegetation Mapping Project (IVMP), which provides maps of existing vegetation, canopy cover, size, and cover type for the entire range of the Northern Spotted Owl using satellite imagery from Landsat Thematic Mapper (TM). The LSOG Monitoring Report contains detailed descriptions of the IVMP data and evaluations of IVMP map accuracy (Moeur et al. 2005, pp. 18-30, 108-109, 123-128). Those descriptions and evaluations are incorporated here by reference.

The IVMP was initiated in 1998 under joint program management and funding by the Bureau of Land Management-Oregon and the Forest Service-Region 6. The project's goal was to provide consistent spatial data for monitoring older forests within the portions of the Plan area in Washington and Oregon. The IVMP mapped existing vegetation in the nine physiographic provinces in Washington (Eastern and Western Cascades, Olympic Peninsula, and Western Lowlands) and Oregon (Eastern and Western Cascades, Coast Range, Willamette Valley, and Klamath Mountains).

The IVMP modeling approach combined remotely sensed satellite imagery (25-m Landsat TM), digital elevation models, interpreted aerial photos, and inventory information collected on the ground to classify existing vegetation. Landsat scenes used in the IVMP project ranged from fall 1992 through summer 1996. Of the 17 scenes, 2 were acquired in 1992, 1 each in 1994 and 1995, and 13 in 1996. A regression modeling approach was used to predict vegetation characteristics from this Landsat data.

Inventory plot data were used as reference information for IVMP model building and accuracy assessment. Almost 10,000 plots were used for model building and testing, and another 2,800 plots were held out for an independent accuracy assessment. These data came primarily from Current Vegetation Survey (CVS) plots maintained by Forest Service-Region 6 and Bureau of Land Management-Oregon on Forest Service and Bureau of Land Management lands in Washington and Oregon, and from Forest Inventory and Analysis (FIA) plots administered by Pacific Northwest Research Station on nonfederal lands.

All IVMP map data and supporting documentation are available online at

http://www.or.blm.gov/gis/projects/ivmp.asp

Average Historical Conditions and the Historic Range of Variability

The description of the Affected Environment and the analysis of effects include a comparison of current and future conditions to the Historic Range of Variability. Characterization of historic landscape conditions can provide a reference point for comparison in the analysis of effects of different land management strategies. Historic landscape conditions were dynamic, which requires characterization of landscape conditions as a range, rather than a discrete point.

There are several challenges in describing the Historic Range of Variability:

1. Selecting metrics

Historic Range of Variability is often described by abundance of habitat types and frequency of disturbance, such as mean fire return interval. Some descriptions have included spatial pattern of habitats, such as patch size. Because the Historic Range of Variability is a range, it is not easily quantified, and at many spatial scales, the range is very broad (see, e.g., Wimberly et al. 2000). Simply describing an upper and lower bound of historic conditions may overemphasize the rare, extreme events that defined the bounds (Landres et al. 1999). However, more sophisticated descriptions may be difficult to communicate to decision-makers and the public, and may be difficult to compare to the effects of different land management strategies.

2. Selecting the portion of history

Historical conditions varied not only in a range of natural disturbance frequencies, but with patterns of pre-European anthropogenic disturbances and with climate changes. The selection of the portion of history to characterize can strongly influence the resulting "range" that is described (Millar and Woolfenden 1999, Long et al. 1998).

3. Incomplete and unavailable information

Our knowledge of historical landscape conditions is fragmentary at best. Descriptions of Historic Range of Variability have been built from pollen deposits in lake sediments, tree-ring data, fire-scar data, even animal deposits, such as pack-rat middens. These records are incomplete. Reconstructions from such data sources require inference and modeling to derive a description of Historic Range of Variability.

4. Change from historical conditions

> Some biological and physical characteristics have changed irreversibly from historic conditions and may distort any comparison to Historic Range of Variability. Climate conditions have changed and are continuing to change at a rapid rate. Species introductions and species extirpations have altered biological relationships.

These challenges should be considered in interpreting the Historic Range of Variability and caution against using it as an explicit target or management objective.

Several commentors have hypothesized that a landscape that reflects the abundance and arrangement of habitats within the Historic Range of Variability will support the species and processes that were historically present, and that the further the landscape lies outside the Historic Range of Variability, the less likely it will support those species and processes (see, e.g., Landres et al. 1999). These hypotheses remain largely untested, but several studies have characterized the historic range of variability in western Oregon and used it as a reference point to compare the effects of management strategies (Nonaka and Spies 2005, Wimberley 2002, Wimberley et al. 2000, Cissel et al. 1999, Rasmussen and Ripple 1998).

This analysis uses the description of habitat abundances and mean fire return intervals from the draft Rapid Assessment Reference Condition Models (USFS and BLM 2005). These models derived historic abundances by modeling disturbance probabilities generated from mean fire return intervals combined with the probabilities of other disturbances such as wind, insect and pathogens. These models described the average amount of the landscape that would be expected in each of the broad vegetation classes, which are roughly equivalent to the structural classes used in this analysis.

This analysis used the description of spatial patterns of habitat types from Nonaka and Spies (2005), which modeled historic spatial pattern in the Coast Range. Although this research applies to only a portion of the planning area, it presents an available description of historic spatial pattern. The historic spatial pattern in the other provinces in the planning area likely differed from the Coast Range, and therefore the comparative value of this description of Historic Range of Variability is limited and must be used with caution.

FRAGSTATS

FRAGSTATS is a computer software program designed to compute a wide variety of landscape metrics for categorical map patterns. The original software (version 2) was released in the public domain during 1995 in association with the publication of a USDA Forest Service General Technical Report (McGarigal and Marks 1995).

The following discussion is summarized from the FRAGSTATS website (http://www.umass.edu/landeco/research/fragstats/fragstats.html), which describes FRAGSTATS in detail, those descriptions incorporated here by reference.

FRAGSTATS is a spatial pattern analysis program for categorical maps. The landscape subject to analysis is user-defined and can represent any spatial phenomenon. FRAGSTATS simply quantifies the areal extent and spatial configuration of patches within a landscape; it is incumbent upon the user to establish a sound basis for defining and scaling the landscape (including the extent and grain of the landscape) and the scheme upon which patches are classified and delineated. The output from FRAGSTATS is meaningful only if the landscape mosaic is meaningful relative to the phenomenon under consideration.

FRAGSTATS computes 3 groups of metrics. For a given landscape mosaic, it computes several metrics for: (1) each patch in the mosaic; (2) each patch type (class) in the mosaic; and (3) the landscape mosaic as a whole. The FRAGSTATS website contains a detailed description of the metrics.

The FRAGSTATS website includes a discussion on the conceptual background of FRAGSTATS analysis, including advice and caveats about use of the software. Key points from that discussion are summarized here.

A landscape is not necessarily defined by its size; rather, it is defined by an interacting mosaic of patches relevant to the phenomenon under consideration (at any scale). It is incumbent upon the investigator or manager to define landscape in an appropriate manner. The essential first step in any landscape-level research or management endeavor is to define the landscape, and this is of course prerequisite to quantifying landscape patterns.

Classes of Landscape Pattern

Real landscapes, at any scale, contain complex spatial patterns in the distribution of resources that vary over time. Quantifying these patterns and their dynamics is the purview of landscape pattern analysis. Landscape patterns can be quantified in a variety of ways depending on the type of data collected, the manner in which it is collected, and the objectives of the investigation. Broadly considered, landscape pattern analysis involves four basic types of spatial data corresponding to different representations of landscape pattern. These look rather different numerically, but they share a concern with the relative concentration of spatial variability:

(1) Spatial point patterns represent collections of entities where the geographic locations of the entities are of primary interest, rather than any quantitative or qualitative attribute of the entity itself.

(2) Linear network patterns represent collections of linear landscape elements that intersect to form a network.

(3) Surface patterns represent quantitative measurements that vary continuously across the landscape; there are no explicit boundaries (i.e., patches are not delineated). Here, the data can be conceptualized as representing a three-dimensional surface, where the measured value at each geographic location is represented by the height of the surface.

(4) Categorical (or thematic; choropleth) map patterns represent data in which the system property of interest is represented as a mosaic of discrete patches. From an ecological perspective, patches represent relatively discrete areas of relatively homogeneous environmental conditions at a particular scale. The patch boundaries are distinguished from their surroundings by abrupt discontinuities (boundaries) in environmental character states of magnitudes that are relevant to the ecological phenomenon under consideration

Patch-Corridor-Matrix Model

Patch must be defined relative to the phenomenon under investigation or management; regardless of the phenomenon under consideration (e.g., a species, geomorphological disturbances, etc), patches are dynamic and occur at multiple scales; and patch boundaries are only meaningful when referenced to a particular scale.

It is incumbent upon the investigator or manager to establish the basis for delineating among patches and at a scale appropriate to the phenomenon under consideration.

Corridors are distinguished from patches by their linear nature and can be defined on the basis of either structure or function or both. If a corridor is specified, it is incumbent upon the investigator or manager to define the structure and implied function relative to the phenomena (e.g., species) under consideration.

It is incumbent upon the investigator or manager to determine whether a matrix element exists and should be designated given the scale and phenomenon under consideration.

The Importance of Scale

One of the most important considerations in any landscape ecological investigation or landscape structural analysis is (1) to explicitly define the scale of the investigation or analysis, (2) to describe any observed patterns or relationships relative to the scale of the investigation, and (3) to be especially cautious when attempting to compare landscapes measured at different scales.

Landscape Context

A landscape should be defined relative to both the patch mosaic within the landscape as well as the landscape context. Moreover, consideration should always be given to the landscape context and the openness of the landscape relative to the phenomenon under consideration when choosing and interpreting landscape metrics.

Appendix C. Socioeconomics

This appendix provides background on the analysis of socioeconomic conditions.

In this appendix:

Analysis of Socioeconomic Effects 955

Analysis of Socioeconomic Effects

The socioeconomic analysis describes the impacts of the alternatives in terms of:

Employment – full time equivalent jobs by economic sector.

Income – wages associated with employment.

Payments to Counties – Counties' share of the revenues paid to BLM.

BLM budget – Money spent for BLM personnel, services, equipment, etc.

Contract costs – Money spent on contracting certain silvicultural costs.

Present net value – Sum of discounted revenues and costs associated with the timber sale program.

Employment, income and payments to counties were calculated at the County level, for each of the eighteen O&C Counties. BLM budgets and contract costs were calculated at the BLM District level. The present net value was calculated for the entire planning area.

Process Overview

The OPTIONS model provided data about the volume and size of timber in each harvest unit, and the type of harvest (regeneration, partial cut, thinning). Historic BLM timber sale data were used to estimate species mix and log grade for each proposed harvest unit and values by grade and species. A stumpage value was estimated for each harvest unit, based on the volume and grade of timber, logging costs and average road costs. For the first decade, the estimated stumpage was reduced 3.5 percent based on an analysis of the market price impact of selling additional BLM timber. The adjusted estimated stumpage value formed the basis for calculating total BLM timber revenues and BLM payments to counties.

Harvest by county was allocated to specific manufacturing centers using the Western Oregon Model, described below. In addition, the Western Oregon Model projected the impact of additional BLM timber on the market price of timber, and the effect on private harvest levels. This model also projected the value of the products produced at each manufacturing center – data used in the county-level input output models.

County-level Input/Output (I/O) models were built for each of the O&C Counties, and calibrated to local economies based on field visits and additional research. Given the value of wood products production in each County, and the federal payments to each County, changes to employment and income were projected.

Changes to the BLM budget were estimated using a unit cost associated with timber harvest. Contractor costs were based on the amount and type of harvest specified by the OPTIONS model.

The present net value calculation is based on the stumpage values derived from the OPTIONS model for five decades, and the estimated cost of the BLM timber program.

Information about County budgets, how reliant each County is on BLM payments, and how each County spends the BLM payments was based on a survey of the 18 O&C Counties.

The following sections describe each of these processes in more detail. More complete descriptions can be found in the references.

The Western Oregon Model

The Western Oregon Model was developed at Oregon State University by Darius Adams and Greg Latta. It is used to analyze questions about timber supply, public policies and how markets might respond to changes in fundamental factors.

The Western Oregon Model has five basic components: (i) inventory data describing private lands; (ii) assumptions about likely future silvicultural regimes to be applied to those lands; (iii) projections of future timber yields under the several regimes; (iv) assumptions about changes in timberland area through gains or losses to other uses or owners; and (v) a model that projects future harvests based on inventory and other assumptions, applies the management regimes, and updates the inventory over time.

Inventory

The approach involved projecting and harvesting the plots in a simulation system designed to mimic actual growth and harvest. Inventories were brought to a common starting point (2003) using a harvest scheduling model that selected plots (condition classes in western Oregon) for harvest to maximize the present net worth of timber returns over the period from the inventory date to 2003. Simulated harvesting was constrained to mimic actual historical cut by year and owner at the county level. Cut by species group, period-to-period changes in harvest per acre, and the area partial cut were constrained at the half-state level (the finest scale for which historical data are available). In this process, tree lists from the original plots were updated using a version of the Forest Vegetation Simulator (Dixon 2003).

Management Intensity Classes

A Management Intensity Class is a regime of silvicultural activities applied over the life of a stand. In this analysis, stands are classified as either: (i) “existing,” those that are part of the original inventory at the start of the projection, or (ii) “new,” those that are regenerated during the projection. There are seven Management Intensity Classes for existing stands and eight for new stands.

Yield Projections

Yields for each Management Intensity Class in each stand were generated using one of three regional variants of the Forest Vegetation Simulator. It is assumed that, by ecoregion, the stems per acre and species composition in new naturally regenerated stands were the same as that derived from averages for all young stands from the Forest Inventory Analysis database.

Land Area Changes

It is assumed that the general direction of past area trends will continue over the next 15 years but at reduced rates. The recent historical gain in western Oregon's private base was small, and a constant timberland area for that region is assumed.

Market Model

Timber harvest is a measure of the processing activity on the supply side of the regional log market. A model of the western Oregon log market that explicitly recognizes the spatial dispersion of log processing facilities and the forested lands that supply logs was constructed. Demand is derived from lumber and plywood production and log exports, all of which are sensitive to the delivered price of logs. The supply of logs in the short term is based on private owners' decisions about harvest timing to optimize the value of their timber investments given stand growth and interest rates. In the longer term, it depends on management (silvicultural) investments because these are influenced by anticipated yield increments, management costs, interest rates, and price expectations.

Log processing is grouped into specific milling or processing centers in the region. Mills generate a demand for delivered logs at these centers, which varies with log price up to the point of capacity. Log demand would shift depending on product prices, technology, non-wood costs, and capacity. Capacity itself is not fixed but varies with product prices, equipment costs, depreciation, and interest rate. Potential sources of private log supply lie at various distances from the processing center and have varying cost characteristics depending on the types of forest management, logging conditions, haul distances, and the interest rate.

Additional Assumptions

In the projections, assumptions about future prices of products and of labor and "other" variable inputs were derived from the 2005 Resource Planning Act Timber Assessment Update (U.S. Forest Service 2005, Timber Assessment Update)[1].

[1] Draft available online at www.fs.fed.us/pnw/about/programs/hnri/index.shtml ; last accessed Jan. 27, 2006.

Harvest from public lands is determined by policies within the respective managing agencies and generally is not sensitive to log price over the five-year time interval used in this analysis. Consequently, public log supply is treated as exogenous and it is assumed that it will remain constant at recent (2000–2002) average levels throughout the projection. Alternative scenarios of BLM timber harvest were constructed by varying the exogenous levels of BLM cut according to the conditions of the scenario.

Public harvest is set at the county level in the model and the costs of moving logs from public lands to mills estimated using an average haul distance from each county to each milling center.

County level Input Output models

Input/output models (I/O) are automated process models that scale national-level economic relationships to fixed-structure county databases. Critical input/output data was abstracted from published source data and active field surveys. The general approach contains four analytical phases:

1. Collection of secondary economic indicator data for the county level from a combination of published and on-line data sources.

Those data sources form a large database for each separate county model. The data matrix is recalibrated from field survey data for key sectors such as wood products and major manufacturers. Data on unearned income, including transfer payments and property income comes from the U.S. Bureau of Economic Analysis' Regional Economic Information System database. Data on seasonal homes in the study area, population and household comes from the U.S. Census Bureau website and Portland State University. County-level wage rates are found in the Oregon Labor Market Information System (OLMIS).

2. Comparison of similar data from multiple sources (including cooperators and other BLM contractors) and refining it with our field calibration surveys.

We received primary source records of BLM harvests, budget allocations and practices as well as historical payments to counties[2]. BLM payments were put in context to all county budget sources.[3] We used secondary state historical data to establish the relative BLM harvest contribution.[4] Spatial log flows are proportioned based on an earlier flow survey.[5] For loggers, we gathered logger data[6], found discrepancies in association estimates[7] and logger safety records[8], so we augmented these estimates from federal proprietor data[9]. Industrial production data came from numerous surveys and models. These estimates were tested and augmented by ForestEcon, Inc. field surveys. We used two sources of log using mill location and activities[10],[11], which were later adjusted to compromise with other estimates. [12]

3. Conducting field surveys to gather detailed data on socio-economic conditions.

Field interviews are augmented by follow-up telephone surveys. In each county, Dr. Dan Green, regional economist, and Maryann Green, resource biologist, both of Economic Analysis Systems contacted county government leaders, wood products industry employers, and businessmen in leading or potentially sensitive economic sectors. Their objective was to test the accuracy of secondary data, add detail to quantitative descriptions of each county's total economy and selective precision for expected critical sectors and ensure that revised data are generally acknowledged as accurate and representative.

3. Analysis of data, including supplemental analyses mostly completed by other contractors and cooperators.

The Timber Assessment Market Model provided regional estimates of stumpage price and owner harvest substitution estimates.[13] These estimates are used to estimate alternative payments to counties.[14] The Western Oregon timber model runs generate new spatial log use, and wood products production patterns by BLM alternative.[15]

---

2 BLM records, Association of O&C Counties Tabulation 10/5/2006, and USFS ASR payments to counties by national forest tabulation 12/22/2006

3 Kevin Davis, Association of O&C Counties

4 Gary Lettman, Oregon Department of Forestry forest economist

5 Jason Brandt, Montana Bureau of Business and Economic Research

6 Oregon Department of Labor

7 Oregon Association of Loggers

8 Oregon Dept of Logger Safety

9 US Department of Commerce

10 Oregon State University

11 Ehinger, Paul. 2006. Western Oregon Wood Products Mill survey

12 Western Oregon Model ibid

13 Darius Adams, Oregon State University

14 Mark Rassmussen, Mason, Bruce and Girard Inc.

15 Greg Latta, Oregon State University

Model Development Process

Dr. Green, our Economic Analysis Systems cooperator, uses a field survey calibration of county economic data bases and builds unique selective precision spreadsheet Input/Output model. The Economic Analysis Systems modeling process is based on a unique resource economy representation technique.[16] The methodology was developed for USDA-Forest Service spatially-sensitive community impact analyses where canned I/O models obscure or misrepresent impacts.

Establish model geography and resolution

We chose a county level of resolution so that most O&C impacts would be captured. That required a set of 17 county models as we decided to represent counties where O&C lands were few, but that O&C operations had economic influences.

Develop County-level databases

A database for each of the models is first assembled from published, on-line data sources, and survey data collected in 2006. The county databases included employment, wage and salary earnings, total industry output, unearned income, seasonal home spending, population, households, commuting patterns, wage rates, residency, employment status, tax rates, and savings and consumption rates (marginal and average propensity to consume locally).

Construct preliminary county models

A preliminary county model for the model areas is constructed from the secondary data sources. Its content and structure are similar to that used by IMPLAN. Employment and earnings totals in the models are controlled to Regional Economic Information System totals for each county. Industrial output by industry for each of the county models was derived using employment/output ratios obtained from the respective county models. The Economic Analysis Systems approach used the "selective precision" approach.[17] With this approach, on-the-ground verification focuses on a select number of sectors that are expected to play a significant role in the analysis. Each of the county models is constructed using a combination of spreadsheet programs along with a mathematical software program, GAUSS[18], which handles complex mathematical operations.

[16] Robison, M. Henry. 1997. Community Input/Output Models for Rural Area Analysis. Annals of Regional Science. Vol 31(3) pp 325-351

[17] Richardson. 1972.

[18] Aptech Systems Software. GAUSS mathematical and statistical system

Calibrate County models

In general, data and relationships for sectors that play an important role in the local economy and that are a key component of the economic base were adjusted with on-the-ground verified data as appropriate.

Modify export base in Key Economic Sectors

Use of mechanical techniques typically results in local absorption of the output of a variety of local industries that export all of their output (i.e., an extreme case of underestimating exports). Export sales are adjusted based on survey data for all key sectors in the analysis (such as wood products) and other sectors such as agriculture that are principal components of the economic base.

Perform sensitivity analyses and adjustments

Preliminary runs of the models using a range of input variables are undertaken to determine whether the model's projections of impacts were reasonable. This procedure focuses on the wood products sector of the county model. Multipliers from the model are also compared to multipliers developed by the U.S. Bureau of Economic Analysis Regional Input-Output Modeling multipliers and for IMPLAN models of the area and to a county model (Western Oregon).

Timber Assessment Market Model

The Timber Assessment Market Model focuses on the solid wood products sector and also provides the linkage between products markets (solid wood and pulpwood) and the timber inventory. Since its inception in the late 1970s, the model has undergone a number of extensions and revisions designed to improve the realism of its projections and the utility of its output to resource analysts and policymakers.

The Timber Assessment Market Model is a special model of the solid wood and timber inventory elements of the United States forest products sector and of softwood lumber and OSB production in Canada. The Timber Assessment Market Model provides annual projections of volumes and prices in the solid wood products and sawtimber stumpage markets, and estimates of total timber harvest and inventory by geographic region for periods of up to 50 years.

The demand module for softwood solid wood products uses Spelter's diffusion analysis of demands for softwood lumber, softwood plywood, and oriented strand board/ waferboard. The current wood products supply module assumes that product output is obtained in fixed proportions to log input (the product recovery factor linkage) but in variable proportions to all other factors, implying that logs are separable from other inputs in production. Given the assumptions of fixed log input-product output relations in the Timber Assessment Market Model, the derived demand for logs is simply the

product of recovery factors times output. The supply of wood to processing facilities is modeled as a mixture of price-sensitive relations, and exogenous flows describing the volumes of timber available for immediate harvest and the volumes of logs delivered to mills. The Timber Assessment Market Model also includes a program module that provides linkage to the ATLAS timber inventory system for the solid wood, paper and board, and fuelwood models.

Survey of counties

To better understand County budgets, and the role that BLM payments play in those budgets, MB&G sent a questionnaire to each of the 18 O&C Counties. Follow up phone calls clarified unclear answers.

County Budget Data for FY2005 – BLM Western Oregon Plan Revision

County: _____
Contact Person: _____
Phone: _____

PART 1 – FISCAL YEAR 2005 BUDGET

	Fiscal Year 2005	
County Expenditures *(see following page for definition of categories)*	Total Budget (including Discretionary Budget)	Discretionary Budget Only
Health & Community Services		
Public Safety		
Economic Dev., Natural Res. & Recreation		
Transportation & Land Use		
Other Community Services		
Debt Service		
Other (Specify):		
_____		
_____		
Total Expenditures		
County Revenues		
State Transfers & Reimbursements		
Property Taxes		
Safety Net Payments associated with O&C Lands		
Safety Net Payments associated with USFS Lands		
Other Federal Grants & Payments		

Fees, Charges for Services		
City, Special District & Other County Payments & Reimbursements		
Interest Earnings		
Bonding or other borrowing		
Other (Specify):		
_____		
_____		
_____		
Total Revenues		

PART 2 – HISTORIC COUNTY EXPENDITURES

Fiscal Year	Total Budget (including Discretionary Budget)	Discretionary Budget Only
1985		
1990		
1995		
2000		
2001		
2002		
2003		
2004		
2005		

Part 3 - Describe primary expenditures of discretionary funding

Please describe in as much detail as possible the specific uses for discretionary funds in your County. Your responses to Part 1 above puts expenditures in general categories. It would be very helpful to have more detail about specific programs and projects supported by O&C and other discretionary funds in recent years. Please feel free to attach graphs, charts, or other descriptive budget documents that help explain how your County uses its discretionary funds.

BLM Budget

To calculate changes to the BLM budget, the non-timber portion of each District's budget was calculated from the FY 2006 budget data. The timber portion of the budget was calculated using a fixed rate of $159/Mbf. This figure was based on historic budget information.

Timber Program Costs

Timber program costs for the present net value calculation were based on historic BLM budget data as $200/Mbf. This includes overhead at the District and State offices.

Expenditure Categories		
Health & Community Services	• Aging Services • Alcohol & Drug Addiction Services • Services for Children & Families • Developmentally Disabled • Mental Health Services • Oregon Health Plan Services	• Veterans Services • Public Health Services • Environmental Health Services • Housing Services • Medical Examiner • Solid Waste Disposal/Recycling
Public Safety	• Trial Courts • District Attorney • County Jail • 911/Emergency Communications • Emergency Management • Homeland Security	• Community Corrections • Court Security • Juvenile Services • County Law Library • Sheriff Patrol • Animal Control
Economic Development, Natural Resources and Recreation	• Oregon Plan Implementation • State Forest Management • Federal Land Policy • Extension Services • Telecommunications • County Fair	• Watermaster • County Forests • County Library • County Parks • County Museums
Transportation & Land Use	• Highway & Road Systems • Land Use Planning & Coordination • Senior & Disabled Transportation • Development Services	• Engineering • Building Permitting & Inspections • Surveying • Capital Projects
Other Community Services	• Management & Administration • Elections • Assessment & taxation • Human Resources & Employee Relations	• Property & Facilities Management • Procurement • Recording Public Documents

Appendix D. Timber

This appendix provides background on the analysis of timber valuation effects and the process for completing a 10 year scenario to verify the practicality of harvest scheduling the OPTIONS modeling results and to assist in estimating the effects of the alternatives.

In this appendix:

Timber Valuation.....967

Ten-Year Scenario Quality Check 971

Timber Valuation

The estimate of values which would be produced by the different alternatives must take into account the volume and quality of the timber offered, and the cost of harvest and transportation. The estimate of stumpage is being completed as a portion of the analysis of effects of the alternatives the first 10 years. As the alternatives are projected forward beyond the first 10 years, changes are expected in the receipt levels as the mix of sizes, quality and species changes in response to the harvest of different stand types, growth of other stands, and the application of silvicultural practices.

Stumpage and receipts will be generally be calculated in following manner:

Stumpage = Pond value – harvest and transportation costs.

- Pond value will be a weighted pond value inclusive of both the species mix and grade of logs anticipated from the different levels and types of harvest.
- Harvest and transportation costs will be an average by harvest type for each district.

Receipts will be the sum of all stumpage prices multiplied by the corresponding log volumes.

Analytical assumptions

Prices and costs will be calculated in constant dollars, set at 2005.

Costs, species composition, recovery and grade will be developed using an historical reconstruction approach with a variety of base periods.

Costs were developed for each district by two harvest types, thinning and regeneration harvest. Sales were selected from a base period of 1996 thru 2006. The first year of the forest plan, 1995 was not used due to expected bias since watershed analysis had not yet been completed on the majority of BLM-managed lands and no road construction could be undertaken in Riparian Reserves until the completion of watershed analysis for individual watersheds.

Sales which were actually offered were included as provided by the districts, in response to a data query. Sales where data was incomplete were excluded.

Sales were included regardless of award and execution or litigation. Volume weighted averages by thinning and regeneration harvest were developed for each district to obtain a "standing tree to mill" cost including cutting, yarding, road construction, transportation, maintenance, miscellaneous and other costs used in the standard BLM appraisal methods. All costs were expressed in dollars per thousand board feet (MBF) for 16-foot short-log, Scribner scale. Costs varied considerably by district with the cost of hauling logs to the mills one of the more variable. Costs for thinnings were generally higher than for regeneration harvest.

Costs for thinning will be used in the analysis for the thinning, uneven-age harvest, and partial harvest treatments described in Alternative 3.

A base size of approximately 1,100 million board feet was included in order to estimate costs, with a total cost of over $390 million in 2005 dollars.

Species composition

Commercially valuable species compositions for the analysis were developed for each district, using an historical reconstruction technique. Volumes and percentages of volume by species were developed using the period 1990 thru 2006(in part) as the base period.

Analysis of the data contained in the species data base of TSIS (Timber Sale Information System), the BLM accounting and record keeping system for timber sales, indicates a high level of similarity of species between districts with the exception of the Klamath Falls Resource Area.

Douglas-fir is the dominant commercial species with all districts having a harvest percentage of Douglas-fir by volume at or near 80 percent. Stratifying the base period into pre-Northwest Forest Plan, (1990-1995), early Northwest Forest Plan (1996-2000), and current Northwest Forest Plan era (2001-2006) yields only minor changes in species composition of sales. This species percentage composition has remained generally constant despite a substantial change in the harvest types and ages harvested over these three periods.

No formal sampling method was used to select a sample of sales available for use. Sales with missing or incomplete information were excluded. Some sales from the base period had been archived from TSIS, and were not included, as information was not available. Emphasis was placed on including large sales, as well as those from pre-Northwest Forest Plan years. Sales of less than one million board feet and those consisting of primarily fire salvage were excluded.

Log Quality

Log quality was estimated using historical reconstruction of log grades weighted by volume. Few sales were available in older forest types across the districts for the Northwest Forest Plan era, so sales from 1985-1990 were used to develop estimates for harvest of older timber, with the exception of Coos Bay district, where no records of this time could be located. For the Coos Bay district the base period of 1970-1975 was used.

Sales were included when the data was available, complete and legible. Sales of less than one million board feet were excluded as were certain salvage sales where species bias was likely. With the exception of the Klamath Falls resource area, 150-300+ MMBF were included in the reconstruction base for each district.

District cruiser estimates were used for grade breaks in thinnings where the price differences between lower sawlog grades are low.

Four types of forest stands were used to estimate quality by percent of volume. First are thinning stands. These were typically commercial thinning or density management treatments designed to remove/prevent suppression mortality and improve stand composition, vigor or value. Cruiser estimates of sawlog grade percentages will be used for these stands, in particular the DF 4 sawlog. The second type is regeneration or clearcut treatment in young stands, typically less than 80-100 years of age depending upon site quality. A modest number of pre-Northwest Forest Plan stands are available for this estimation, and some Northwest Forest Plan regeneration harvests fall within this category. The third type is mature stands, generally older than 80-100 years, typically dominated by one species, and generally of higher overall density. These stands correspond to the mature structural stage. Fourth are stands older than 150-200 years corresponding to the structurally complex classification. A more complete description of these structural stages is contained in Appendix 12: Ecology, Section I – Structural Stage Classification.

For each district, average percentages by log grade for each of these structural classes will be prepared for Douglas-fir, ponderosa pine, white fir, and sugar pine. Other species will be estimated using a camp run method with no grade differentiation. Analysis of the data indicates that higher log grades in other than these four species are rare.

The sales used as a basis were classified by structural stage class, described above, using a combination of local knowledge, species composition, average log size in board feet, and average number of Douglas-fir trees per acre.. Typically, stands with more than 100 trees per acre and an average log volume of less than 100 board feet would be in the "young" stand classification. The "structurally complex" class would contain stands with less than 40 trees/acre of the dominant species and average log volume generally greater than 200 board feet. The "mature" stand class would lie between these figures. These levels will differ by district based on differences in site productivity. Volume weighted percentages of grades were then developed by structural classes and by district.

Preparation of weighted pond values

Species composition will be assumed to be similar between regeneration harvest and thinning.

Species were consolidated into commonly used groups for which prices are available. For example, true firs and hemlocks were consolidated into "white wood"

For Douglas-fir, sugar pine and ponderosa pine, prices will be a weighted average by grade for the stand categories of young, mature and structurally complex.

Prices for species and grades, where applicable, were averaged levels for calendar year 2005 for commonly priced groups, using data obtained from Log Lines Log Price Reporting Service (published monthly) PO Box 2215 Mount Vernon WA 98273, loglines@fidalgo.net)."

Weighted pond values for each district were then prepared for young, mature and structurally complex stand classes using the pricing groups, grade weighted prices for Douglas-fir, sugar pine, and ponderosa pine, and consolidated percentages for grouped species such as true firs and hemlocks with their associated camp run prices. Log volumes and prices published in Log Lines are based on 32 foot long-log volumes. BLM volumes are expressed in 16-foot short-log, Scribner scale. Conversion factors used to adjust prices to 16-foot short-log were 0.8 for sawlog grades and 0.85 for peeler grades

The above matrix of weighted pond values will be held in 2005 dollars for the 10 year estimate of stumpage and receipts, as will costs.

Calculation of bid ratio

The period between 1990 and 2006 was used to calculate an average bid ratio for each district. This information was extracted from the BLM's TSIS database system and was volume weighted.

Preparation of stumpage and receipt estimation

For each district, each harvest type and each stand structural stage matrix will be prepared which will subtract harvesting costs from weighted pond values. Thinning costs will be used for the partial harvest in Alternative 3 due to the anticipated difficulties associated with this type of harvest in mature and structurally complex stands.

Once a matrix of stumpage values for the various treatments and stand categories has been prepared, anticipated receipts are calculated by multiplying the stumpage value per thousand board feet by the corresponding harvest level by structural stage to obtain a total expected price for the 10 years.

No correction for the "delay" in harvest after sale will be made. After a sale is sold and executed, a delay in sale receipts will normally occur since receipts are not generated until harvest occurs. This may be immediately after execution, or may be delayed depending upon seasonal requirements, sale specifications such as required construction or market conditions. In a similar manner, no delay will be assumed for litigation of individual sales.

Ten-Year Scenario Quality Check

The ten-year scenario is a method of both verifying the practicality of the harvest scheduling as modeled, and a method of estimating the effects to soils and hydrology by developing estimates of road construction and acres harvested by harvesting method.

The ten-year scenario is a simulation, and is a single solution to harvest scheduling in the first ten years. There may be a large number of solutions to implementation in the first 10 years in terms of both harvest locations and harvest types. It is intended to be representative of the implementation of the plan for the first 10 years, but is not intended to be used to predict or decide locations of actual harvest units.

Procedure

Once harvest units are modeled by OPTIONS as harvested in the first 10 years, the locations and harvest types are mapped with accompanying tables of information. These maps are distributed to the districts for analysis. District planners and others familiar with harvest unit design and road systems develop road locations and harvest methods for the selected units. These designs are captured in a Geographic Information System mapping database and assembled for analysis.

The OPTIONS model selects units for harvest based on a WOPR ID number. These WOPR ID units are polygons in the Geographic Information System database used for analysis of alternatives. They are typically subdivisions of the Forest Operations Inventory polygons, and are formed by the intersection and overlay of a variety of Geographic Information System layers or themes such as roads, streams, etc. (See Appendix Q - Vegetative Modeling for further information).

Planners examine the **sampled** (see below) WOPR ID units as these ID units are formed into logical larger harvest units where the WOPR ID units are contiguous. Planners then use a variety of Geographic Information System themes such as elevation contours, streams, ownership boundaries, etc. to create a “paper plan” for each harvest unit.

Once harvest units are determined, planners use local knowledge and the Geographic Information System theme layers to locate and document the existing roads and new road construction needed for access, location of landings to be constructed, and the harvest method (ground based, cable/skyline or helicopter) to be used.

Once these Geographic Information System themes have been completed, the layers are assembled and are overlaid in order to perform operations to assemble the information at a variety of scales.

Sampling

Since the ten-year scenario is a simulation, these methods provide an estimate of such effects as miles of new road construction, acres of ground-based harvest, and number of new stream crossings.

In order to develop the estimates in a reasonable time and with a reasonable level of effort, a sampling method was developed to select a portion of the simulated units for analysis.

Sections where harvest occurs within the ten-year scenario are sampled at a 1 in 3 random sample. Results from this sampling are developed as ratios such as miles of new road construction per million board feet, by thinning or regeneration harvest. These ratios are then expanded to the entire population to yield estimates of the amount for the entire harvest over the 10 years.

Sampling a particular township, range, and section is not stratified. That is to say that all sections where at least one WOPR ID unit is harvested have an equal chance of being sampled independent of the size of harvest within that section and independent of the acres of BLM land within that section.

Although units are selected by section, examination of the results show that many metrics such as acres sampled or volume sampled are within a few percent of the expected values of 33 percent. Actual expansion is based upon the sampled volume level.

The ratios developed are split by district, alternative, harvest type (thinning/regeneration harvest), and road type (temporary/permanent and surfaced/natural). These ratios are then expanded to estimate the total miles of road by road and harvest type, the acres disturbed from construction, etc. Once these ratios are developed, they are prorated to other units for expansion.

Appendix E. Botany

This appendix provides a list of federally listed and candidate plant species and actions and plans related to federally listed and BLM special status plant species. It also includes a list of special status plants by habitat group. The analysis of effects for plant species is based on using these habitat groups.

In this appendix:

Federally Listed and Candidate Plant Species **975**

Digest of Actions Contained in Individual Recovery Plans for Federally-Listed Plant Species **977**

Digest of Conservation Plans for Special Status Plants **980**

Habitat Groups **984**

Federally Listed and Candidate Plant Species

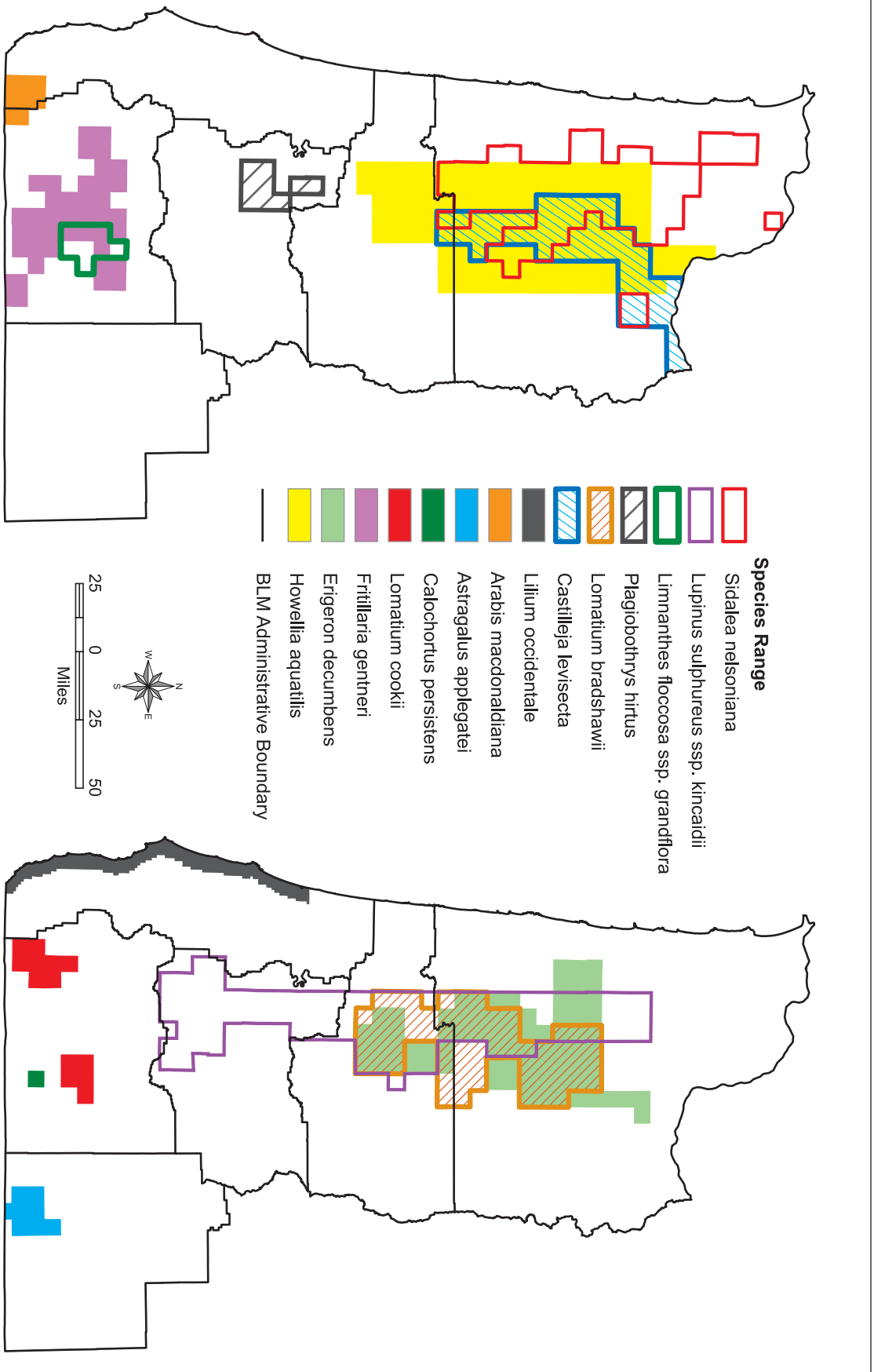
The following table and maps show the federally listed and candidate plant species in the planning area.

Table 239. Federally Listed and Candidate Plant Species

Federal Status	Species	Common Name	Critical Habitat Designation	Recovery Plan	Conservation Agreement
FTO	Castilleja levisecta	Golden Paintbrush	Not Designated	August-00	
FTO	Howellia aquatilis	Water Howellia	Not Designated	September-96	
FTO	Lupinus sulphureus ssp. kincaidii	Kincaid's Lupine	Not Designated		April-06
FTO	Sidalcea nelsoniana	Nelson's Checker-mallow	Not Designated	September-98	
FEO	Arabis macdonaldiana	MacDonald's Rock-Cress	Not Designated	February-84	
FEO	Astragalus applegate	Applegate's Milk-Vetch	Not Designated	April-98	
FEO	Erigeron decumbens var. decumbens	Willamette Valley Daisy	Not Designated		
FEO	Fritillaria gentneri	Gentner's Fritillary	Not Designated	July-03	
FEO	Lilium occidentale	Western Lily	Not Designated	March-98	
FEO	Limnanthes floccosa ssp. grandiflora	Large-Flowered Wooly Meadowfoam	Not Designated	Draft 2006	
FEO	Lomatium bradshawii	Bradshaw's Desert Parsley	Not Designated	August-93	
FEO	Lomatium cookii	Cook's Lomatium	Not Designated	Draft 2006	
FEO	Plagiobothrys hirtus	Rough Popcorn Flower	Not Designated	July-03	
FCO	Calochortus persistens	Siskiyou Mariposa lily	Not Designated		

FTO = Federally Threatened Oregon
FEO = Federally Endangered Oregon
FCO = Federal Candidate Oregon

Map 35. Federally Listed Plants



M06-12-02

Digest of Actions Contained in Individual Recovery Plans for Federally-Listed Plant Species

Recovery Plans for nine (9) federally-listed plant species have been completed and approved by the U.S. Fish and Wildlife Service. The individual recovery plans are incorporated by reference, and each stands on its own with a complete list of recovery actions.

The bulleted lists of conservation actions for each species are excerpts from the individual recovery plans. The key elements vary by species and by recovery plans, and are not intended to be a comprehensive list of all potential actions. Writing style and vocabulary differ as these recovery plans have been written by numerous authors over a period of 20 years.

Nelson's checker-mallow (Sidalcea nelsoniana) (USDI, USFWS 1998a)

- Establish reserves to manage for the recovery of the species;
- Actively manage habitat within reserves to achieve natural recruitment, population size and age structure;
- Manage reserves to maintain suitable habitat, to reduce succession and competition threats; and
- Augment populations, collect seed, and propagate seedlings.

Rough popcorn flower (Plagiobothrys hirtus) (USDI, USFWS 2003a)

- Conserve all existing populations and manage reserves within recovery areas for long-term viability of the species;
- Protect habitat within reserves including habitat for pollinators;
- Manage existing sites by reducing competition and impacts from native and non-native species; and
- Develop new populations in recovery units by planting or seeding areas.

Kincaid's lupine (Lupinus sulphureus spp. kincaidii) (Conservation Agreement applicable to the Roseburg District, BLM only) (USDI USFWS 2006a)

- Maintain stable populations by protecting and restoring habitat of each population;
- Maintain viable populations by reducing threats;
- Conserve a minimum of two meta-populations within the recovery zone in Douglas County;
- Conserve a minimum of 5,000 m2 of occupied habitat;
- Survey suitable habitat for new populations and manage habitat to meet recovery goals;
- Select, protect and manage reserve populations to address threats and increase the population; and
- Introduce and/or augment populations into suitable habitat.

Western lily (*Lilium occidentale*) (USDI, USFWS 1998b)

- Search for additional sites and potential suitable habitat;
- Protect all known populations;
- Establish, delineate and secure management areas that include all necessary habitat and plants to sustain a viable population;
- Manage sites to enhance the habitat so that existing populations will naturally increase. Remove over-topping vegetation;
- Reintroduce or augment populations as prudent; and
- Allow grazing with minimal negative effects to the lily, or suspend during the flowering and fruiting season as prudent.

Gentener's fritillary (*Fritillary gentneri*) (UDSI, USFWS 2003b)

- Establish 8 management areas within 4 recovery units to provide for long-term maintenance or improvement of habitat;
- Develop protection strategies to reduce successional encroachment and shading, curtail new roads in habitat, control and prevention of invasive weed colonization, reduction of herbivory by deer and livestock, prevention of public bulb collection;
- Augment populations as needed to meet recovery criteria;
- Collect and cultivate bulblets for augmentation within management areas; and
- Survey for undiscovered populations in suitable habitat.

Bradshaw's lomatium (*Lomatium bradshawii*) (UDSI, USFWS 2003c)

- Secure and manage habitat within 4 recovery areas;
- Establish 10 management areas, develop management plans, secure and protect the habitat supporting each population, and implement site specific plans;
- Enhance populations within management areas by reducing threats to the species. Manage secondary succession, habitat modification, competition from native and introduced species, removal of trees altering soil conditions, insect and fungal diseases, human impacts, herbicide impacts, and grazing impacts; and
- Locate additional sites by identifying potential habitat and conducting searches for additional populations.

McDonald's rock-cress (*Arabis mcdonaldiana*) (USDI, USFWS 1990)

- Protect and conserve all existing populations and habitat;
- Identify and protect essential habitat;
- Survey additional suitable habitat; and
- Withdraw lands from mining, designate as "special areas", and acquire suitable habitat where possible.

Golden paintbrush (*Castelleja levisecta*) (USDI, USFWS. 2000)

- Maintain the current geographic distribution of the species by maintaining habitat integrity;
- Implement habitat management that includes; protection of sites with the best potential for providing long-term stable habitat, and maintenance of unoccupied, potential habitat in suitable condition;
- Establish new populations within the historic range of the species;
- Conduct inventory surveys for undiscovered populations in suitable habitat; and
- Reintroduce populations into unoccupied habitat in its former range.

Applegate's milk-vetch (*Astaragalus applegate*) (USDI, USFWS 1998c)

- Conserve natural and introduced populations;
- Establish 6 recovery areas and develop management strategies for long-term stability;
- Manage the habitat of each population to achieve the desired population size and age structure, to encourage natural population recruitment and to minimize adverse impacts to populations;
- Inventory for undiscovered populations;
- Select population preservation and establishment sites;
- Secure extant populations and establishment sites; and
- Establish introduced populations and augment populations.

Water howellia (*Howellia aquatilis*) (USDI, USFWS 1996)

- Maintain the extant geographic range and habitat integrity that include the following key components; the maintenance of the natural vegetation, hydrologic, and geomorphologic conditions that determine the natural habitat succession rates and seasonal inundation and drying patterns of the habitat;
- Implement habitat management that will sustain occurrences and maintain habitat integrity to ensure functioning of meta-population dynamics;
- Provide protection on federal lands through special management designations such as Research Natural Areas or other designations;
- Conduct inventories in suitable habitat throughout the range of the species; and
- Develop and implement a reintroduction plan.

Digest of Conservation Plans for Special Status Plants

The lists below summarize the primary actions described in the agreements and strategies for Bureau sensitive species that would be applied on BLM managed lands. These lists are not intended to be complete and comprehensive. The conservation agreements and conservation strategies of each species are the documents that provide complete details and guide the management of the species.

Conservation Strategies

Gorman's Aster (*Aster gormanii*) (USDA, USDI 1994a)

- Maintain healthy reproductive populations at a variety of sites;
- Protect populations from immediate threats to their existence, such as: grazing by livestock or wildlife, habitat loss from timber harvest operations, road construction, and recreation; and
- Inventory suitable habitat of the species and collect baseline data on habitat requirements and vegetation community characteristics.

Silvery Phacelia (*Phacelia argentea*) (USDI, BLM, Coos Bay District 1995)

- Survey suitable habitat for new populations and update information of existing populations including threats and habitat;
- Improve occupied habitat and protect known populations from OHV use, European beachgrass infestation; and
- Collect seed for long term conservation.

Green Gentian (*Frasera umpquaensis*) (USDA, USDI 1993b)

- Ensure the continued viability of the species by designating all populations on BLM lands as critical to maintain viable, genetically stable populations;
- Protect populations from timber harvest operations, encroachment of trees into meadows, and fire suppression; and
- Field reconnaissance and survey for *F. umpquaensis* populations in potential habitat.

Columbia cress (*Rorippa columbiae*) (USDA, USDI 1996a)

- Employ one or more of the following actions to protect this species from livestock grazing and trampling: fence habitat and known populations, provide alternative water sources for cattle, alter grazing schedules to avoid the growing season of *R. columbiae* (April-October), and reduce or eliminate the number of livestock in the grazing unit;
- Allow higher water levels in early spring to reproduce the scouring effects of floods to help control the establishment of woody and weedy species.
- Provide populations with a 200-300 foot buffer near timber harvest sites;
- Install gates and signs to manage access by vehicles;
- Conduct inventory for potential habitat and undiscovered populations;

- Protect local hydrologic function by avoiding habitat changes when implementing erosion control, timber harvests and road construction projects; and
- Control competing herbaceous vegetation and invading tree species.

Tall Bugbane (*Cimicifuga elata*) (USDA, USDI 1996b)

- Selected sites will be managed to:
    - Maintain and enhance site viability.
    - Mitigate direct and indirect impacts, including: alterations in hydrology, canopy closure, changes in habitat from timber harvest, and road building in order to create and maintain conditions favorable for the C. elata.
- Management for non-selected populations is discretional;
- Improve the quality of existing habitat through broadcast burning and thinning to create and maintain forest gaps;
- Collect seeds and fruits for long term storage and potential future propagation;
- Install signs and protect populations within road right of ways. Restrict blading and ditching activities that would harm populations;
- Salvage plants for relocation when protection is not possible;
- Identify suitable habitat where reintroductions would benefit the species; and
- Inventory in suitable habitat.

Conservation Agreements

Large-flowered rush lily (*Hastingsia bracteosa),* Purple-flowered rush lily *(Hastingsia atropurpurea,* Mendocino gentian (*Gentiana setigera), Oregon willow-herb (Epilobium oreganum), and* Western bog violet (*Viola primulifolia ssp. occidentalis)* (USDA, USDI 2006)

- Provide conservation for five rare plant species and their serpentine wetland habitat, known as *Darlingtonia californica* fens;
- Inventory to identify new suitable and/or occupied habitat;
- Manage the *Darlingtonia* fens and protect their significant biological and ecological functions and values; and
- Protect *Darlingtonia* fens from threats such as: mining activities, road construction and maintenance, up slope logging, OHV use, fire suppression activities, water siphoning, over utilization for commercial, recreational, scientific or educational purposes, and from several invasive and noxious weed species.

Crinite Mariposa Lily (*Calochortus coxii*) (USDI, BLM and USFWS 2004f)

- Restore *Calochortus coxii* meadow habitat with native bunchgrasses and/or prescribe burn on a frequency matching natural fire return level. Thin or girdle trees to produce gaps in forest habitat;
- Inventory and control invasive and noxious weeds using integrated pest management (mechanical, manual, biological, and chemical methods);
- Exclude livestock inside habitat of *C. coxii; and*
- Collect seeds for long term conservation and propagation.

Umpqua Mariposa Lily *(Calochortus umpquaensis)* (USDA, USDI BLM and USFWS 1995)

- Acquire habitat on private lands to increase the amount of habitat in Federal ownership;
- Mitigate impacts from energy right of way and corridors;
- Manage livestock grazing and vehicle access inside habitat by installing gates and fences;
- Maintain and restore *Calochortus umpquaensis* meadow habitat with native bunchgrasses or other native species;
- Conduct prescribed burning and thinning to produce gaps in forest habitat; and
- Conduct inventories of potential habitat.

Habitat Groups

For the analysis of effects, special status plant species were categorized based on habitat relationships as shown in Table 240. A species can occur in more than one habitat group. Survey and Manage Species under No Action were also categorized by habitat and are shown in Table 241.

Habitat Groups and Abbreviations are as follows:

MG=Meadows/Grassland, SC=Shrub Community, OHW=Oak/Hardwood Woodlands, CF=Conifer/Mixed Evergreen Forest, SW=Seasonal Wetland Fends/Vernal Pools, RI=Riparian and Aquatic, SE=Serpentine Areas, RK=Rocky Areas Outcrops/Scree, MZ=Maritime Zone

Bureau Status and abbreviations are as follows:

SEO= State Endangered Oregon, STO=State Threatened Oregon, BAO=Bureau Assessment Oregon, BSO=Bureau Sensitive Oregon, FEO=Federally Endangered Oregon, FTO=Federally Threatened Oregon.

Taxon and abbreviations are as follows:

VA=Vascular, FU=Fungi, BR=Bryophyte, LI=Lichen

Table 240. Special Status Plant Species Habitat Groups

Habitat Groups	Scientific Name	Common Name	Bureau Status	Taxon	Life Form	Habitat Description
MZ	ABRONIA UMBELLATA SSP. BREVIFLORA	PINK SAND-VERBENA	SEO	VA	forb	Sandy areas, coastal dunes and scrub
CF, RK	ADIANTUM JORDANII*	CALIFORNIA MAIDEN-HAIR	BAO	VA	fern	Shaded seeps, hillsides, moist woods, rocky outcrops, vertical cliffs, forest openings, rocky banks in mists, in falls spray. Suspected – only a historic site on the UW RA.
MG	AGOSERIS ELATA	TALL AGOSERIS	BAO	VA	forb	Meadows, shrubby slopes and open woodlands to mid elevation. 1200 ft near Roseburg
MG	AGROSTIS HENDERSONII	HENDERSON'S BENTGRASS	BSO	VA	graminoid	Vernal pools
RK	AGROSTIS HOWELLII*	HOWELL'S BENTGRASS	BSO	VA	graminoid	moist cliffs, Columbia Gorge
MZ, CF	ALBATRELLUS AVELLANEUS		BSO	FU	FUNGUS	Terrestrial in chaparell, hardwood and conifer habitat, mycorrhizal with pines
SE	ALLIUM PENINSULARE	PENINSULAR ONION	BAO	VA	forb	dry slopes and flats
CF	ALPOVA ALEXSMITHII		BSO	FU	FUNGUS	buried in humus soil, near alders
RI, RK	ANDREAEA SCHOFIELDIANA		BAO	BR	MOSS	acidic rock, granite
MG	ANDROSACE ELONGATA SSP. ACUTA	LONG-STEMMED ANDROSACE	BAO	VA	forb	dry grassy slopes
MG	ANEMONE OREGANA VAR. FELIX	BOG ANEMONE	BAO	VA	forb	bogs in shady woods
RK	ARABIS KOEHLERI VAR. KOEHLERI*	KOEHLER'S ROCKCRESS	BSO	VA	subshrub	Dry, rocky cliffs
SE,RK	ARABIS MACDONALDIANA	MACDONALD'S ROCK-CRESS	FEO	VA	forb	Serpentine or granitic slopes ridges and rock outcrops, crevices and openings in Jeffery pine forests
SE,RK	ARABIS MODESTA	ROGUE CANYON ROCKCRESS	BAO	VA	forb	Serpentine soils, deep soil on steep slopes, cliffs, shaded canyon ledges
RK	ARABIS SPARSIFLORA VAR. ATRORUBENS	SICKLE-POD ROCKCRESS	BAO	VA	forb	Rocky slopes, valleys

* Species with 20 or fewer populations

Habitat Groups	Scientific Name	Common Name	Bureau Status	Taxon	Life Form	Habitat Description
RK	ARABIS SUFFRUTESCENS VAR. HORIZONTALIS	CRATER LAKE ROCKCRESS	BSO	VA	subshrub	Gravelly or stony slopes, dry pumice
CF	ARCANGELIELLA CAMPHORATA*		BSO	FU	FUNGUS	in duff under conifers and mixed hardwoods
SE,SC	ARCTOSTAPHYLOS HISPIDULA	HAIRY MANZANITA	BAO	VA	shrub	Rocky serpentine soils or sandstone, open shrub and forests, not fire tolerant
RK	ARNICA VISCOSA	SHASTA ARNICA	BAO	VA	subshrub	Open, rocky, subalpine to alpine sites
MZ	ARTEMISIA PYCNOCEPHALA	COASTAL SAGEWORT	BAO	VA	forb	Rocky or sandy soils, coastal strand
CF	ASARUM WAGNERI	GREEN-FLOWERED WILD-GINGER	BSO	VA	forb	Open boulder fields under White-fir/Red fir conifer stands near Mt McGlofflin at timberline,
RK	ASPLENIUM SEPTENTRIONALE	GRASS-FERN	BAO	VA	Spleen wort	Crevices of granite rocks
CF	ASTER BREWERI	BREWER'S ASTER	BAO	VA	subshrub	Subalpine meadows, open woods
MG,SW	ASTER CURTUS (Sericocarpus rigidus)	WHITE-TOPPED ASTER	STO	VA	forb	wet prairies, low elevations (humid and arid tranzition zone - Abrams)
RK	ASTER GORMANII	GORMAN'S ASTER	BSO	VA	forb	dry, rocky slopes, boreal zone
SW	ASTRAGALUS APPLEGATEI	APPLEGATE'S MILK-VETCH	FEO/ SEO	VA	forb	Moist meadows,
MG	ASTRAGALUS CALIFORNICUS	CALIFORNIA MILK-VETCH	BAO	VA	forb	Dry, open areas in scrub, woodland
RK	ASTRAGALUS PECKII	PECK'S MILK-VETCH	STO	VA	forb	dry, sandy ground
RI	BACCHARIS DOUGLASII	MARSH BACCHARIS	BAO	VA	forb	Moist salt marshes, stream edges
MG	BALSAMORHIZA HOOKERI VAR. LANATA	WOOLLY BALSAMROOT	BSO	VA	forb	Open woods, grassy slopes
SW,RI, CF	BENSONIELLA OREGANA	BENSONIA	BSO	VA	forb	Wet meadows, bogs and streams in deep soils under conifer forests
RK	BOLANDRA OREGANA	OREGON BOLANDRA	BSO	VA	subshrub	Near streams and moist rock crevices, wet cliffs in deep shade to open areas, lower Columbia river gorge
CF	BOLETUS PULCHERRIMUS		BSO	FU	FUNGUS	mixed woods and conifers

Habitat Groups	Scientific Name	Common Name	Bureau Status	Taxon	Life Form	Habitat Description
CF	BOTRYCHIUM MONTANUM	MOUNTAIN GRAPE-FERN	BAO	VA	grape-fern	Shady coniferous forests, edges of bogs, cedar swamps
RK	BOTRYCHIUM PUMICOLA	PUMICE GRAPE-FERN	STO	VA	grape-fern	fine pumice gravel on open slopes,dense lodgepole pine stands, high elevation
RK	BRACHYDONTIUM OLYMPICUM		BAO	BR	MOSS	rock, tiny
CF	BRIDGEOPORUS NOBILISSIMUS		BSO	FU	FUNGUS	conifer forests, true firs, Silver fir zone
MZ	BRODIAEA TERRESTRIS	DWARF BRODIAEA	BAO	VA	forb	Grassland, open woodlands
SW	BRUCHIA FLEXUOSA		BAO	BR	MOSS	Wet prairie habitat, mud flats around reservoir, low elevation grasslands
MZ, CF	BRYORIA PSEUDOCAPILLARIS		BSO	LI	Lichen	Picea sitchensis forests, exposed sites along the immediate coast, canopy, bark and wood,
MZ, CF	BRYORIA SPIRALIFERA		BSO	LI	Lichen	mostly conifers but also hardwoods, canopy, bark and wood, spiralling around branches, within 2 miles of coast
MZ, CF	BRYORIA SUBCANA*		BAO	LI	Lichen	Picea sitchensis forests,mostly conifers but also hardwoods and shrubs, canopy, bark and wood, spiralling around branches, along coastal bays and streams, ridges and summits in CA
RI,RK	BRYUM CALOBRYOIDES*		BAO	BR	MOSS	montane to alpine elevations in the Coast Ranges and the Rocky Mountains
SW	BULBOSTYLIS CAPILLARIS	SAND SEDGE	BAO	VA	forb	Meadows, grassy clearings
RI	CALAMAGROSTIS BREWERI	BREWER'S REEDGRASS	BAO	VA	grass	Moist subalpine and alpine meadows, lake margins, streambanks
CF	CALICIUM ADSPERSUM		BAO	LI	Lichen	Highly textured bark on the boles of old growth conifer trees
SW	CALLIERGON TRIFARIUM		BAO	BR	MOSS	wetland sites, bogs and fens

Habitat Groups	Scientific Name	Common Name	Bureau Status	Taxon	Life Form	Habitat Description
SE,MG, CF	CALOCHORTUS COXII*	CRINITE MARIPOSA-LILY	SEO	VA	forb	ultramafic slopes, open woodlands
SC,MG	CALOCHORTUS GREENEI	GREENE'S MARIPOSA-LILY	BSO	VA	forb	Dry rocky hillsides, bluffs and flats in openings and margins of shrubs and conifer woodlands
SE	CALOCHORTUS HOWELLII	HOWELL'S MARIPOSA-LILY	STO	VA	forb	ultrmafic soils in meadows, open woodlands
SE	CALOCHORTUS INDECORUS	SEXTON MT. MARIPOSA-LILY	SEO	VA	forb	ultramafics, open slopes,
RK,MG	CALOCHORTUS MONOPHYLLUS*	ONE-LEAVED MARIPOSA-LILY	BAO	VA	forb	Wooded slopes, clay-loam soils
RK	CALOCHORTUS NITIDUS*	BROAD-FRUIT MARIPOSA-LILY	BAO	VA	forb	grasslands and meadows
RK	CALOCHORTUS PERSISTENS*	SISKIYOU MARIPOSA-LILY	FCO	VA	forb	Open, dry rocky ridgetops
SE,MG, CF	CALOCHORTUS UMPQUAENSIS	UMPQUA MARIPOSA-LILY	SEO	VA	forb	open forests and grasslands
RI, SW	CALYPOGEIA SPHAGNICOLA		BAO	BR	LIVER-WORT	Wetland bogs containing sphagnum
MG,SE	CAMASSIA HOWELLII	HOWELL'S CAMAS	BSO	VA	forb	serpentine slopes, open woodlands
OHW,MG	CAMISSONIA GRACILIFLORA	SLENDER-FLOWERED EVENING-PRIMROSE	BAO	VA	forb	Open or shrubby slopes, generally clay soils, grasslands, oak woodlands
MZ, RI	CAMPYLOPUS SCHMIDII*		BAO	BR	MOSS	Wetlands along the coast, In partially-stabilized coastal sand dunes w/in one mile of ocean. In open stands of shore pine, cedar & cypress; shaded to exposed sand around the edges of vernal pools, and in deflation plains
RK	CARDAMINE PATTERSONII	SADDLE MOUNTAIN BITTERCRESS	BSO	VA	forb	Moist, mossy rocks, cliffs, open slopes with shallow soil.
RI	CAREX ABRUPTA	ABRUPT-BEAKED SEDGE	BAO	VA	sedge	Generally moist meadows, open forest
MZ, RI	CAREX BREVICAULIS	SHORT STEMMED SEDGE	BAO	VA	sedge	Rocky or sandy soil; sand dunes in Festuca rubra community; coastal
RI	CAREX BRUNNESCENS SSP. BRUNNESCENS	BROWNISH SEDGE	BAO	VA	sedge	wet places, banks and open woods

Habitat Groups	Scientific Name	Common Name	Bureau Status	Taxon	Life Form	Habitat Description
RI	CAREX CAPITATA	CAPITATE SEDGE	BAO	VA	sedge	Generally wet places
RI,SW	CAREX COMOSA	BRISTLY SEDGE	BAO	VA	sedge	Marshes, lakeshores and wet meadows
MZ, RI	CAREX CRAWFORDII	CRAWFORD'S SEDGE	BAO	VA	sedge	open places
RI	CAREX DIANDRA	LESSER PANICLED SEDGE	BAO	VA	sedge	Marshy meadows
RI, MG, CF, SW	CAREX GYNODYNAMA	HAIRY SEDGE	BAO	VA	sedge	Wet meadows; open forests; <600m
RI	CAREX LASIOCARPA VAR. AMERICANA	SLENDER SEDGE	BAO	VA	sedge	Lake, pond shores, generally in standing water
RI	CAREX LIVIDA	PALE SEDGE	BAO	VA	sedge	Bogs, swampy woods, OR coast and Cascades, extirpated in CA
RI	CAREX RETRORSA	RETRORSE SEDGE	BAO	VA	sedge	Edges of sloughs and lakes, swamps, bogs, wet meadows; in foothills and lowlands
SE, RI, SW	CAREX SCABRIUSCULA	SISKIYOU SEDGE	BAO	VA	sedge	marshy meadows, swamps, bogs, moist rocky slopes
OHW, SW, RI	CAREX SERRATODENS	SAW-TOOTH SEDGE	BAO	VA	sedge	Moist places
SW,RI	CAREX SP. NOV.	A SEDGE	BSO	VA	sedge	
CF	CASTILLEJA CHLOROTICA	GREEN-TINGED PAINTBRUSH	BSO	VA	forb	
SW, MG	CASTILLEJA LEVISECTA	GOLDEN PAINTBRUSH	FTO/ SEO	VA	forb	lowland meadows and along water
MZ, SC	CASTILLEJA MENDOCINENSIS	MENDOCINO COAST INDIAN PAINTBRUSH	BSO	VA	forb	coastal bluffs, coastal praire, scrub and conifer forests
RK	CASTILLEJA RUPICOLA	CLIFF PAINTBRUSH	BAO	VA	forb	rock cliffs in Cascades
RI	CERATOPHYLLUM ECHINATUM	PRICKLY HORNWORT	BAO	VA	aquatic forb	Lakes, ponds, marshes. More acidic and oligotrophic water than common hornwort.
RK	CHEILANTHES COVILLEI	COVILLE'S LIP-FERN	BAO	VA	fern	Crevices, bases of rocks, sun or shade
RK	CHEILANTHES INTERTEXTA	COASTAL LIPFERN	BAO	VA	fern	Crevices, bases of rocks
RI	CHILOSCYPHUS GEMMIPARUS		BSO	BR	LIVER-WORT	Attached to rocks in the bed of cold water streams, submerged or emergent in the splash zone (known from 2 localities in OR)

Habitat Groups	Scientific Name	Common Name	Bureau Status	Taxon	Life Form	Habitat Description
OHW	CHLOROGALUM ANGUSTIFOLIUM*	NARROW-LEAVED AMOLE	BAO	VA	forb	Heavy soils of grassland or woodland
RI, OHW, SW,MG, RK	CICENDIA QUADRANGULARIS*	TIMWORT	BAO	VA	forb	Crevices, bases of rocks, coastal wetlands, vernal pools, moist valley grasslands and oak woodland
RI	CICUTA BULBIFERA	BULB-BEARING WATER-HEMLOCK	BAO	VA	forb	marshes and lake borders
CF	CIMICIFUGA ELATA	TALL BUGBANE	BSO	VA	forb	Moist shady woods, open canopy, at lower elevations, often with big leaf maple in overstory, always dominant swordfern ground cover; north to northeast-facing steep slopes; mid-slope: near creeks
OHW,MG	CIRSIUM CILIOLATUM	ASHLAND THISTLE	BSO	VA	forb	Open woodland
MZ, RK	CLADIDIUM BOLANDERI		BAO	LI	Lichen	Crustose microlichen, rock outcrops in coastal prairies, Bodega Bay, CA
OHW	CLARKIA HETERANDRA	SMALL-FRUIT CLARKIA	BAO	VA	forb	Shady sites, woodland, yellow-pine forest
MZ	COCHLEARIA OFFICINALIS	SPOONWORT	BAO	VA	forb, maritime succulent	Open woodland, coastal headlands and offshore rocks
CF,RI, MG	COLLOMIA MAZAMA	MT. MAZAMA COLLOMIA	BSO	VA	forb	open forests, rock outcrops
RI, CF	COPTIS TRIFOLIA	THREE-LEAF GOLDTHREAD	BAO	VA	forb	cool, moist conifer forests
RI	CORDYLANTHUS MARITIMUS SSP. PALUSTRIS	POINT REYES BIRD'S BEAK	SEO	VA	forb	Coastal salt marshes
RI, CF	CORYDALIS AQUAE-GELIDAE	COLD-WATER CORYDALIS	BSO	VA	aquatic forb	margins of springs, streams and gravel bars, gravel substrate, riparian, intermediate canopy closure
RI,RK	CRUMIA LATIFOLIA		BAO	BR	MOSS	On wet rocks and cliff faces, riparian, often on calcareous substrates. May be submerged in streams.
MZ	CRYPTANTHA LEIOCARPA	SEASIDE CRYPTANTHA	BAO	VA	forb	Stabile and shifting sand dunes

Habitat Groups	Scientific Name	Common Name	Bureau Status	Taxon	Life Form	Habitat Description
RK	CRYPTANTHA MILO-BAKERI	MILO BAKER'S CRYPTANTHA	BAO	VA	forb	Rocky or gravelly soils, generally coniferous forest
RK	CRYPTOGRAMMA STELLERI	STELLER'S ROCK-BRAKE	BAO	VA	fern	moist shaded cliffs, mid to upper montane
CF	CRYPTOMITRIUM TENERUM		BAO	BR	LIVER-WORT	Partly shady slope with Lithocarpus and Umbrellularia on soil in trail cut. Abundant with capsules.
CF	CUPRESSUS BAKERI*	BAKER'S CYPRESS	BAO	VA	tree	Mixed-evergreen forests, open slopes, flats, basalt or serpentine
RI	CYPERUS ACUMINATUS	SHORT-POINTED CYPERUS	BAO	VA	forb	Wet,low places in valley and lowlands, edges of temporary pools, ponds, streams, ditches
CF	CYPRIPEDIUM FASCICULATUM	CLUSTERED LADY'S-SLIPPER	BSO	VA	forb	Open coniferous forest
MG, RK	DELPHINIUM LEUCOPHAEUM	WHITE ROCK LARKSPUR	SEO	VA	forb	low, moist meadows, rocky banks
RK,CF, OHW	DELPHINIUM NUDICAULE	RED LARKSPUR	BAO	VA	forb	Common. Moist talus, wooded, rocky slopes:
RI, MG	DELPHINIUM NUTTALLII	NUTALL'S LARKSPUR	BAO	VA	forb	low, moist meadows
MG, OHW	DELPHINIUM OREGANUM	WILLAMETTE VALLEY LARKSPUR	BSO	VA	forb	open plains and hillsides
OHW	DELPHINIUM PAVONACEUM	PEACOCK LARKSPUR	SEO	VA	forb	meadows
MZ, CF	DERMOCYBE HUMBOLDTENSIS*		BSO	FU	FUNGUS	on ground under conifers, particularly pines
CF	DESTUNTZIA RUBRA		BSO	FU	FUNGUS	buried in soil or duff in mixed woods or conifers, favors Doug-fir
RK	DICENTRA PAUCIFLORA	FEW-FLOWERED BLEEDINGHEART	BAO	VA	forb	Gravelly areas, high elevation coastal range
RI,CF	DIPLOPHYLLUM PLICATUM		BAO	BR	LIVER-WORT	Cool, moist habitats, decayed wood, downed logs, trunks, soil and rocks, moist shaded cliffs, along rivers and stream banks
RI, CF	DODECATHEON AUSTROFRIGIDUM*	FRIGID SHOOTINGSTAR	BSO	VA	forb	open or shaded vernally moist areas, cliffs or rock slopes

Habitat Groups	Scientific Name	Common Name	Bureau Status	Taxon	Life Form	Habitat Description
RK	DRABA HOWELLII	HOWELL'S WHITLOW-GRASS	BSO	VA	forb	Rock crevices
RI	ELEOCHARIS PARVULA	SMALL SPIKERUSH	BAO	VA	forb	Wet saline or alkaline sites; marshes. Coastal in OR, including deflation plains.
RI	ENCALYPTA BREVICOLLA VAR. CRUMIANA		BSO	BR	MOSS	exposed rocky areas , cost range, high elevation
MG, RI, OHW	ENTOSTHODON FASCICULARIS*		BAO	BR	MOSS	growing on rock outcrops, soil, dry,open habitats
SW	EPILOBIUM OREGANUM	OREGON WILLOW-HERB	BSO	VA	forb	Ultramafics, wet meadows, bogs, small streams, ditches, full sun or part shade
OHW, SC	ERICAMERIA ARBORESCENS	GOLDEN FLEECE	BAO	VA	shrub	Foothill woodland and chaparral
SE, MG, RK	ERIGERON CERVINUS	SISKIYOU DAISY	BAO	VA	forb	Open, rocky slopes, meadows, pine to fir woods and serpentine areas
MG, OHW, SW	ERIGERON DECUMBENS VAR. DECUMBENS	WILLAMETTE VALLEY DAISY	FEO/ SEO	VA	forb	Woodland, open forest
RK, MG	ERIGERON HOWELLII	HOWELL'S DAISY	BSO	VA	forb	moist often rocky places
RI, MG	ERIGERON PEREGRINUS VAR. PEREGRINUS	WANDERING DAISY	BAO	VA	forb	moist meadow, streamsides or bogs in mts
MZ, CF	ERIODERMA SOREDIATUM*		BAO	LI	Lichen	costal fog zone, bark or wood of hardwoods and conifers
RK	ERIOGONUM LOBBII	LOBB'S BUCKWHEAT	BAO	VA	forb	Common. Open, rocky slopes and ridges
MG	ERIOGONUM UMBELLATUM VAR. GLABERRIMUM	GREEN BUCKWHEAT	BSO	VA	forb	Sand or gravel
RI	ERIOPHORUM CHAMISSONIS	RUSSET COTTON-GRASS	BAO	VA	sedge	Bogs, swamps and wet places. Open, rocky slopes and ridges, also coastal bogs
MG	ERODIUM MACROPHYLLUM	LARGE-LEAVED FILAREE	BAO	VA	forb	Open sites, grassland, scrub
SW	ERYNGIUM ALISMIFOLIUM	INLAND COYOTE-THISTLE	BAO	VA	forb	Vernal pools, flooded meadows
MZ	ERYSIMUM MENZIESII SSP. CONCINNUM	PACIFIC WALLFLOWER	BAO	VA	forb	Open sites, grassland, scrub, coastal bluffs, headlands, and cliffs

Habitat Groups	Scientific Name	Common Name	Bureau Status	Taxon	Life Form	Habitat Description
MG, CF, RK	ERYTHRONIUM ELEGANS	COAST RANGE FAWN-LILY	STO	VA	forb	Northern Coast Range in Oregon, in open meadows, rocky cliffs, brushland, edges of sphagnum bogs (Grenier 1991).old & second growth conifer & hardwood forests w/ open canopies; also in shaded woods where plants smaller and may not flower; forest edges, roadsides; south facing dry sites w/ poison oak
SE,CF	ERYTHRONIUM HOWELLII	HOWELL'S ADDER'S-TONGUE	BSO	VA	forb	serpentine influence, meadows open woodlands, mixed evergreen
RK,MG	ESCHSCHOLZIA CAESPITOSA*	GOLD POPPY	BAO	VA	forb	Open chaparral, rocky slopes
CF, ME, MG, OHW	EUCEPHALUS VIALIS	WAYSIDE ASTER	STO	VA	forb	rocky hilsides, open woodland, chaparrel
RI	EUCLADIUM VERTICILLATUM		BAO	BR	MOSS	seeps and springs, high calcareous or alkaline, areas of tufa precipitation
OHW, MG	FESTUCA ELMERI	ELMER'S FECSUE	BAO	VA	grass	Moist, wooded slopes, under trees in rich soil
RI, CF	FILIPENDULA OCCIDENTALIS	QUEEN-OF-THE-FOREST	BSO	VA	forb	Riparian along streams
MG,CF	FRASERA UMPQUAENSIS	UMPQUA SWERTIA	BSO	VA	forb	open woodlands, meadows in mid to upper elevations
MG, RI	FRITILLARIA CAMSCHATCENSIS	INDIAN RICE	BAO	VA	forb	moist areas, tideflats to mt meadows
OHW,MG, SC,CF	FRITILLARIA GENTNERI	GENTNER'S FRITILLARY	FEO/ SEO	VA	forb	open woods and thickets
SE, RK	FRITILLARIA GLAUCA	SISKIYOU FRITILLARIA	BAO	VA	forb	Serpentine, rocky dry ridges and slopes
RK	FRITILLARIA PURDYI	PURDY'S FRITILLARY	BAO	VA	forb	Serpentine, rocky dry ridges and slopes
CH,RK, MG, SC	FUNARIA MUHLENBERGII		BAO	BR	MOSS	rock outcrops, open canopy Medford Dist, desert areas
CF	GASTROBOLETUS IMBELLUS		BSO	FU	FUNGUS	buried in soil or duff in mixed woods or conifers
SW	GENTIANA NEWBERRYI	NEWBERRY'S GENTIAN	BAO	VA	forb	MT meadows, banks, sub-alpine

Habitat Groups	Scientific Name	Common Name	Bureau Status	Taxon	Life Form	Habitat Description
SW	GENTIANA PLURISETOSA	ELEGANT GENTIAN	BSO	VA	forb	UNCOMMON. Wet mtn meadows
SW	GENTIANA SETIGERA	WALDO GENTIAN	BSO	VA	forb	Wet mtn meadows and bogs, sometimes scree
MZ	GILIA MILLEFOLIATA	SEASIDE GILIA	BSO	VA	forb	Stabilized or shifting coastal dunes
CF	GYMNOMYCES NONDISTINCTA		BSO	FU	FUNGUS	buried in soil or duff in conifers stands
MG	HACKELIA BELLA	BEAUTIFUL STICKSEED	BAO	VA	forb	Streambanks, roadsides, forest openings
SW	HASTINGSIA BRACTEOSA VAR. ATROPURPUREA	PURPLE-FLOWERED RUSH-LILY	BSO	VA	forb	Serpentine mountain meadows and springs
SW	HASTINGSIA BRACTEOSA VAR. BRACTEOSA	LARGE-FLOWERED RUSH-LILY	STO	VA	forb	Serpentine mountain meadows and springs
SW	HELIOTROPIUM CURASSAVICUM	SALT HELIOTROPE	BAO	VA	forb	Moist to dry, saline soils
SW	HELODIUM BLANDOWII		BAO	BR	MOSS	bogs and fens
RK	HERBERTUS ADUNCUS		BAO	BR	LIVER-WORT	wet shady cliffs and bark of trees, basalt outcrops
RI	HERBERTUS SAKURAII		BAO	BR	LIVER-WORT	shaded cliffs
MZ, CF	HETERODERMIA LEUCOMELOS		BAO	LI	Lichen	coast fog zone, on conifers hardwoods and occasionaly rock
CF	HETERODERMIA SITCHENSIS		BAO	LI	Lichen	immediat coast
MG	HORKELIA CONGESTA SSP. CONGESTA	SHAGGY HORKELIA	BSO	VA	forb	Vernally moist,sparsly wooded areas, meadows and grasslands on rocky clay, generally ultramafic
OHW	HORKELIA TRIDENTATA SSP. TRIDENTATA	THREE-TOOTHED HORKELIA	BAO	VA	forb	Granitic or volcanic soils
RI	HOWELLIA AQUATILIS	WATER HOWELLIA	FTO	VA	aquatic forb	In stagnant ponds and sloughs.
MZ, RI	HYDROCOTYLE VERTICILLATA	WHORLED MARSH-PENNYWORT	BAO	VA	forb	Along edges of coastal and inland lakes ongranitic or volcanic soils, swampy ground, wetlands
MZ, CF	HYPOGYMNIA PULVERATA		BAO	LI	Lichen	coastal OR

Habitat Groups	Scientific Name	Common Name	Bureau Status	Taxon	Life Form	Habitat Description
MZ, CF	HYPOGYMNIA SUBPHYSODES		BAO	LI	Lichen	Shore pine forest on Oregon coast, only known location
CF, MZ	HYPOTRACHYNA REVOLUTA		BAO	LI	Lichen	coastal, on trees and rocks, Cascades in WA, near Seattle.
CF,SC	ILIAMNA BAKERI	BAKER'S GLOBE-MALLOW	BSO	VA	forb	UNCOMMON. Mtn slopes, pine forests, juniper woodland, lava beds
CF,RI	ILIAMNA LATIBRACTEATA	CALIFORNIA GLOBE-MALLOW	BAO	VA	forb	Moist ground and stream sides in conifer forests, often on shady, disturbed ground
CF	IWATSUKIELLA LEUCOTRICHA		BAO	BR	MOSS	conifer tree trunks on fog drenched ridges
RI	JAMESONIELLA AUTUMNALIS VAR. HETEROSTIPA		BSO	BR	LIVER-WORT	Apparently an obligate aquatic, on stones, in moving water or in deep, ultra-oligotrophic lakes, bottom of Waldo Lake OR
RK	KALMIOPSIS FRAGRANS	FRAGRANT KALMIOPSIS - (DOUGLAS CO. POP.)	BSO	VA	forb	
CF	KECKIELLA LEMMONII	BUSH BEARDTONGUE	BAO	VA	subshrub or shrub	Rocky slopes, coniferous and mixed forests, chaparral
RI	KURZIA MAKINOANA*		BAO	BR	LIVER-WORT	in forests, rocky cliffs and ledges, shaded moist sites,bogs
MZ	LASTHENIA MACRANTHA SSP. PRISCA	LARGE-FLOWERED GOLDFIELDS	BSO	VA	forb	Coastal headlands
OHW,CF MG	LATHYRUS HOLOCHLORUS	THIN-LEAVED PEAVINE	BSO	VA	forb	open forests and thickets, margins of woods; roadsides, fencerows and near farmlands
CF, MZ	LEIODERMA SOREDIATUM		BAO	LI	Lichen	coastal fog zone, stabilized dunes in old Picea sitchensis and Pinus contorta forests, stems of hardwoods and conifers, semi-open habitat, dune woodlands
MZ, CF	LEPTOGIUM BREBISSONII		BAO	LI	Lichen	costal fog zone, bark or wood of hardwoods and conifers

Habitat Groups	Scientific Name	Common Name	Bureau Status	Taxon	Life Form	Habitat Description
CF	LEUCOTHOE DAVISIAE	SIERRA LAUREL	BAO	VA	shrub, small tree	Uncommon. Bogs, wet areas
RK	LEWISIA COLUMBIANA VAR. COLUMBIANA	COLUMBIA LEWISIA	BAO	VA	forb	Granite slopes, cliffs
RK	LEWISIA COTYLEDON VAR. PURDYI	PURDY'S LEWISIA	BSO	VA	forb	Granitic or serpentine rock outcrops, sun or shade, oak or pine forests
CF	LILIUM KELLOGGII	KELLOGG'S LILY	BAO	VA	forb	Gaps and roadsides in conifer forest
MZ	LILIUM OCCIDENTALE	WESTERN LILY	FEO/ SEO	VA	forb	Coastal bogs and marshes, scrub near cost
MZ, RI, CF	LIMBELLA FRYEI		BSO	BR	MOSS	On wet, rotten wood, leaf litter and lower trunks of tall shrubs in dense coastal shrub swamps, wetland site, coastal OR,
SW	LIMNANTHES FLOCCOSA SSP. BELLINGERIANA	BELLINGER'S MEADOW-FOAM	BSO	VA	forb	vernal pools, seasonaly wet rocky areas and meadows, volcanic origin
SW	LIMNANTHES FLOCCOSA SSP. GRANDIFLORA	LARGE-FLOWERED WOOLY MEADOWFOAM	FEO/ SEO	VA	forb	seasonaly wet meadows, open areas, local endemic, Upper and Lower Taqble Rock Medford
SW	LIMNANTHES FLOCCOSA SSP. PUMILA*	DWARF MEADOW-FOAM	STO	VA	forb	edges of deep vernal pools and wet meadows, open areas, local endemic, summits of Upper and Lower Taqble Rock Medford
SW	LIMNANTHES GRACILIS SSP. GRACILIS	SLENDER MEADOW-FOAM	BSO	VA	forb	seasonaly wet meadows, open areas, serpentine
RI	LIMONIUM CALIFORNICUM	WESTERN MARSH-ROSEMARY	BAO	VA	forb	coastal salt marshes
RI	LIPOCARPHA MICRANTHA	SMALL-FLOWERED LIPOCARPHA	BAO	VA	sedge	Beaches, sand bars, wet bottomlands.
CF, RK	LOBARIA LINITA		BAO	LI	Lichen	trees, shrubs, mossy rocks, alpine sod, montane (var. linita is arctic, alpine, and montane rock outcrops; sterile. Var. tenuior is epiphytic, higher elevation old growth stands; apotheciate.)

Habitat Groups	Scientific Name	Common Name	Bureau Status	Taxon	Life Form	Habitat Description
MG, SW	LOMATIUM BRADSHAWII	BRADSHAW'S DESERTPARSLEY	FEO/ SEO	VA	forb	Wet prairies; grassy swales; along waterways at low elevations in areas that are seasonally wet and void of shrubs and trees
MG,OHW	LOMATIUM COOKII	COOK'S LOMATIUM	FEO/ SEO	VA	forb	open valley bottomlands and woodlands, local endemic
SE	LOMATIUM ENGELMANNII*	ENGLEMANN'S DESERT-PARSLEY	BAO	VA	forb	Gravelly slopes in coniferous forest
MZ, SW, RI	LOPHOZIA LAXA		BAO	BR	LIVER-WORT	growing among and over branches of sphagnum in well-developed peatlands, coastal areas and in Cascade Mts.
CF/RI	LOTUS STIPULARIS*	STIPULED TREFOIL	BAO	VA	forb	Open pine forests, streambeds, ditches, thickets, chaparral, logged areas
CF	LUPINUS BREWERI VAR. BREWERI	BREWER'S LUPINE	BAO	VA	forb	Common. Generally open montane forest
MG, OHW, CF	LUPINUS SULPHUREUS SSP. KINCAIDII	KINCAID'S LUPINE	FTO/ STO	VA	forb	Open montane forest, dry, open woods, valley prairie grasslands, oak forests, often in sandy soil
CF	LUPINUS TRACYI	TRACY'S LUPINE	BAO	VA	forb	UNCOMMON. Dry, open montane forest
RI	LUZULA ARCUATA SSP. UNALASCHCENSIS	ALASKA CURVED WOODRUSH	BAO	VA	forb	Mossy banks, boggy shores, rocky areas. At 3000', Hood River Co., also reported 1000-1600' Douglas Co. (rocky rideges, high elevation, glacial moraines, Peck)
MZ, RI	LYCOPODIELLA INUNDATA	BOG CLUB-MOSS	BAO	VA	CLUB-MOSS	Coastal wetlands, moist areas in lake and pond margins, muddy depressions, peat bogs, fends, edge, and coastal habitats
CF	LYCOPODIUM COMPLANATUM	GROUND CEDAR	BAO	VA	forb	in woods and thickets
CF	MARTELLIA IDAHOENSIS		BSO	FU	FUNGUS	buried in soil or duff in conifers stands
OHW, MG, SW	MECONELLA OREGANA*	WHITE FAIRYPOPPY	BSO	VA	forb	Open ground, moist, sandy, gravelly areas

Habitat Groups	Scientific Name	Common Name	Bureau Status	Taxon	Life Form	Habitat Description
MG	MEESIA ULIGINOSA*		BAO	BR	MOSS	wetland sites, often bogs and fens
RK	MELICA STRICTA	NODDING MELIC	BAO	VA	forb	Open sites, coniferous forest, rocky areas in alpine
CF, MZ	METZGERIA TEMPERATA		BAO	BR	LIVER-WORT	Hypermaritime, on tree trunks, usually shaded, near coast; growing in dense mats or mixed among other bryophytes
CF	MICROCALICIUM ARENARIUM		BAO	LI	Lichen	boles of large trees, partically on a small selection of lichens on aged bark or wood, humid rock cliffs, (on farinose lichens, e.g., Chaenotheca furfuracea, on rocks or tree trunk bases. Old growth PSME, TSHE, TABR.)
RI, SW	MICROMITRIUM SYNOICUM		BAO	BR	MOSS	
MZ, RI	MICROSERIS BIGELOVII	COAST MICROSERIS	BAO	VA	forb	Open, moist sandy, gravelly areas, in coastal headlands
MG	MICROSERIS DOUGLASII SSP. DOUGLASII	DOUGLAS' MICROSERIS	BAO	VA	forb	Inland clay soils, grassland, often near vernal pools or serpentine outcrops
SE	MICROSERIS HOWELLII	HOWELL'S MICROSERIS	STO	VA	forb	Serpentine soils on flat or sloped moist to rocky areas
SC,MG	MICROSERIS LACINIATA SSP. DETLINGII	DETLING'S MICROSERIS	BSO	VA	forb	Open grassland, meadows, rocky slopes, forest edge
RK	MIMULUS BOLANDERI*	BOLANDER'S MONKEYFLOWER	BAO	VA	forb	Burns, openings in chaparral, disturbed areas
RK	MIMULUS CONGDONII*	CONGDON'S MONKEYFLOWER	BAO	VA	forb	Disturbed areas or seepage, runoff areas on slopes, generally granitic soils
RI	MIMULUS EVANESCENS*	DISAPPEARING MONKEYFLOWER	BSO	VA	forb	juniper plant associations, among rocky rubble and boulders in vernally moist, heavy gravel; stream edges, reservoir margins

Habitat Groups	Scientific Name	Common Name	Bureau Status	Taxon	Life Form	Habitat Description
RI, CF, SW	MIMULUS TRICOLOR	THREE-COLORED MONKEY-FLOWER	BAO	VA	forb	Vernally wet depressions, streamanks
SE, RK	MONARDELLA PURPUREA	SISKIYOU MONARDELLA	BAO	VA	forb	Serpentine, in open areas in rock, chaparral, woodland, montane forest
SW	NAVARRETIA HETERANDRA	TEHAMA NAVARRETIA	BAO	VA	forb	UNCOMMON. Heavy soil, vernal pools, wet or drying flats
SW	NAVARRETIA WILLAMETTENSIS	WILLAMETTE NAVARRETIA	BSO	VA	forb	Wetland prairie, vernal pools, roadsides.
RK	NEMACLADUS CAPILLARIS	SLENDER NEMACLADUS	BAO	VA	forb	Dry slopes, burned areas
CF, MZ	NIEBLA CEPHALOTA*		BAO	LI	Lichen	trees, shrubs, rocks, coastal fog belt, exposed coastal trees, less often rock
CF	OCTAVIANINA MACROSPORA		BSO	FU	FUNGUS	buried in soil or duff in mixed woods or conifers, favors Doug-fir
MZ	OENOTHERA WOLFII	WOLF'S EVENING-PRIMROSE	STO	VA	forb	Coastal bluffs
MZ, RI	OPHIOGLOSSUM PUSILLUM	ADDER'S-TONGUE	BAO	VA	fern	Wet meadows, marsh edges, deflation plains along the coast
MZ, CF	PANNARIA RUBIGINOSA*		BAO	LI	Lichen	bark or wood, hardwoods shrubs or conifers in wetlands and riparian areas
RK	PELLAEA ANDROMEDIFOLIA*	COFFEE FERN	BAO	VA	fern	Rocky outcrops, non-calcareous rock
RK	PELLAEA MUCRONATA SSP. MUCRONATA*	BIRD'S-FOOT FERN	BAO	VA	fern	Rocky outcrops
CF	PENSTEMON GLAUCINUS	BLUE-LEAVED PENSTEMON	BSO	VA	forb	pine forests
MG,CF, OHW, SW	PERIDERIDIA ERYTHRORHIZA	RED-ROOTED YAMPAH	BSO	VA	forb	moist meadows, poor drained soils, and open woodlands and pine forests
MZ	PHACELIA ARGENTEA	SILVERY PHACELIA	STO	VA	forb	sand dunes
CF	PHACELIA LEONIS	SISKIYOU PHACELIA	BSO	VA	forb	Often ultramafics, rocky to sandy openings in conifer forests
CF	PHAEOCOLLYBIA CALIFORNICA		BSO	FU	FUNGUS	on ground or duff in mixed woods or conifers, favors Doug-fir

Habitat Groups	Scientific Name	Common Name	Bureau Status	Taxon	Life Form	Habitat Description
MZ, CF	PHAEOCOLLYBIA GREGARIA*		BSO	FU	FUNGUS	on ground or duff in mixed woods or conifers
CF	PHAEOCOLLYBIA OLIVACEA		BSO	FU	FUNGUS	on ground or duff in mixed woods or conifers
CF	PHAEOCOLLYBIA OREGONENSIS*		BSO	FU	FUNGUS	under conifers
SW	PHYSCOMITRELLA PATENS		BAO	BR	MOSS	mud laid bare from retreating water of lakes and ponds, Willamette Valley wet prairies
RK,CF	PILOPHORUS NIGRICAULIS*		BAO	LI	Lichen	noncalcareous rock substrate (volcanic), cool, moist areas on stable talus slopes; coniferous forests that are especially humid: riverbanks, canyons, coast.
SW	PILULARIA AMERICANA	AMERICAN PILLWORT	BAO	VA	forb aquatic	Vernal pools, mud flats, lake margins, reservoirs, etc
SW	PLAGIOBOTHRYS AUSTINIAE*	AUSTIN'S PLAGIOBOTHRYS	BAO	VA	forb	Vernal pools, wet sites
SW, RI	PLAGIOBOTHRYS FIGURATUS SSP. CORALLICARPUS	CORAL SEEDED ALLOCARYA	BSO	VA	forb	wet meadows, riparian areas, valley floor
SW, RI	PLAGIOBOTHRYS GLYPTOCARPUS	SCULPTURED ALLOCARYA	BAO	VA	forb	Moist places, grasslands, woodlands
SW, RI	PLAGIOBOTHRYS GREENEI	GREENE'S POPCORN FLOWER	BAO	VA	forb	Wet sites, grassland to woodland
SW,OHW	PLAGIOBOTHRYS HIRTUS*	ROUGH POPCORN FLOWER	FEO/ STO	VA	forb	Moist places, grasslands, woodlands
SW, RI	PLAGIOBOTHRYS LAMPROCARPUS	SHINY-FRUITED ALLOCARYA	SEO	VA	forb	Moist places, grasslands, woodlands
CF,MG	POA RHIZOMATA*	TIMBER BLUEGRASS	BAO	VA	grass	UNCOMMON. Shady moist slopes in forest, in rich loose soils, over granitics
MZ	POA UNILATERALIS	SAN FRANCISCO BLUEGRASS	BAO	VA	grass	Coastal headlands and prairires in +/- saline soils
SW	POGOGYNE FLORIBUNDA*	PROFUSE-FLOWEREED MESA MINT	BSO	VA	forb	UNCOMMON. Vernal pools, seasonal lakes
MZ, SW, RI	POHLIA SPHAGNICOLA		BAO	BR	MOSS	sphagmum hummocks

Habitat Groups	Scientific Name	Common Name	Bureau Status	Taxon	Life Form	Habitat Description
CF, RI, RK	POLYSTICHUM CALIFORNICUM*	CALIFORNIA SWORD-FERN	BAO	VA	fern	Woods, streambanks, to rocky open slopes with moisture
RK	POLYTRICHUM SPHAEROTHECIUM		BAO	BR	MOSS	montane and coastal bogs
OHW	PORELLA BOLANDERI		BAO	BR	LIVER-WORT	on rocks and bark of living trees QUGA4 forest, PSME forest on rock outcrops. Maple bark, tree trunk bases in CA.
RI	PORELLA VERNICOSA VAR. FAURIEI		BAO	BR	LIVER-WORT	Columbia Gorge, 1 known site
RI	POTAMOGETON DIVERSIFOLIUS	RAFINESQUE'S PONDWEED	BAO	VA	forb aquatic	Uncommon. Shallow water, ditches, ponds, lakes
RI	POTAMOGETON FOLIOSUS VAR. FIBRILLOSUS	FIBROUS PONDWEED	BAO	VA	forb aquatic	Shallow water, small streams
RK	POTENTILLA VILLOSA	VILLOUS CINQUEFOIL	BAO	VA	forb	
CF	PSEUDOCYPHELLARIA MALLOTA*		BAO	LI	Lichen	old conifers or understory harwoods, (TABR2, RHMA3 branches in late successional forests, also branches, young ALRU2 or PSME forest).
RK, SE	PSEUDOLESKEELLA SERPENTINENSIS		BAO	BR	MOSS	serpentine endemic, found on rock
SW, MZ	PYRROCOMA RACEMOSA VAR. RACEMOSA	RACEMOSE PYRROCOMA	BAO	VA	forb	Wet meadows and open places, coastal valleys, marshes, sometimes in saline soils
RI	RACOMITRIUM DEPRESSUM		BAO	BR	MOSS	plants growing in streams, mostly high montane
RK	RADULA BRUNNEA		BAO	BR	LIVER-WORT	north-facing basalt breccia cliffs, peaty ledges, sheltered and open sites just below the ridgetop, grows in thick mats
MZ, RI	RAMALINA POLLINARIA*		BAO	LI	Lichen	bark and wood of various trees and shrubs, especially old ones, shaded rocks, low elevation moist areas, swamps
CF	RAMARIA SPINULOSA		BSO	FU	FUNGUS	conifers

Habitat Groups	Scientific Name	Common Name	Bureau Status	Taxon	Life Form	Habitat Description
CF, MZ	RAMARIA SPINULOSA VAR. DIMINUTIVA*		BSO	FU	FUNGUS	on ground or duff in conifers stands
OHW, MG	RANUNCULUS AUSTROOREGANUS	SOUTHERN OREGON BUTTERCUP	BSO	VA	forb	open meadows, chaparrel, valley floor
SC	RHAMNUS ILICIFOLIA	REDBERRY	BAO	VA	shrub, small tree	Chaparral, montane forests
CF	RHIZOMNIUM NUDUM		BAO	BR	MOSS	moist soil in woods and along streams, mid to high elevation moist conifer forests
CF	RHIZOPOGON CHAMALEONTINUS		BSO	FU	FUNGUS	buried in soil or duff in conifers stands
CF	RHIZOPOGON ELLIPSOSPORUS*		BSO	FU	FUNGUS	buried in soil or duff in conifers stands
MZ, CF	RHIZOPOGON EXIGUUS		BSO	FU	FUNGUS	buried in soil or duff in conifers stands
SW	RHYNCHOSPORA CAPITELLATA	BROWNISH BEAKRUSH	BAO	VA	sedge	Marshes, seeps
RK	RHYTIDIUM RUGOSUM		BAO	BR	MOSS	Forming loose mats on dry soil or rock, usually on the sloping sides and tops of dry bluffs and cliffs, at middle to higher elevations west of Cascade Range, usually calcareous regions.
MG,SW, RK, RI	ROMANZOFFIA THOMPSONII	THOMPSON'S MISTMAIDEN	BSO	VA	forb	moist rocky areas, wet cliffs, south facing slopes steep, well drained slopes.
RI, SW	RORIPPA COLUMBIAE*	COLUMBIA CRESS	BSO	VA	forb	Meadows, playas, seasonal stream bottoms, river margins
RI	ROTALA RAMOSIOR	TOOTHCUP	BAO	VA	forb	Lake and pond margins, streamsWet places, lake and pond margins, streams, sloughs, vernal pools, irrigated fields, <1900m.
SE,RI	SALIX DELNORTENSIS	DEL NORTE WILLOW	BAO	VA	shrub	Serpentine riparian areas
RK	SAXIFRAGOPSIS FRAGARIOIDES*	JOINT-LEAVED SAXIFRAGE	BAO	VA	forb	Uncommon. Rock crevices
RK	SCAPANIA GYMNOSTOMOPHILA		BAO	BR	LIVER-WORT	
RI	SCHEUCHZERIA PALUSTRIS VAR. AMERICANA	SCHEUCHZERIA	BAO	VA	aquatic or terrestrial	Floating mats, bogs, lake margins, Cascades

Habitat Groups	Scientific Name	Common Name	Bureau Status	Taxon	Life Form	Habitat Description
CF	SCHISTOSTEGA PENNATA		BAO	BR	MOSS	humid lowland forests, intensly shaded recesses, rock or mineral soil, riparian old growth or near lakes on the Cascade crest floresces
RI	SCIRPUS PENDULUS	DROOPING BULRUSH	BAO	VA	sedge	Marshes, wet meadows, ditches
RI, MZ	SCIRPUS SUBTERMINALIS	WATER CLUBRUSH	BAO	VA	sedge	Fress water lake margins, ponds, marshes, shallow water
RK	SEDUM MORANII	ROGUE RIVER STONECROP	BSO	VA	subshrubs, fleshy	Rock outcrops, local endemic, Rogue River (serpentine??)
RK	SEDUM OBLANCEOLATUM	APPLEGATE STONECROP	BSO	VA	subshrubs, fleshy	Rocky slopes
SE	SENECIO HESPERIUS	WESTERN SENECIO	BSO	VA	forb	serpentine areas, open meadows, chaparrel, Jeffery Pine
MG	SIDALCEA CAMPESTRIS	MEADOW SIDALCEA	BSO	VA	forb	grassy meadows and hillsides uplands
RI	SIDALCEA HENDERSONII	HENDERSON'S SIDALCEA	BSO	VA	forb	Coastal tideland and marshes
RK,SC	SIDALCEA HICKMANII SSP. NOV.*	HICKMAN'S CHECKERBLOOM	BSO	VA	forb	Chaparral, open conifer forest, sometimes on serpentine
MZ, MG, CF, SE, ME	SIDALCEA MALVIFLORA SSP. PATULA	COAST CHECKER BLOOM	BSO	VA	forb	Open coastal forest, prairie, mixed evergreen forest, grassy coastal headlands and meadows, often serpentine soils
MG	SIDALCEA NELSONIANA	NELSON'S HECKERMALLOW	FTO/ STO	VA	forb	moist open meadows and woodlands
OHW	SILENE HOOKERI SSP. BOLANDERI	BOLANDER'S CATCHFLY	BAO	VA	forb	Serpentine, rocky slopes, open areas, oak woodland, coniferous forest
MG	SISYRINCHIUM HITCHCOCKII*	HITCHCOCK'S BLUE-EYED GRASS	BSO	VA	forb	Willamette Valley and Umpqua Valley grasslands and oak woodlands
MG, RI	SISYRINCHIUM SARMENTOSUM	PALE BLUE-EYED GRASS	BSO	VA	forb	wet meadows and stream margins
OHW	SOLANUM PARISHII	PARISH'S HORSE-NETTLE	BAO	VA	forb	Dry chaparral, oak/pine woodland, pine forest
OHW, CF	SOPHORA LEACHIANA	WESTERN SOPHORA	BSO	VA	forb	ultramafics, open to sparsely wooded areas

Habitat Groups	Scientific Name	Common Name	Bureau Status	Taxon	Life Form	Habitat Description
RI	SPHAEROCARPOS HIANS		BSO	BR	LIVER-WORT	On mud of river bank, seasonal ephemeral which is evident in summer (Pullman) and fall (Corvallis) when water levels are low (3 known disjunct localities)
RI	SPLACHNUM AMPULLACEUM		BAO	BR	MOSS	Forming green sods on old dung of herbivores, or on soil enriched by dung, in peatlands or wetlands.
MZ	STELLARIA HUMIFUSA	CREEPING CHICKWEED	BAO	VA	forb	Known from Alsea Bay Island
CF,RK	STEREOCAULON SPATHULIFERUM		BAO	LI	Lichen	siliceous rock, north-facing talus slopes, cool moist habitats, subalpine to alpine in the Cascades
SE,CF, OHW	STREPTANTHUS HOWELLII	HOWELL'S STREPTANTHUS	BSO	VA	forb	ultramafics, sparsely wooded areas, open conifer and hardwood forests
CF	STREPTOPUS STREPTOPOIDES	KRUHSEA	BAO	VA	forb	alpine forests
CF,OHW	SULCARIA BADIA		BAO	LI	Lichen	Bark and limbs, canopy, pendulus, hardwoods mostly and conifers; dry open conifer forests, coastal pine forest
RK	SULLIVANTIA OREGANA	OREGON SULLIVANTIA	BSO	VA	forb	wet rocks and cliffs
CF	TAYLORIA SERRATA		BAO	BR	MOSS	sphagnum wetlands, high nitrogen substrates of dung and long decayed carcasses.
MZ	TELOSCHISTES FLAVICANS*		BAO	LI	Lichen	coastal headlands, fog belt, on bark and wood of conifers and hardwoods
CF	TETRAPHIS GENICULATA		BAO	BR	MOSS	humid conifer forests, coastal areas to sub alpine, on large rotten logs and wood or peaty soil, rarely rock

Habitat Groups	Scientific Name	Common Name	Bureau Status	Taxon	Life Form	Habitat Description
CF	TETRAPLODON MNIOIDES*		BAO	BR	MOSS	lowland moist forests, on old dung or soil and rotten wood enriched by dung or carcasses, in peatlands as well as drier uplands.
SC, MG	TEXOSPORIUM SANCTI-JACOBI		BAO	LI	Lichen	biotic crust, arid to semi-arid grasslands, shrublands, or savannas, intolerance of calcareous, saline, and heavily disturbed sites
MZ, CF	THAXTEROGASTER PAVELEKII		BSO	FU	FUNGUS	buried in soil or duff in conifers stands
SW	THELYPODIUM BRACHYCARPUM	SHORT-PODDED THELYPODY	BAO	VA	forb	UNCOMMON. Alkaline soils, adobe flats, pond margins
CF	THOLURNA DISSIMILIS*		BAO	LI	Lichen	branches of exposed conifers, rarely on rock, subalpine and alpine habitats. Occasionally lower elevation where cool, moist.
RI,CF	TREMATODON BOASII		BSO	BR	MOSS	tiny, moist soil along streams, ponds, subalpine, Central Cascades
CF, SC	TRILLIUM KURABAYASHII	SISKIYOU TRILLIUM	BAO	VA	forb	Moists forest, montane coniferous forest, foothill woodland, and chaparral
RK, CF	TRIPTEROCLADIUM LEUCOCLADULUM		BAO	BR	MOSS	Forming mats on shaded to exposed rocks, cliffs and bark of hardwoods such as oak and bigleaf maple, mostly at low elevations
MZ, CF	TRIQUETRELLA CALIFORNICA		BSO	BR	MOSS	coastal grasslands downslope of rock outcrops, within 10 miles of coast.
RK, MG, CF	TRITELEIA HENDERSONII VAR. LEACHIAE	LEACH'S BRODIAEA	BSO	VA	forb	Rocky areas, forest edges, wooded or open slopes and brush, meadow edges
CF	TRITELEIA IXIOIDES SSP. ANILINA	SIERRA BRODIAEA	BAO	VA	forb	Coniferous forest edge, often in gravel or sand
MG, SC, ME	TRITELEIA LAXA	ITHURIEL'S SPEAR	BAO	VA	forb	Meadows in mixed evergreen, foothill woodland, and chaparral

Habitat Groups	Scientific Name	Common Name	Bureau Status	Taxon	Life Form	Habitat Description
CF, RI	TRITOMARIA EXSECTIFORMIS		BAO	BR	LIVER-WORT	decaying wood in contact with water, mid elevation riparian areas
CF	USNEA NIDULANS		BAO	LI	Lichen	On both conifers and hardwoods, immediate coast and coast ranges. Found in stand of PSME, TSHE, THPL, ALRU2.; TSHE/ POMU Association
SW, MZ, RI	UTRICULARIA GIBBA*	HUMPED BLADDERWORT	BAO	VA	forb	Ponds, shallow lakes, bogs, wetlands, creeping over moss or mud
SW, MZ, RI	UTRICULARIA MINOR	LESSER BLADDERWORT	BAO	VA	forb	Wetlands, ponds, shallow lakes, margins, sphagnum bogs
RI	UTRICULARIA OCHROLEUCA	NORTHERN BLADDERWORT	BAO	VA	forb	Wetlands, ponds, shallow lakes, margins, sphagnum bogs
SE, SW	VIOLA PRIMULIFOLIA SSP. OCCIDENTALIS	WESTERN BOG VIOLET	BSO	VA	forb	Serpentine marshes, bogs and fens
RI	WOLFFIA BOREALIS	DOTTED WATER-MEAL	BAO	VA	forb	Freshwater ponds, sloughs; <100m
RI, SW	WOLFFIA COLUMBIANA	COLUMBIA WATER-MEAL	BAO	VA	forb	Freshwater ponds, sloughs; <100m
SC	ZYGADENUS FONTANUS*	SMALL-FLOWERED DEATH CAMAS	BAO	VA	forb	Meadows in foothill woodland, and chaparral

Table 241. Survey and Manage Species Habitat Groups

SPECIES GROUP	HABITAT GROUPS	SCIENTIFIC NAME
Bryophyte	CF	Brotherella roelli
Bryophyte	CF,RI	Buxbaumia viridis
Bryophyte	CF	Diplophyllum albicans
Bryophyte	CF	Diplophyllum plicatum
Bryophyte	CF,RK	Encalypta brevicolla var. crumiana
Bryophyte	CF,RK	Herbertus aduncus
Bryophyte	CF	Iwatsukiella leucotricha
Bryophyte	CF,RI	Kurzia makinoana
Bryophyte	RI	Marsupella emarginata var. aquatica
Bryophyte	CF	Orthodontium gracile
Bryophyte	CF	Racomitrium aquaticum
Bryophyte	CF,RI	Rhizomnium nudum
Bryophyte	CF,RI	Schistostega pennata
Bryophyte	CF	Tetraphis geniculata
Bryophyte	CF,RI	Tritomaria exsectiformis

SPECIES GROUP	HABITAT GROUPS	SCIENTIFIC NAME
Bryophyte	RI,RK	Tritomaria quinquedentata
Fungus	CF	Acanthophysium farlowii
Fungus	CF	Albatrellus avellaneus
Fungus	CF	Albatrellus caeruleoporus
Fungus	CF	Albatrellus ellisii
Fungus	CF	Albatrellus flettii
Fungus	CF	Alpova alexsmithii
Fungus	CF	Alpova olivaceotinctus
Fungus	CF	Arcangeliella camphorata
Fungus	CF	Arcangeliella crassa
Fungus	CF	Arcangeliella lactarioides
Fungus	CF	Asterophora lycoperdoides
Fungus	CF	Asterophora parasitica
Fungus	CF	Baeospora myriadophylla
Fungus	CF	Balsamia nigrens
Fungus	CF	Boletus haematinus
Fungus	CF	Boletus pulcherrimus
Fungus	CF	Bondarzewia mesenterica
Fungus	CF	Bridgeoporus nobilissimus
Fungus	CF	Cantharellus subalbidus
Fungus	CF	Catathelasma ventricosa
Fungus	CF	Chalciporus piperatus
Fungus	CF	Chamonixia caespitosa
Fungus	CF	Choiromyces alveolatus
Fungus	CF	Choiromyces venosus
Fungus	CF	Chromosera cyanophylla
Fungus	CF	Chroogomphus loculatus
Fungus	CF	Chrysomphalina grossula
Fungus	CF	Clavariadelphus ligula
Fungus	CF	Clavariadelphus occidentalis
Fungus	CF	Clavariadelphus sachalinensis
Fungus	CF	Clavariadelphus subfastigiatus
Fungus	CF	Clavariadelphus truncatus
Fungus	CF	Clavulina castanopes var. lignicola
Fungus	CF	Clitocybe senilis
Fungus	CF	Clitocybe subditopoda
Fungus	CF	Collybia bakerensis
Fungus	CF	Collybia racemosa
Fungus	CF	Cordyceps capitata
Fungus	CF	Cordyceps ophioglossoides
Fungus	CF	Cortinarius barlowensis
Fungus	CF	Cortinarius boulderensis
Fungus	CF	Cortinarius cyanites
Fungus	CF	Cortinarius depauperatus
Fungus	CF	Cortinarius magnivelatus
Fungus	CF	Cortinarius olympianus
Fungus	CF	Cortinarius speciosissimus

SPECIES GROUP	HABITAT GROUPS	SCIENTIFIC NAME
Fungus	CF	Cortinarius tabularis
Fungus	CF	Cortinarius umidicola
Fungus	CF	Cortinarius valgus
Fungus	CF	Cortinarius variipes
Fungus	CF	Cortinarius verrucisporus
Fungus	CF	Cortinarius wiebeae
Fungus	CF	Craterellus tubaeformis
Fungus	CF	Cudonia monticola
Fungus	CF	Cyphellostereum laeve
Fungus	CF	Dermocybe humboldtensis
Fungus	CF	Destuntzia fusca
Fungus	CF	Destuntzia rubra
Fungus	CF	Dichostereum boreale
Fungus	CF	Elaphomyces anthracinus
Fungus	CF	Elaphomyces subviscidus
Fungus	CF	Endogone acrogena
Fungus	CF	Endogone oregonensis
Fungus	CF	Entoloma nitidum
Fungus	CF	Fayodia bisphaerigera
Fungus	CF	Fevansia aurantiaca
Fungus	CF	Galerina atkinsoniana
Fungus	CF	Galerina cerina
Fungus	CF	Galerina heterocystis
Fungus	CF	Galerina sphagnicola
Fungus	CF	Galerina vittaeformis
Fungus	CF	Gastroboletus imbellus
Fungus	CF	Gastroboletus ruber
Fungus	CF	Gastroboletus subalpinus
Fungus	CF	Gastroboletus turbinatus
Fungus	CF	Gastroboletus vividus
Fungus	CF	Gastrosuillus amaranthii
Fungus	CF	Gastrosuillus umbrinus
Fungus	CF	Gautieria magnicellaris
Fungus	CF	Gautieria otthii
Fungus	CF	Gelatinodiscus flavidus
Fungus	CF	Glomus radiatum
Fungus	CF	Gomphus bonarii
Fungus	CF	Gomphus clavatus
Fungus	CF	Gomphus kauffmanii
Fungus	CF	Gymnomyces abietis
Fungus	CF	Gymnomyces nondistincta
Fungus	CF	Gymnopilus punctifolius
Fungus	CF	Gyromitra californica
Fungus	CF	Gyromitra esculenta
Fungus	CF	Gyromitra infula
Fungus	CF	Gyromitra melaleucoides
Fungus	CF	Gyromitra montana

SPECIES GROUP	HABITAT GROUPS	SCIENTIFIC NAME
Fungus	CF	Hebeloma olympianum
Fungus	CF	Helvella crassitunicata
Fungus	CF	Helvella elastica
Fungus	CF	Helvella maculate
Fungus	CF	Hydnotrya inordinata
Fungus	CF	Hydnotrya subnix
Fungus		Hydnum umbilicatum
Fungus	CF	Hydropus marginellus
Fungus	CF	Hygrophorus caeruleus
Fungus	CF	Hygrophorus karstenii
Fungus	CF	Hygrophorus vernalis
Fungus	CF	Hypomyces luteovirens
Fungus	CF	Leucogaster citrinus
Fungus	CF	Leucogaster microsporus
Fungus	CF	Macowanites chlorinosmus
Fungus	CF	Macowanites lymanensis
Fungus	CF	Macowanites mollis
Fungus	CF	Marasmius applanatipes
Fungus	CF	Martellia fragrans
Fungus	CF	Martellia idahoensis
Fungus	CF	Mycena hudsoniana
Fungus	CF	Mycena monticola
Fungus	CF	Mycena overholtsii
Fungus	CF	Mycena quinaultensis
Fungus	CF	Mycena tenax
Fungus	CF,RI	Mythicomyces corneipes
Fungus	CF	Neolentinus adhaerens
Fungus	CF	Neolentinus kauffmanii
Fungus	CF	Neournula pouchetii
Fungus	CF	Nivatogastrium nubigenum
Fungus	CF	Octavianina cyanescens
Fungus	CF	Octavianina macrospora
Fungus	CF	Octavianina papyracea
Fungus	CF	Otidea leporina
Fungus	CF	Otidea onotica
Fungus	CF	Otidea smithii
Fungus	CF	Phaeocollybia attenuata
Fungus	CF	Phaeocollybia californica
Fungus	CF	Phaeocollybia dissiliens
Fungus	CF	Phaeocollybia fallax
Fungus	CF	Phaeocollybia gregaria
Fungus	CF	Phaeocollybia kauffmanii
Fungus	CF	Phaeocollybia olivacea
Fungus	CF	Phaeocollybia oregonensis
Fungus	CF	Phaeocollybia piceae
Fungus	CF	Phaeocollybia pseudofestiva
Fungus	CF	Phaeocollybia scatesiae

SPECIES GROUP	HABITAT GROUPS	SCIENTIFIC NAME
Fungus	CF	Phaeocollybia sipei
Fungus	CF	Phaeocollybia spadicea
Fungus	CF	Phellodon atratus
Fungus	CF	Pholiota albivelata
Fungus	CF	Pithya vulgaris
Fungus	CF	Plectania melastoma
Fungus	CF	Plectania mIlleri
Fungus	CF	Podostroma alutaceum
Fungus	CF	Polyozellus multiplex
Fungus	CF	Pseudaleuria quinaultiana
Fungus	CF	Ramaria abietina
Fungus	CF	Ramaria amyloidea
Fungus	CF	Ramaria araiospora
Fungus	CF	Ramaria aurantiisiccescens
Fungus	CF	Ramaria botryis var. aurantiiramosa
Fungus	CF	Ramaria celerivirescens
Fungus	CF	Ramaria claviramulata
Fungus	CF	Ramaria concolor f. marrii
Fungus	CF	Ramaria concolor f. tsugina
Fungus	CF	Ramaria conjunctipes var. sparsiramosa
Fungus	CF	Ramaria coulterae
Fungus	CF	Ramaria cyaneigranosa
Fungus	CF	Ramaria gelatiniaurantia
Fungus	CF	Ramaria gracilis
Fungus	CF	Ramaria hilaris var. olympiana
Fungus	CF	Ramaria largentii
Fungus	CF	Ramaria lorithamnus
Fungus	CF	Ramaria maculatipes
Fungus	CF	Ramaria rainierensis
Fungus	CF	Ramaria rubella var. blanda
Fungus	CF	Ramaria rubribrunnescens
Fungus	CF	Ramaria rubrievanescens
Fungus	CF	Ramaria rubripermanens
Fungus	CF	Ramaria spinulosa var. diminutiva
Fungus	CF	Ramaria stuntzii
Fungus	CF	Ramaria suecica
Fungus	CF	Ramaria thiersii
Fungus	CF	Ramaria verlotensis
Fungus	CF	Rhizopogon abietis
Fungus	CF	Rhizopogon atroviolaceus
Fungus	CF	Rhizopogon brunneiniger
Fungus	CF	Rhizopogon chamaleontinus
Fungus	CF	Rhizopogon ellipsosporus
Fungus	CF	Rhizopogon evadens var. subalpinus
Fungus	CF	Rhizopogon exiguus
Fungus	CF	Rhizopogon flavofibrillosus
Fungus	CF	Rhizopogon inquinatus

SPECIES GROUP	HABITAT GROUPS	SCIENTIFIC NAME
Fungus	CF	Rhizopogon truncatus
Fungus	CF	Rhodocybe speciosa
Fungus	CF	Rickenella swartzii
Fungus	CF	Russula mustelina
Fungus	CF	Sarcodon fuscoindicus
Fungus	CF	Sarcodon imbricatus
Fungus	CF	Sarcosoma latahense
Fungus	CF	Sarcosoma mexicana
Fungus	CF	Sarcosphaera eximia
Fungus	CF	Sedecula pulvinata
Fungus	CF	Sowerbyella rhenana
Fungus	CF	Sparassis crispa
Fungus	CF	Spathularia flavida
Fungus	CF	Stagnicola perplexa
Fungus	CF	Thaxtoerogaster pavelekii
Fungus	CF	Tremiscus helvelloides
Fungus	CF	Tricholoma venenatum
Fungus	CF	Tricholomopsis fulvescens
Fungus	CF	Tuber asa
Fungus	CF	Tuber pacificum
Fungus	CF	Tylopilus porphyrosporus
Lichen	CF,MZ	Bryoria pseudocapillaris
Lichen	CF,MZ	Bryoria spiralifera
Lichen	CF	Bryoria subcana
Lichen	CF,OHW	Bryoria tortuosa
Lichen	CF,MZ	Buellia oidalea
Lichen	CF,OHW	Calicium abietinum
Lichen	CF	Calicium adspersum
Lichen	CF	Calicium glaucellum
Lichen	CF	Calicium viride
Lichen	CF	Cetrelia cetrarioides
Lichen	CF	Chaenotheca chrysocephala
Lichen	CF,OHW	Chaenotheca ferruginea
Lichen	CF	Chaenotheca furfuracea
Lichen	CF	Chaenotheca subroscida
Lichen	CF	Chaenothecopsis pusilla
Lichen	CF	Cladonia norvegica
Lichen	CF	Collema nigrescens
Lichen	CF,OHW	Dendriscocaulon intricatulum
Lichen	CF,RI	Dermatocarpon meiophyllizum (ex. luridum)
Lichen	CF,MZ	Fuscopannaria saubinetii
Lichen	CF	Heterodermia sitchensis
Lichen	CF	Hypogymnia duplicata
Lichen	CF	Hypogymnia oceanica
Lichen	CF,MZ	Hypogymnia vittata
Lichen	CF	Hypotrachyna revoluta
Lichen	CF	Leptogium burnetiae var. hirsutum

SPECIES GROUP	HABITAT GROUPS	SCIENTIFIC NAME
Lichen	CF	Leptogium cyanescens
Lichen	CF,RI	Leptogium rivale
Lichen	CF	Leptogium teretiusculum
Lichen	CF	Lobaria linita
Lichen	CF,RK	Microcalicium arenarium
Lichen	CF	Nephroma bellum
Lichen	CF	Nephroma isidiosum
Lichen	CF	Nephroma occultum
Lichen	CF,MZ	Niebla cephalota
Lichen	CF	Pannaria rubiginosa
Lichen	CF	Pannaria saubinettii
Lichen	CF	Peltigera pacifica
Lichen	CF	Platismatia lacunosa
Lichen	CF	Pseudocyphellaria rainierensis
Lichen	CF	Pseudocyphellaria perpetua
Lichen	CF,MZ	Pyrrhospora quernea
Lichen	CF,MZ	Ramalina pollinaria
Lichen	CF,OHW	Ramalina thrausta
Lichen	CF	Stenocybe clavata
Lichen	CF,OHW,MZ	Teloschistes flavicans
Lichen	CF,MZ	Tholurna dissimilis
Lichen	CF,SH	Usnea hesperina
Lichen	CF	Usnea longissima
Vascular_Plant	CF	Botrychium minganense
Vascular_Plant	CF	Botrychium montanum
Vascular_Plant	CF	Coptis asplenifolia
Vascular_Plant	CF	Coptis trifolia
Vascular_Plant	CF,RI	Corydalis aquae-gelidae
Vascular_Plant	CF	Cypripedium fasciculatum
Vascular_Plant	CF	Cypripedium montanum
Vascular_Plant	CF	Eucephalus vialis
Vascular_Plant	CF	Galium kamtschaticum
Vascular_Plant	CF	Platanthera orbiculata var. orbiculata

Appendix F. Invasive Plants

This appendix provides background on the methodology used in the analysis of invasive plants.

In this appendix:

Analytical methods used to determine relative risk to introduce invasive plant species between the alternatives..... 1015

Analytical methods used to determine relative risk to introduce invasive plant species between the alternatives.

Analytical assumptions used for the effects analysis are integrated into the invasive plants portion of Chapters 3 and 4. The analytical methods used to determine the relative risk to introducing and spreading invasive plant species between the alternatives are described in this appendix.

The condition of invasive plant infestations on BLM managed lands in western Oregon can be characterized by analyzing a few invasive species. The following representative sample of invasive species is used to describe the condition of invasive plants on BLM managed lands in western Oregon on BLM managed lands:

- Yellow starthistle
- Knotweeds
- False brome
- Spotted and diffuse knapweeds
- Meadow knapweed
- Scotch and French brooms
- Dyer's woad
- Canada thistle.

Step 1

Determined the current Invasive Species Distribution Category at the fifth-field watershed level: _

The sample invasive species distribution data was imported from WeedMapper in January 2007 and reported species presence was evaluated for each square mile in a grid applied to the planning area. All of the sample invasive species distribution data was pooled for the analysis.

Invasive Species Distribution Categories of *abundant, limited,* and *low* were based on the known species distribution in the fifth-field watersheds:

Abundant

The sample invasive species were reported from more than 25% of the square miles within the fifth-field watershed.

Limited

The sample invasive species were reported from between less than *25%* and more than 1% of the square miles within the fifth-field watershed.

Low

The sample invasive species were reported in no more than 1% of the square miles in the fifth-field watershed.

Figure XX to show Invasive Plant Distribution of selected species in the planning area.

Step 2

Determined the relative risk of introducing invasive plant species into fifth-field watersheds over the first ten years of plan implementation as a by-product of timber harvest activities for each alternative.

Step 2a -

Weights of 1or 5 were assigned to the four timber harvest types based on their respective post-harvest light levels. Regeneration and partial harvests were assigned a weight of 5. Commercial thinning and uneven aged management activities were assigned a weight of 1.

Step 2b -

Weights of 1, 3 and 5 were assigned to logging methods based on their respective levels of soil disturbance. Aerial harvests were assigned a weight of 1, cable yarding systems a weight of 3, and ground based methods a weight of 5.

Step 2c -

A combined timber harvest activity weighted value was calculated by multiplying the weights from *Steps 2a* and *2b*.

Step 2d -

These combined timber harvest activity weights were multiplied by the number of acres modeled for harvest in the first ten years, to generate a set of values describing the level of susceptibility for invasive plant introduction as a result of probable timber harvest activities.

Step 2e –

The susceptibility values were evenly divided into three categories: *high, medium* and *low*.

Zero values were assigned to fifth field watersheds where there is no BLM ownership.

Figure X (Relative susceptibility of fifth field watersheds to invasive plant introduction, as a result of timber harvest activities in the first ten years) to show which watersheds would generate the most and least post-harvest light and soil disturbance from timber harvest activities.

Step 2f -

Combining invasive species presence with susceptibility generated by timber harvest activities to determine relative risk of introduction.

For each alternative a matrix, use Figure below to determine relative risk of invasive species introduction associated with timber harvest activities in the first ten years for each fifth field watershed in the planning area. Within the matrix invasive plant species distribution categories (*Low, Limited,* and *Abundant*) and the susceptibility categories from timber harvest activities (*Low, Moderate, High*) are related to determine relative risk of introducing invasive plants in the fifth field watersheds as a result of timber harvest activities in the first ten years.

Watersheds with a combination of *Low* invasive species distribution and *Low* or *Moderate* susceptibility for introduction of invasive plants from timber harvest activities would have the lowest risk of invasion. Fifth field watersheds with the highest category for either distribution or susceptibility would have a greater risk of invasive species introduction than watersheds with lower categories.

The greatest risk of invasion would be in fifth field watersheds where both invasive species are *Abundant* and where the susceptibility of introducing invasive plants associated timber harvest activities would be *High*.

Species distribution categories	Susceptibility categories for introduction of invasive plants from timber harvest activities		
	Low	Moderate	High
Low	Low	Low	Moderately Low
Limited	Low	Moderate	Moderate
Abundant	Moderately Low	Moderate	High

Use a figure to show by alternative the relative risk of invasive plant introduction, from timber harvest activities in the first ten years, for each fifth field watershed.

The relative risk of invasive species introduction associated with timber harvest activities in the first ten years is summarized across the alternatives in Figure A where stacked columns show the relative amounts of fifth field watersheds in each of the risk categories.

Step 3

Determined the relative risk of introducing invasive plant species into riparian habitats over the first ten years of plan implementation as a result of timber harvest and associated management activities

A similar analytical process as the one used to determine risk associated with timber harvest activities under all alternatives is used to compare the risk of introducing invasive plants into riparian habitats.

Step 3a -

Weights were applied to the different Riparian Management Area prescriptions to compare the relative risk of invasive plant introduction into riparian areas as an inadvertent by-product of timber harvest activities.

Thinning would occur within the Riparian Management Areas and is a constant proportion of the total thinning acres under all alternatives. Therefore, the thinning acres used to determine the relative risk of introducing invasive plants into fifth field watersheds in the first ten years was also be used for the riparian habitat risk analysis.

Under Alternatives 2 and 3 Riparian Management Area (RMA) widths are 25 feet wide on either side of the intermittent streams which would result in the highest post-harvest shade levels. The analytical assumption for risk of invasive plant introduction in the intermittent RMAs under Alternative 2 and 3 is the shade levels in these intermittent RMAs would mimic the levels in the surrounding timber harvest units. The intermittent stream post-harvest shade levels would be lower under Alternatives 2 and 3 than under the No action alternative and Alternative 1.

Susceptibility weights for invasive plant introduction to riparian habitats associated with timber harvest activities under all alternatives were assigned using Table 242.

Table 242. Susceptibility weights for harvest activity types for introduction of invasive species into riparian areas

Alternative	Timber harvest type	Susceptibility weight
All Alts	Thinnings	1
Alts 2 & 3	Uneven age management Klamath Falls	1
Alt 3	Uneven age management Medford south of Grants Pass	1
Alts 2	Regeneration harvest	2
Alt 3	Partial Harvest	2

Step 3b -

For each alternative, the weights were multiplied by the number of acres modeled for harvest in the first ten years for each harvest type to generate a set of values describing the level of susceptibility for invasive plant introduction into riparian areas from the different timber harvest types.

Step 3c –

Likewise, for each alternative, the logging methods used for these harvesting activities were also be considered to generate riparian habitat susceptibility to invasion associated with these activities in riparian habitats.

Step 3d -

Together, the riparian susceptibility values associated with harvest types and logging methods determine the overall riparian susceptibility to invasion in the first ten years of plan implementation under each alternative.

These two values were multiplied together to generate a comprehensive susceptibility value. These values ranged between E and F and were divided into three equal categories: *high*, *medium* and *low*.

Step 3e -

The riparian susceptibility category and invasive plant distribution category were used to determine the relative risk of introducing invasive species in riparian habitats for the first ten years of plan implementation using the same methods described for timber harvest activities in *Step 2e* above.

Step 4

Determined the relative susceptibility of off-highway vehicle designation areas of having invasive plant introductions as a by-product of the designation.

Step 4a -

Assigned off-highway vehicle designation weights, as identified below, to each part of the fifth field watershed having a different off-highway vehicle designation.

Off-Highway Vehicle Designation Susceptibility weights:

Open/limited Off-Highway Vehicle emphasis and potential emphasis areas = 5

Limited = 3

Closed = 0

Step 4b -

Determine the relative susceptibility for inadvertent introduction of invasive species related to off-highway vehicle use as a by-product of the off-highway vehicle designations.

For the No action and Action alternatives, the susceptibility weights were multiplied by the number of acres modeled for each designation to generate a set of susceptibility values for the fifth field watersheds. These values ranged between E and F and were divided into three equal categories: *high*, *medium* and *low.*

Step 4c -

The riparian susceptibility category and invasive plant distribution category were used to determine the relative risk of introducing invasive species in fifth field watersheds using the same methods described for timber harvest activities in *Step 2e* above.

Step 5

Determined the susceptibility of fifth field watersheds to roadside invasive plant introductions from what we know about road densities, on all ownerships, and current invasive plant distribution categories.

Step 5a –

Divided road densities into classes based on the number of miles of road: < 2 miles/section, 2 – 4 miles/section, 4- 8 miles/section, >8 miles/section

Step 5b –

Used Table 243 to derive roadside susceptibility categories based on invasive plant distribution and road densities in fifth field watersheds.

Table 243. Roadside susceptibility categories based on invasive plant distribution and road densities in fifth field watersheds.

Species distribution categories	Road Densities			
	< 2 miles/ section	2 – 4 miles/ section	4 – 8 miles/ section	> 8 miles/ section
Low	Low	Low	Moderately Low	Moderate
Limited	Low	Moderate	Moderately High	High
Abundant	Moderately Low	Moderately High	High	High

Step 5c –

Figure R shows the relative roadside susceptibility categories for invasive plant introduction, for each fifth field watershed.

The relative susceptibility of invasive species introduction associated with road densities and current invasive plant distribution is shown in Figure V where columns show the relative amounts of fifth field watersheds in each of the susceptibility categories.

Step 6

Determined the risk to fifth field watersheds of roadside invasive plant introductions from their invasive plant distribution categories and the relative amounts of new road construction and road related activities, by alternative.

Step 6a –

Divide the amount of new road construction and road related activities evenly into three categories, *high*, *moderate* and *low*.

Step 6b –

Used the matrix in Table 244 to determine the relative risk categories of invasive plant introduction from the amounts of new road construction and road related activities and species distribution categories.

Table 244. Matrix to determine the relative risk categories of invasive plant introduction from new road construction and related activities

Species distribution categories	Relative Levels of Road Construction and Related Activities		
	Low	**Moderate**	**High**
Low	Low	Low	Moderately Low
Limited	Low	Moderate	Moderate
Abundant	Moderately Low	Moderate	High

Step 6c -

A figure will show the relative risk of invasive plant introduction from new road construction and road related activities based on species distribution categories, for each fifth field watershed and by alternative.

The relative risk of invasive species introduction associated with new road construction and related activities and species distribution categories to be shown in a figure.

Appendix G. Wildlife

This appendix provides background on the analysis of wildlife including detailed data from recovery plans, critical habitat for the northern spotted owl and marbled murrelet, and special status animal species.

In this appendix:

Management Opportunities on BLM-Administered Lands in the Recovery Plans for the Columbia White-tailed Deer (Columbia River population), Marbled Murrelet, and Bald Eagle. 1025

Data in Support of Northern Spotted Owl Analysis 1037

Marbled Murrelet Critical Habitat. 1060

Special Status Animal Species 1065

Management Opportunities on BLM-Administered Lands in the Recovery Plans for the Columbia White-tailed Deer (Columbia River population), Marbled Murrelet, and Bald Eagle.

Columbia white-tailed deer (Columbia River population)

The focus of the recovery strategy is on the national wildlife refuge lands and surrounding privately owned lands. Nothing has been excerpted from the recovery plan.

Marbled Murrelet

Portions excerpted from *Recovery Plan For The Threatened Marbled Murrelet (Brachyramphus marmoratus) In Washington, Oregon, And California* (pages 125-160 in USFWS 1997).

D. Narrative Outline for Recovery Actions.

1. Implement management plans for each Marbled Murrelet Conservation Zone

1.3 Oregon Coast Range Zone (Zone 3).

The Oregon Coast Range Zone extends from the Columbia River, south toNorth Bend, Coos County, Oregon. This Zone includes waters within 2 kilometers (1.2 miles) of the Pacific Ocean shoreline and extends inland a distance of up to 56 kilometers *(35* miles) from the Pacific Ocean shoreline and coincides with the "Zone 1" boundary line described by the Forest Ecosystem Management Assessment Team, with minor adjustments (U.S. Department of Agriculture *et al.* 1993). The boundary encompasses all of the marbled murrelet critical habitat units designated (the boundary extends slightly beyond 56 kilometers (35 miles) in certain areas.

This Zone includes the majority of known marbled murrelet occupied sites in Oregon. Marbled murrelet occupied sites along the western portion of the Tillamook State Forest are especially important to maintaining well distributed marbled murrelet populations. Efforts should focus on maintaining these occupied sites, minimizing the loss of unoccupied but suitable habitat, and

decreasing the time for development of new habitat. Relatively few known occupied sites occur north of the Tillamook State Forest. Recovery efforts should be directed at restoring some of the north-south distribution of marbled murrelet populations and habitat in this Zone. Maintenance of suitable and occupied marbled murrelet nesting habitat in the Elliott State Forest, Tillamook State Forest, Siuslaw National Forest, and Bureau of Land Management-administered forests is an essential component for the stabilization and recovery of the marbled murrelet.

1.4 Siskiyou Coast Range Zone (Zone 4).

The Siskiyou Coast Range Zone extends from North Bend, Coos County, Oregon, south to the southern end of Humboldt County, California. It includes waters within 2 kilometers (1.2 miles) of the Pacific Ocean shoreline (including Humboldt and Arcata bays) and, in general, extends inland a distance of 56 kilometers (35 miles) from the Pacific Ocean shoreline and coincides with the "Zone 1" boundary line described by the Forest Ecosystem Management Assessment Team with minor adjustments (U.S. Department of Agriculture *et al.* 1993). The boundary encompasses all of the marbled murrelet critical habitat units designated (the boundary extends slightly beyond 56 kilometers *(35* miles) in certain areas.

This Zone includes the marbled murrelet population occupying sites in Redwood National Park and several state parks (Jedediah Smith, Del Norte, Prairie Creek, Grizzly Creek, and Humboldt) in California. In addition, this Zone includes nesting habitat on private lands in southern Humboldt County. Additional marbled murrelet nesting habitat occurs at lower elevations in western portions of the Smith River National Recreation Area. State policies regarding protection of marbled murrelet occupied sites on private lands differ in the Oregon and California portions of this Zone.

Recovery actions should be focused on preventing the loss of occupied nesting habitat, minimizing the loss of unoccupied but suitable habitat, and decreasing the time for development of new suitable habitat. Much marbled murrelet nesting habitat is found in state and national parks that receive considerable recreational use. The need to maintain high quality marbled murrelet terrestrial habitat should be considered in planning any modifications to state or national parks for recreational purposes. Both highway and campground construction, including picnic areas, parking lots, and visitors centers, could present threats to the marbled murrelet through loss of habitat, nest disturbance, and/or increasing potential predation from corvids associated with human activities such as Steller's jays and crows. Implementing appropriate garbage/trash disposal may help decrease potential predator populations in high human use areas such as county, state and national parks.

This Zone has large blocks of suitable habitat critical to the three-state marbled murrelet population recovery over the next 100 years. However, the amount of suitable habitat protected in parks is probably not sufficient by itself to guarantee long-term survival of marbled murrelets in this Zone. On the other hand, a considerable amount of habitat is preserved in parks such that survival may be more likely in this Zone than in several other Zones. Private lands at the southern end of this Zone are important for maintaining the current distribution of the species. There is already a considerable gap in distribution between this area and the central California population in Zone 6. Efforts should be implemented to, at a minimum, not expand the current distribution gap.

2. Delineate and protect areas of habitat within each Zone.

Areas within each Zone that are essential for marbled murrelet recovery should be delineated and protected, using a variety of means (e.g., designation as critical habitat, protection through Habitat Conservation Plans, management [as reserves] under the Forest Plan, other existing regulatory mechanisms, etc.).

2.1 Protect terrestrial habitat essential for marbled murrelet recovery.

There appears to be little opportunity for increases in marbled murrelet productivity as a result of forest maturation in the near future. Even under optimum conditions and with the successful use of various silvicultural techniques, it will take 50 to 100 years or more to develop new suitable nesting habitat within most reserve areas. Any further substantial reduction in occupied nesting habitat for the marbled murrelet would hamper efforts to stabilize the population and the recovery of the species.

Marbled murrelet population trends described above (also see Appendix B) have led the U.S. Fish and Wildlife Service to conclude that a number of areas, including nesting areas and feeding sites well-distributed throughout its terrestrial and marine range, are essential to the conservation of the species. Late-Successional Reserves, as described in the Forest Plan and the final rule designating critical habitat for marbled murrelets, will eventually contribute to recovery. However, these areas alone are insufficient to reverse the decline and maintain a well-distributed population. Thus, additional areas, including non-Federal lands and marine areas, should be protected using a variety of means including critical habitat, Habitat Conservation Plans, and other existing regulatory mechanisms as described below. If these areas are protected, there is a high likelihood that populations will stabilize.

A. Essential nesting habitats that occur on forest lands managed by the Federal government include:

(1) Any suitable habitat in Late-Successional Reserves located in the Forest Ecosystem Management Assessment Team Zone 1 (see pages IV-23 and IV-24 in U.S. Department of Agriculture *et al.* 1993 for a description of Zone 1);

(4) Other large areas of suitable nesting habitat outside of Late-Successional Reserves on Federal lands. For example, large areas of suitable nesting habitat occur on the Siskiyou National Forest, Oregon, the Six Rivers National Forest, California, and in Redwood National and State Park, California.

2.3 Develop and implement a landscape management strategy for each of the six Conservation Zones.

Although many of the factors that have contributed to the decline of marbled murrelet populations in the three-state area are common to all zones, each zone presents unique challenges to the recovery of the species. For example, mortality resulting from incidental capture in net fisheries is a major concern in Zone 1, mortality from oil spills is a major concern in Zones 2 and 6, and potential loss of key suitable nesting habitat on non-Federal lands is of major concern for all Zones. A landscape management plan that addresses the unique circumstances of each Zone should be developed, taking into consideration all affected parties (Federal, state, tribal, private, etc.).

2.3.1 Develop and implement management plans that incorporate the needs of the marbled murrelet for each protected habitat area on Federal lands.

Each protected habitat area within a particular Zone may have unique ecological features and exists in a unique spatial context with lands that may be managed for a variety of values. It is important that these unique characteristics be addressed in the context of a management plan for each of these areas, including the development of appropriate definitions of suitable marbled murrelet habitat for each Zone. In the development of these plans for each Zone, all managers should have an opportunity to be involved, regional issues must be considered, and recovery objectives must be addressed in a consistent manner throughout the range. In some cases, these management plans could be developed using information from the Late-Successional Reserve assessments called for in the Forest Plan Record of Decision.

Management plans should be based on the best available information on the biology and recovery needs of the marbled murrelet and should be able to adapt to new information as it becomes available. For example, a variety of management activities could decrease predation mortality at marbled murrelet nests (e.g., silvicultural practices designed to provide shelter to nest sites or to speed development of murrelet habitat; garbage removal from state and national parks). Efforts to reduce or eliminate these manmade food sources in state and national parks are currently being discussed. As successful strategies are developed to reduce predation at the nest, they should be incorporated into management plans for specific secured areas. An outline of specific management recommendations is provided in task 3.

3. Incorporate management recommendations for protected habitat areas.

Management recommendations for the marbled murrelet need to address two different biological time frames, which reflect (1) aspects o the murrelet's life history and demographic trends, and (2) the length of time required to develop the majority of new nesting habitat or improve current forest habitat conditions. Short-term actions must address the apparent rapid decline of current populations and the need for immediate stabilization. The ability of marbled murrelet populations to recover rapidly is low due to the low reproductive potential of the species. Long-term actions address the long time-frames required to cultivate or enhance mature forest habitat conditions or to improve marine habitat quality because of the nature and complexity of these ecosystems. Little additional older forest habitat will become available until after 2040.

3.1 Implement short-term actions to stabilize and increase the population.

3.1.1 Maintain/protect occupied nesting habitat and minimize loss of unoccupied but suitable nesting habitat.

3.1.1.1 Maintain occupied nesting habitat.

The loss of occupied nesting habitat appears to be the primary cause of marbled murrelet population declines in Washington, Oregon, and California. The low reproductive potential of this species, and lack of knowledge concerning its ability to locate and reestablish new nesting areas after elimination of nesting habitat, makes it imperative to maintain all occupied nesting habitat, as is being done, for the most part, through implementation of the Forest Plan on Forest Service and Bureau of Land Management lands.

On non-Federal lands the maintenance of all occupied sites also should be the goal. However, it is realized that through the Habitat Conservation Plan process, there may be some limited loss of occupied sites or unsurveyed suitable habitat. In the short-term (the next 5 - 10 years), until additional information is obtained, loss of any occupied sites or unsurveyed suitable habitat should be avoided or the potential impacts significantly reduced through a habitat evaluation and ranking process outlined in the Habitat Conservation Plan.

Short term trade-offs for long-term benefits should be evaluated very carefully at this early stage of marbled murrelet recovery and should be done on a case-by-case basis.

3.1.1.2 Maintain potential and suitable habitat in larger contiguous blocks while maintaining current north/south and east/west distribution of nesting habitat.

By maintaining occupied sites and suitable habitat in larger blocks with low levels of fragmentation, several objectives will be met. Larger stands will (1) have more nesting and hiding opportunities, (2) provide for multiple alternative nesting sites for individual pairs of birds over time, (3) facilitate nesting for multiple pairs of birds (and thus promote increased social contact), and (4) provide greater interior forest habitat conditions (to reduce potential nest and adult predation, increase protection of nests from windstorms and environmental changes, and reduce loss of habitat from windthrow and fire). Larger stands also may provide a core of birds to attract or develop sufficient activity and eventual nesting by subadults or nonbreeding adult birds to replace breeding adults lost from this habitat over time due to natural causes or human activities. The more contiguous the habitat distribution, the lower the likelihood of future large gaps in distribution of the species due to catastrophic events such as oil spills or large wildfires. Preventing further erosion of the already patchily-distributed nesting habitat is a key element in buffering the species against such catastrophic events. This is especially important in areas where gaps already occur. Furthermore, it is currently unknown how nesting success differs with distance from the coast, and far inland habitats may be as important to species survival as those nearer to shore. Therefore, it is important to maintain both north/south and east/west distribution of suitable habitat.

3.1.1.3 Maintain and enhance buffer habitat surrounding occupied habitat.

Maintaining buffers around occupied habitat will mediate the effects of edge by helping to reduce environmental changes within the stand, reduce loss of habitat from windthrow and fire, reduce fragmentation levels, increase the amount of interior forest habitat available, and potentially help reduce predation at the nest. To have the greatest benefits, buffer widths should be a minimum of 300-600 feet and should consist of whatever age stand is present, including existing plantations (which should be managed to provide replacement.

3.1.3 Minimize nest disturbances to increase reproductive success.

Low juvenile:adult ratios have been documented throughout the three-state range of the marbled murrelet (Appendix B). Current evidence suggests that the cause of this low reproductive rate may be due to high rates of predation on eggs, young, and possibly adults at the nest site. Population modeling indicates that adjusted juvenile:adult ratios should be 15 - 22 percent at a minimum to result in stable or increasing

populations. Current best estimates of unadjusted ratios average 5 percent (range 0.1 - 13.8 percent) and it is unlikely that adjustment will result in 4 - 10 times larger ratios. Breeding adult alcids in general are sensitive to nest site disturbance during the incubation period and the first few days of chick rearing. Disturbances near marbled murrelet nest sites that flush incubating or brooding adults from the nest site may expose adults and young to increased predation or accidental loss of eggs or nestlings by falling or being knocked out of nests. Human activities near nesting areas that result in an increase in the number of predators also could lead to a greater likelihood of nest predation. The timing of disturbances should be adjusted to avoid disruption of marbled murrelet activities, such as courtship, mating, and nesting. Human activities should be modified to reduce attraction of predators to specific forest areas although this action may not reduce actual predator numbers over wider areas. Higher-than normal predation levels are likely to occur in nesting habitat due to forest fragmentation and other causes in many cases.

3.2 Implement long-term actions to stop population decline and increase population growth.

3.2.1 Increase the amount and quality of suitable nesting habitat.

An increase in amount and quality of suitable nesting habitat is important in all zones. However, it is especially important in the western Washington Coast Range and the northern portions of the Oregon Coast Range Zones. In these areas, remaining patches of suitable nesting habitat are relatively small and fragmented, involve private and state lands, and are vitally important for maintaining the current small populations in these areas; thus, blocking up habitat is needed to increase patch size. It also would be desirable to increase and block up suitable nesting habitat in the Mendocino and Santa Cruz Mountains Zones. Little habitat remains outside parks in these two zones, such that an increase in the short term does not appear feasible.

3.2.1.1 Decrease fragmentation by increasing the size of suitable stands to provide a larger area of interior forest conditions.

The majority of suitable nest stands currently exist as small islands within a matrix of younger forests. Although these fragments will provide critically important habitat during the several decades required for younger stands to develop structural characteristics suitable for marbled murrelet nesting, they cannot be considered high quality habitat because of vulnerability to wildfire and windthrow, and perhaps a higher abundance of avian predators. Research is needed to develop judicious ways to use silvicultural techniques such as thinning in young (nonhabitat) stands to hasten development of large trees and decrease vulnerability of habitat fragments to fire, wind, and perhaps predators. Consistent with the Forest Plan Record

of Decision, thinning within Late-Successional Reserves should be restricted to stands younger than 80 years. However, the Record of Decision also permits thinning within Late-Successional Reserves up to age 110 in Coast Range lands administered by the Bureau of Land Management (Nestucca block) and in the Oregon and California Klamath Provinces (U.S. Department of Agriculture and U.S. Fish and Wildlife Service 1994b). Unthinned buffers should be left around any occupied stands. Precautions should be taken to reduce fire hazard from thinning slash and avoid soil compaction.

3.2.1.2 Protect "recruitment" nesting habitat to buffer and enlarge existing stands, reduce fragmentation, and provide replacement habitat for current suitable nesting habitat lost to disturbance events.

Stands (currently 80 years old or older) that will produce suitable habitat within the next few decades are the most immediate source of new habitat and may be the only replacement for existing habitat lost to disturbance (e.g., timber harvest, fires, etc.) over the next century. Such stands are particularly important because of the vulnerability of many existing habitat fragments to fire and wind and the possibility that climate change will increase the effects of the frequency and severity of natural disturbances. Such stands should not be subjected to any silvicultural treatment that diminishes their capacity to provide quality nesting habitat in the future. Within secured areas, these "recruitment" stands should not be harvested or thinned. In the matrix (on Federal lands), harvest in younger-aged stands should adhere to the techniques discussed in the following task (3.2.1.3) to more quickly develop into marbled murrelet habitat.

3.2.1.3 Use silvicultural techniques to increase speed of development of new habitat.

Nesting marbled murrelets select stands with large trees that provide suitable nesting platforms (large, protected branches, preferably with moss). When available, large stands appear to be preferred over small ones. Nests have been located in stands with a wide range of stocking densities, however the low rate of nesting success raises considerable uncertainty regarding what constitutes quality habitat. It is expected that since marbled murrelets require very specific structures in order to successfully nest, silvicultural techniques may be available to speed the development of these structures in stands of younger forest.

Several silvicultural techniques may be appropriate to increase the area of suitable nesting stands and the rate at which they develop (e.g., thinning, long rotations, etc.). Thinning accelerates tree growth and can be used as a tool to produce large trees more quickly than in normal stand development. However, simply growing large trees is not

sufficient to obtain suitable marbled murrelet habitat. Trees must have large moss-covered, or mistletoed branches that provide nest platforms, something that is likely to be achieved only by growing at least some trees on long rotations. There are two alternatives for doing that (1) "Green-tree retention" designates approximately 20 - 40 trees per hectare to be retained at harvest, with a new crop of younger trees established beneath the older tree canopy. Leaving trees on site and allowing them to grow to an older age will likely produce marbled murrelet nest trees and eventually produce coarse woody debris (important habitat for numerous other species). As younger trees mature, a multilayered canopy develops, which is also an important structural attribute of older forest habitat; and (2) evidence available at this time indicates that growing whole stands on long rotations will produce higher quality habitat in the long-term than green tree retention, which may create sink habitat for a number of bird species. Long rotations have other ecological and economic benefits as well. Landscapes with a higher proportion of older stands should be less susceptible to catastrophic wildfire (providing reduced hazard from thinning slash). Because thinned Douglas-fir maintains good growth well into its second century, silviculturists now conclude that long rotations are economically viable in the Douglas-fir region.

3.2.2 Improve Distribution of Nesting Habitat.

3.2.2.1 Improve and develop north/south distribution of nesting habitat.

Improving the distribution of nesting habitat helps to buffer existing populations against poor breeding success and catastrophic loss and probably facilitates gene flow among separated populations. Three major gaps in existing habitat are particularly apparent: (1) from the southern Olympic Peninsula in Washington to Tillamook in northwestern Oregon; (2) between Patrick's Point and southern Humboldt Bay in northern California (see Figure 1); and (3) throughout most of the Mendocino Zone and the northern part of the Santa Cruz Mountains Zone (between southern Humboldt County and central San Mateo County). These three geographic gaps represent probable partial barriers to gene flow across them. They include large areas of second-growth forests that originated after logging, from fire (parts of northwestern Oregon), or from natural discontinuities of nesting habitat (especially parts of northern and central California). Gap areas often have a high proportion of private lands and little or no Federal land. State lands cover significant portions of northwest Oregon (the Tillamook and Clatsop State Forests) and southwest Washington. Silvicultural techniques to create suitable habitat at both the stand and landscape level (discussed in task 3.2.1.3) may be particularly beneficial to marbled murrelet recovery in the long term if applied in these areas.

Portions of the Mendocino Zone and Santa Cruz Mountains Zone also contain blocks of unsuitable habitat that probably naturally created small gaps in the murrelet's terrestrial range. Again, loss of suitable habitat around these small natural gaps has greatly widened them. These gaps have probably grown together and eliminated suitable nesting habitat over a large section of their range. The existence of small natural gaps in suitable habitat must be recognized when designing ways to improve and develop north/south distribution of nesting habitat.

3.2.2.2 Improve and develop east/west distribution of nesting habitat.

Improving east-west distribution means filling in habitat gaps within the Conservation Zone boundaries described earlier. Many portions of the species range no longer have large amounts of suitable nesting habitat close to the coast and marbled murrelets must fly considerable distances inland to nest. In addition to the north-south gaps discussed above, opportunities exist on the Olympic Peninsula, Puget trough, and along virtually the entire California coast within the murrelet's range to improve the current east/west distribution of habitat. An important step in developing methods to improve this distribution will be the complete identification of the inland boundary of suitable nesting habitat for the three-state area and identification of factors determining these boundaries in different regions.

Bald Eagle

Portions excerpted from *Recovery Plan for the Pacific Bald Eagle* (pages 73-83 in USFWS 1985).

1. Provide Secure Habitat

Providing secure habitat for eagles involves identifying important habitat, arranging for its long-term protection, and managing it to ensure that its components (e.g., food, nest sties, roost trees) are maintained and enhanced.

1.2 Secure Breeding and Nonbreeding Habitat

Much of the bald eagle habitat in the Pacific recovery area is threatened by development and is not adequate protected by legal statutes. Land use and zoning policies can provide protection in some situations. In others, transfer from private to public ownership must be considered. Habitats in public ownership should be recognized and give priority consideration by agencies. Local working teams (see step 1.26) should play a strong role in all efforts to secure habitat.

1.2.2 Establish Reserves and Management Areas Where Necessary

This approach may be most suitable where human disturbance is a limiting factor for eagles; where intensive, long-term management activities are needed; or where eagle management is being featured over other land management options.

1.2.3 Incorporate Eagle Habitat Guidelines in Agency Land Use Plans

The Bureau of Land Management (BLM) should retain and manage habitat on BLM-administered public lands to benefit bald eagles and compatible uses in accordance with the Federal Land Policy and Management Act (FLPMA). These lands should be identified as important eagle habitat in the Resource Management Planning (RMP) process. The BLM should seriously consider designating all or parts of these areas as "Areas of Critical Environmental Concern".

1.2.5 Design and Implement Plans to Secure Individual Nest Sites, Roosts, and Foraging Areas

Plans must be developed on a site-specific basis throughout the recovery area. Plans should describe the human activities that can be permitted as well as those that must be prohibited. They should also describe the steps needed to protect and secure hey habitat such as nests, roosting trees and food resources. Each plan should include a map outlining the important eagle use areas and a list of appropriate methods for protecting suitable nesting, foraging, and roosting habitat over time.

1.3.2 Maintain and Improve Forested Habitat in Bothe the Breeding and Wintering Range

Timber stands should be managed to promote habitat characteristics required by eagles for long-term nesting and roosting. In most cases, this requires management for old-growth stands. Silvicultural techniques, such as thinning or selective harvest, can help to create proper tree species composition and stand structure. The important element of any silvicultural plan should be to maintain an old growth overstory in the vicinity of nest sties and communal roosts. Development and maintenance of potential eagle habitat is as important as protection and maintenance of habitat currently used by eagles.

1.3.2.1 Maintain Forested Habitat that is Presently Used by Eagles

Habitat loss is currently the most significant threat to bald eagle populations in the 7-state recovery area. The increasing disappearance of old growth stands makes it imperative that existing habitat be protected. In some cases special actions must be taken to maintain existing habitat.

1.3.2.1.1 Prohibit Logging of Known Nest Trees, Perch Trees, and Winter Roost Trees

Trees used by eagles should be clearly identified and protected from logging. In addition, trees that provide wind breaks, that visually shield eagles from disturbances, or that are needed for long-term viability of eagle sue areas must be maintained. Trees with unoccupied nests in suitable habitat and trees which formerly had nests should also be protected because these sites are sometimes used after several years of abandonment and will be important in providing habitat for expanding populations.

1.3.3 Restrict Human Disturbance at Eagle Use Areas

Human activities are known to disrupt eagle activity patterns and in some cases cause reproductive failure. In spite of this, any eagles nest and winter near human population centers. Many types of human disturbances at the right distances are compatible with eagles. Regulation of human activity is a critical part of eagle habitat management.

1.3.3.1 Establish Buffer Zones Around Nest Sites

Buffer zones should be established for individual nest territories based on the location of nest trees, perch trees, and flight paths, as well as stand characteristics, known individual tolerances, and weather patterns.

Until site specific plans are available or until guidelines can be developed by local groups or agencies, guidelines prepared by the U.S. Fish and Wildlife Service Region 1 should serve as minimum protective measures.

1.3.3.2 Exclude Logging, Construction, Habitat Improvement, and Other Activities During Critical Periods of Eagle Use

Picnicking, camping, blasting, firearm use, timber harvest, and low level aircraft operations should not be allowed within 400 meters of nests and roosts during periods of eagle use. These activities should also be regulated up to 800 meters from nests and roosts where eagles have line-of-sight vision. Critical nesting periods vary throughout the recover area but generally fall between 1 January an 31 August. Key wintering areas need protection from disturbance from approximately 15 November to 15 March.

Data in Support of Northern Spotted Owl Analysis

The following section contains background information regarding the northern spotted owl analysis found in Chapter 4. It includes a description of the suitable habitat addressed in section 7 consultations from 1994 to April 12, 2004; available nesting, roosting, and foraging habitat on BLM-administered lands, a description of how the alternatives affect individual critical habitat units; and how lands were classified as owl habitat under Alternative 3.

Suitable habitat addressed in Section 7 Consultation from 1994 – April 12, 2004

Table 245. Aggregate results of all adjusted, suitable habitat (NRF1) acres addressed in section 7 consultation (both formal and informal) for the northern spotted owl; baseline and summary of effects by State, physiographic province and land use function from 1994 to April 12, 2004 (the first decade of the Northwest Forest Plan) (USFWS pers com. 2006).

Physiographic Province[4]		Evaluation Baseline[2]			Habitat Removed/Downgraded[3]			% Provincial Baseline Affected	% Range-wide Affected
		Reserves[5]	Non-Reserves6	Total	Reserves[5]	Non-Reserves[6]	Total		
WA	Olympic Peninsula	548,483	11,734	560,217	67	24	91	-0.02	0.05
	Eastern Cascades	506,340	200,509	706,849	1,746	4,222	5,968	-0.84	3.13
	Western Cascades	864,683	247,797	1,112,480	249	10,952	11,201	-1.01	5.88
	Western Lowlands	0	0	0	0	0	0	0	0
OR	Coast Range	422,387	94,190	516,577	399	4,145	4,544	-0.88	2.39
	Klamath Mountains	448,509	337,789	786,298	2,434	80,394	82,828	-10.53	43.5
	Cascades East	247,624	196,035	443,659	1,813	12,216	14,029	-3.16	7.37
	Cascades West	1,012,426	1,033,337	2,045,763	2,926	52,514	55,440	-2.71	29.11
	Willamette Valley	593	5,065	5,658	0	0	0	0	0
CA	Coast	47,566	3,928	51,494	181	69	250	-0.49	0.13
	Cascades	61,852	2,6385	88,237	0	4,808	4,808	-5.45	2.52
	Klamath	734,103	345,763	1,079,866	1,470	9,800	11,270	-1.04	5.92
Total		4,894,566	2,502,532	7,397,098	11,285	179,144	190,429	-2.57	100

[1] Nesting, roosting, foraging habitat. In California, suitable habitat is divided into two components; nesting – roosting (NR) habitat, and foraging (F) habitat. The NR component most closely resembles NRF habitat in Oregon and Washington. Due to differences in reporting methods, effects to suitable habitat compiled in this, and all subsequent tables include effects for nesting, roosting, and foraging (NRF) for 1994-6/26/2001. After 6/26/2001, suitable habitat includes NRF for Washington and Oregon but only nesting and roosting (NR) for California.

[2] 1994 FSEIS baseline (USDA and USDI 1994).

[3] Includes both effects reported by USDI FWS (2001) and subsequent effects compiled in the Northern Spotted Owl Consultation Effects Tracking System (web application and database).

[4] Defined by the NWFP as the twelve physiographic provinces, as presented in Figure 3&4-1 on page 3&4-16 of the FSEIS.

[5] Land-use allocations intended to provide large blocks of habitat to support clusters of breeding pairs.

[6] Land-use allocations intended to provide habitat to support movement of spotted owls among reserves.

Table 246. Change in suitable spotted owl habitat from 1994 to April 12, 2004, resulting from Federal management actions (Mgmt) and natural events by physiographic province (USFWS pers. com. 2006).

Physiographic Province	Range of Northwest Forest Plan (Acres)	Causes of Habitat Loss		Total Change in Acres	Percent change by Province	Percent of Total Effects[3]
		Mgmt[1]	Natural Events[2]			
Olympic Peninsula	560,217	-91	-299	-390	-0.07	0.10
WA East Cascades	706,849	-5,968	-5,754	-11,722	-1.66	3.14
WA West Cascades	1,112,480	-11201	0	-11,201	-1.01	3.00
Western Lowlands	0	0	0	0	0.00	0.00
OR Coast	516,577	-4,544	-66	-4,610	-0.89	1.23
OR Klamath Mountains	786,298	-82,828	-117,622	-200,450	-25.49	53.61
OR Cascades East	443,659	-10,595	-22,638	-33,233	-7.49	8.89
OR Cascades West	2,045,763	-55,440	-24,583	-80,023	-3.91	21.40
Willamette Valley	5,658	0	0	0	0.00	0.00
CA Coast	51,494	-250	-100	-350	-0.68	0.09
CA Cascades	88,237	-4,808	0	-4,808	-5.45	1.29
CA Klamath	1,079,866	-11,270	-15,869	-27,139	-2.51	7.26
TOTAL	7,397,098	-186,995	-186,931	-373,926	-4.85	100.00

1 Estimates from the NSO consultation effects tracker (Service 2005).
2 Data compiled by the USDI Fish and Wildlife Service, Northern Spotted Owl Coordination Group.
3 Provincial effect expressed as percentage of total range-wide effects.

Table 247. Aggregate results of all adjusted, suitable critical habitat acres affected by Section 7 Consultation for the Northern spotted owl; baseline and summary of effects by state, Physiographic Province and land use function from 1994 to July 19, 2005 (USFWS pers. comm. 2006).

Physiographic Province[3]		Evaluation Baseline[1]			Habitat Removed/Downgraded[2]			% Provincial Baseline Affected	% Range-wide Affected
		Reserves[4]	Non-Reserves[5]	Total	Reserves[4]	Non-Reserves[5]	Total		
WA	Olympic Peninsula	193,081	3,928	197,009	-12	-59	-71	-0.04	0.15
	Eastern Cascades	225,855	100,737	326,592	-87	-4,549	-4,636	-1.42	9.88
	Western Cascades	424,273	90,305	514,578	-3	-4,991	-4,994	-0.97	10.64
	Western Lowlands	0	0	0	0	0	0	0	0
OR	Coast Range	332,562	16,155	348,717	-50	-1,200	-1,250	-0.36	2.66
	Klamath Mountains	228,112	85,157	313,269	-4	-12,923	-12,927	-4.13	27.54
	Cascades East	86,882	51,802	138,684	-334	-1,372	-1,706	-1.23	3.63
	Cascades West	532,571	361,563	894,134	-122	-19,959	-20,081	-2.25	42.78
	Willamette Valley	0	0	0	0	0	0	0	0
CA	Coast	2,589	27	2,616	0	0	0	0	0
	Cascades	47,947	2,740	50,687	0	-472	-472	-0.93	1.01
	Klamath	322,372	33,329	355,701	0	-808	-808	-0.23	1.72
Total		2,396,244	745,743	3,141,987	-612	-46,333	-46,945	-1.49	100

1 1994 FSEIS baseline (USDA and USDI 1994).

2 Includes both effects reported in USDI FWS 2001 and subsequent effects reported in the Northern Spotted Owl Consultation Effects Tracking System (web application and database.)

3 Defined by the Northwest Forest Plan as the twelve physiographic provinces, as presented in Figure 3&4-1 on page 3&4-16 of the FSEIS.

4 Land-use allocations intended to provide large blocks of habitat to support clusters of breeding pairs.

5 Land-use allocations intended to provide habitat to support movement of spotted owls among reserves.

Table 248. Change in northern spotted owl suitable critical habitat from 1994 to December 10, 2004, resulting from Federal management actions and natural events by physiographic province. (USFWS pers. comm. 2006)

Physiographic Province	1994 FSEIS Provincial Critical Habitat Baseline	Critical Habitat (acres) Removed/Downgraded, 1994-2004				Percent of 1994 FSEIS Provincial Critical Habitat Baseline	Percent of all Rangewide Habitat Effects
		Management	Fire	Insect/ Disease	Total		
WA:							
Olympic Peninsula	197,009	71	0	0	71	0.04	0.08
East Cascades	326,592	1,035	6,925[1,2]	532	8,492	2.60	9.67
West Cascades	514,578	4,994	0	0	4,994	0.97	5.69
Western Lowlands	0	0	0	0	0	0.00	0.00
OR:							
Coast Range	348,717	1,224	0	0	1,224	0.35	1.39
Klamath Mountains	313,269	13,912	17,453	0	31,365	10.01	35.72
Cascades East	138,684	1,706	6,878[2]	0	8,584	6.18	9.78
Cascades West	894,134	21,003	1,216	0	22,219	2.48	25.31
Willamette Valley	0	0	0	0	0	0.00	0.00
CA:							
Coast Range	2,616	0	0	0	0	0.00	0.00
Cascades	50,687	365	0	0	365	0.72	0.41
Klamath	355,701	808	9,675	0	10,483	2.95	11.95
Total	3,141,987	45,118	42,147	532	87,797	2.79	100.00

[1] Habitat effects from some 1994 fires were included in the 2001 update, and thus, appear as consulted-on effects in the NSO Consultation Effects Tracking Database. For the purpose of this critical habitat update, habitat effects associated with those fires are included in the fire effects column.

[2] Includes fires in 2003.

Northern Spotted Owl Critical Habitat Units

The Endangered Species Act requires the U.S. Fish and Wildlife Service to designate critical habitat to the maximum extent prudent and determinable concurrently with listing a species as endangered or threatened. The U.S. Fish and Wildlife Service listed the northern spotted owl as a threatened species on June 28, 1990, primarily due to concern over widespread habitat loss and modification, and inadequacy of existing regulatory mechanisms. The U.S. Fish and Wildlife Service designated as critical habitat for the northern spotted owl 3,257,000 acres of federal lands in Oregon, including 1,009,000 acres of BLM-administered land (Federal Register. 1992a).

Critical habitat is defined in the Endangered Species Act as: "(i) the specific areas within the geographic area occupied by a species … on which are found those physical and biological features (I) essential to the conservation of the species, and (II) that may require special management considerations or protection; and (ii) specific areas outside the geographical area occupied by a species … upon determination by the Secretary that such areas are essential for the conservation of the species" (Endangered Species Act of 1973, as amended, Sec. 3(5)(A)).

The Endangered Species Act directs Federal agencies to insure that their actions are not likely to result in the "destruction or adverse modification" of designated critical habitat (Endangered Species Act of 1973, as amended, Sec. 7(a)(2)).

None of the alternatives align land use allocations with designated critical habitat units or include management direction specific to designated critical habitat units. Therefore, the amount of suitable habitat within the critical habitat units would result from the land use allocations and management direction in each alternative as it overlays the designated critical habitat units. . As a result, the development of suitable habitat within critical habitat units would not show consistent patterns for any of the alternatives.

Currently, critical habitat units average suitable habitat on 55% of the habitat-capable acres on BLM-administered lands. The only critical habitat units that have more than 90% suitable habitat are two units which have less than 5 acres of BLM-administered lands each.

Under the No Action alternative, the average suitable habitat on BLM-administered lands in critical habitat units would steadily increase to an average of 82% of the habitat-capable acres on BLM-administered lands by 2106. 25 of the 51 critical habitat units would have more than 90% suitable habitat by 2106. On 10 of the 51 critical habitat units, the amount of suitable habitat would decrease from current amounts at some time over the next 100 years.

Under Alternative 1, the average suitable habitat on BLM-administered lands in critical habitat units would decline to 54% in 2016, and then steadily increase to 72% of the habitat-capable acres on BLM-administered lands by 2106. 22 of the 51 critical habitat units would have more than 90% suitable habitat by 2106. On 20 of the 51 critical habitat units, the amount of suitable habitat would decrease from current amounts at some time over the next 100 years.

Under Alternative 2, the average suitable habitat on BLM-administered lands in critical habitat units would decline to 51% in 2016, and then fluctuate until reaching an average of 54% of the habitat-capable acres on BLM-administered lands by 2106. 12 of the 51 critical habitat units would have more than 90% suitable habitat by 2106. On 30 of the 51 critical habitat units, the amount of suitable habitat would decrease from current amounts at some time over the next 100 years.

Under Alternative 3, the average suitable habitat on BLM-administered lands in critical habitat units would decline to 54% in 2016, and then fluctuate until reaching an average of 53% of the habitat-capable acres on BLM-administered lands by 2106. 3 of the 51 critical habitat units would have more than 90% suitable habitat by 2106. On 33 of the 51 critical habitat units, the amount of suitable habitat would decrease from current amounts at some time over the next 100 years.

Table 249. Suitable Habitat within Critical Habitat Units OR-9 – OR-23, by alternative

Critical Habitat Unit	Habitat-capable acres		% of habitat-capable				
			2006	2016	2026	2056	2106
OR-9	18	No Action	11	17	17	72	94
		Alt 1	11	22	22	72	94
		Alt 2	11	22	22	67	94
		Alt 3	11	22	22	72	94
OR-10	201	No Action	69	57	57	37	49
		Alt 1	69	53	27	20	23
		Alt 2	69	64	55	37	17
		Alt 3	69	51	32	19	35
OR-12	22,988	No Action	66	67	67	83	95
		Alt 1	66	66	67	80	94
		Alt 2	66	56	54	62	56
		Alt 3	66	60	52	66	63
OR-14	35,522	No Action	60	60	62	83	92
		Alt 1	60	56	58	78	85
		Alt 2	60	49	41	46	32
		Alt 3	60	47	43	51	46
OR-16	4,339	No Action	70	76	73	73	74
		Alt 1	70	57	47	49	42
		Alt 2	70	43	18	24	39
		Alt 3	70	76	68	40	78
OR-18	2	No Action	100	50	50	50	100
		Alt 1	100	50	50	50	100
		Alt 2	100	50	50	50	50
		Alt 3	100	100	50	50	100
OR-20	9,572	No Action	31	43	53	72	71
		Alt 1	31	37	45	57	37
		Alt 2	31	42	44	39	29
		Alt 3	31	44	53	79	53
OR-21	1,894	No Action	43	47	48	80	66
		Alt 1	43	26	25	49	39
		Alt 2	43	37	34	45	22
		Alt 3	43	51	51	71	48
OR-22	5,050	No Action	30	47	54	75	59
		Alt 1	30	40	40	50	28
		Alt 2	30	40	40	47	22
		Alt 3	30	49	58	73	47
OR-23	8,310	No Action	26	34	52	68	54
		Alt 1	26	29	46	38	30
		Alt 2	26	36	56	82	96
		Alt 3	26	36	54	65	39

Table 250. Suitable Habitat within Critical Habitat Units OR-24 – OR-38, by alternative

Critical Habitat Unit	Habitat-capable acres	Alternative	% of habitat-capable				
			2006	2016	2026	2056	2106
OR-24	6,436	No Action	32	34	40	51	49
		Alt 1	32	30	32	48	42
		Alt 2	32	36	35	44	28
		Alt 3	32	33	37	51	61
OR-25	53,731	No Action	62	62	63	79	95
		Alt 1	62	60	61	75	92
		Alt 2	62	57	54	64	70
		Alt 3	62	53	45	47	53
OR-27	12,903	No Action	58	51	57	60	52
		Alt 1	58	46	47	50	48
		Alt 2	58	56	44	47	36
		Alt 3	58	55	61	51	51
OR-29	11,122	No Action	71	64	62	57	49
		Alt 1	71	66	63	40	37
		Alt 2	71	65	57	22	23
		Alt 3	71	56	47	20	21
OR-31	1,608	No Action	65	61	56	59	55
		Alt 1	65	45	44	36	44
		Alt 2	65	60	60	14	29
		Alt 3	65	58	56	51	59
OR-32	64,955	No Action	53	56	57	69	86
		Alt 1	53	56	57	66	82
		Alt 2	53	53	50	55	60
		Alt 3	53	51	46	53	47
OR-34	35,982	No Action	57	66	64	71	89
		Alt 1	57	60	57	61	81
		Alt 2	57	53	38	23	37
		Alt 3	57	55	53	62	44
OR-36	7,093	No Action	61	60	52	44	47
		Alt 1	61	52	46	41	18
		Alt 2	61	58	49	24	11
		Alt 3	61	60	49	46	29
OR-37	27,864	No Action	71	74	70	60	61
		Alt 1	71	70	63	42	32
		Alt 2	71	69	63	47	31
		Alt 3	71	60	47	40	41
OR-38	34,740	No Action	61	70	72	76	78
		Alt 1	61	66	65	67	72
		Alt 2	61	65	64	65	70
		Alt 3	61	66	66	72	87

Table 251. Suitable Habitat within Critical Habitat Units OR-39 – OR-50, by alternative

Critical Habitat Unit	Habitat-capable acres	Alternative	% of habitat-capable				
			2006	2016	2026	2056	2106
OR-39	7,207	No Action	57	64	70	94	100
		Alt 1	57	64	70	90	99
		Alt 2	57	56	56	62	53
		Alt 3	57	62	64	69	60
OR-40	34	No Action	0	0	0	100	100
		Alt 1	0	0	0	100	100
		Alt 2	0	0	0	100	35
		Alt 3	0	0	0	100	35
OR-41	36,989	No Action	50	53	56	88	100
		Alt 1	50	53	56	87	100
		Alt 2	50	52	55	91	100
		Alt 3	50	50	48	65	57
OR-43	224	No Action	12	31	92	99	100
		Alt 1	12	31	92	99	61
		Alt 2	12	33	90	67	68
		Alt 3	12	33	88	74	36
OR-44	26,418	No Action	22	33	63	92	98
		Alt 1	22	30	52	89	98
		Alt 2	22	32	55	90	98
		Alt 3	22	34	60	84	46
OR-45	6,651	No Action	41	50	61	91	100
		Alt 1	41	49	58	90	100
		Alt 2	41	49	60	94	99
		Alt 3	41	48	63	83	54
OR-46	226	No Action	80	83	83	83	100
		Alt 1	80	83	83	83	100
		Alt 2	80	66	41	26	31
		Alt 3	80	63	63	26	66
OR-47	25,518	No Action	58	65	72	88	99
		Alt 1	58	64	71	86	98
		Alt 2	58	63	71	89	97
		Alt 3	58	63	65	60	56
OR-48	40,555	No Action	54	65	73	91	99
		Alt 1	54	64	71	89	98
		Alt 2	54	57	64	74	69
		Alt 3	54	60	62	63	56
OR-50	17,657	No Action	54	57	61	89	100
		Alt 1	54	57	61	87	100
		Alt 2	54	56	61	88	97
		Alt 3	54	52	53	67	59

Table 252. Suitable Habitat within Critical Habitat Units OR-51 – OR-60, by alternative

Critical Habitat Unit	Habitat-capable acres	Alternative	% of habitat-capable				
			2006	2016	2026	2056	2106
OR-51	3,640	No Action	35	35	37	67	77
		Alt 1	35	35	37	60	77
		Alt 2	35	32	37	61	50
		Alt 3	35	35	36	73	65
OR-52	33,768	No Action	40	48	59	86	98
		Alt 1	40	48	58	85	98
		Alt 2	40	40	45	59	61
		Alt 3	40	45	49	64	63
OR-53	49,004	No Action	47	51	58	82	91
		Alt 1	47	50	57	77	87
		Alt 2	47	50	58	81	93
		Alt 3	47	46	49	54	52
OR-54	8,183	No Action	49	49	56	84	95
		Alt 1	49	48	57	82	96
		Alt 2	49	47	50	36	29
		Alt 3	49	41	40	57	41
OR-55	15,799	No Action	61	64	71	90	99
		Alt 1	61	64	69	88	99
		Alt 2	61	44	43	40	33
		Alt 3	61	64	71	91	59
OR-56	6,031	No Action	56	55	58	70	79
		Alt 1	56	54	57	63	78
		Alt 2	56	51	36	22	22
		Alt 3	56	49	41	30	39
OR-57	9,848	No Action	59	60	61	71	82
		Alt 1	59	60	61	71	79
		Alt 2	59	41	29	19	20
		Alt 3	59	52	41	26	32
OR-58	48,334	No Action	54	57	60	87	96
		Alt 1	54	57	61	85	95
		Alt 2	54	56	59	85	94
		Alt 3	54	53	49	59	40
OR-59	4,728	No Action	59	61	63	79	86
		Alt 1	59	61	63	76	90
		Alt 2	59	56	56	26	20
		Alt 3	59	56	44	27	40
OR-60	68,751	No Action	52	57	65	86	93
		Alt 1	52	56	62	84	92
		Alt 2	52	55	60	72	76
		Alt 3	52	56	61	76	52

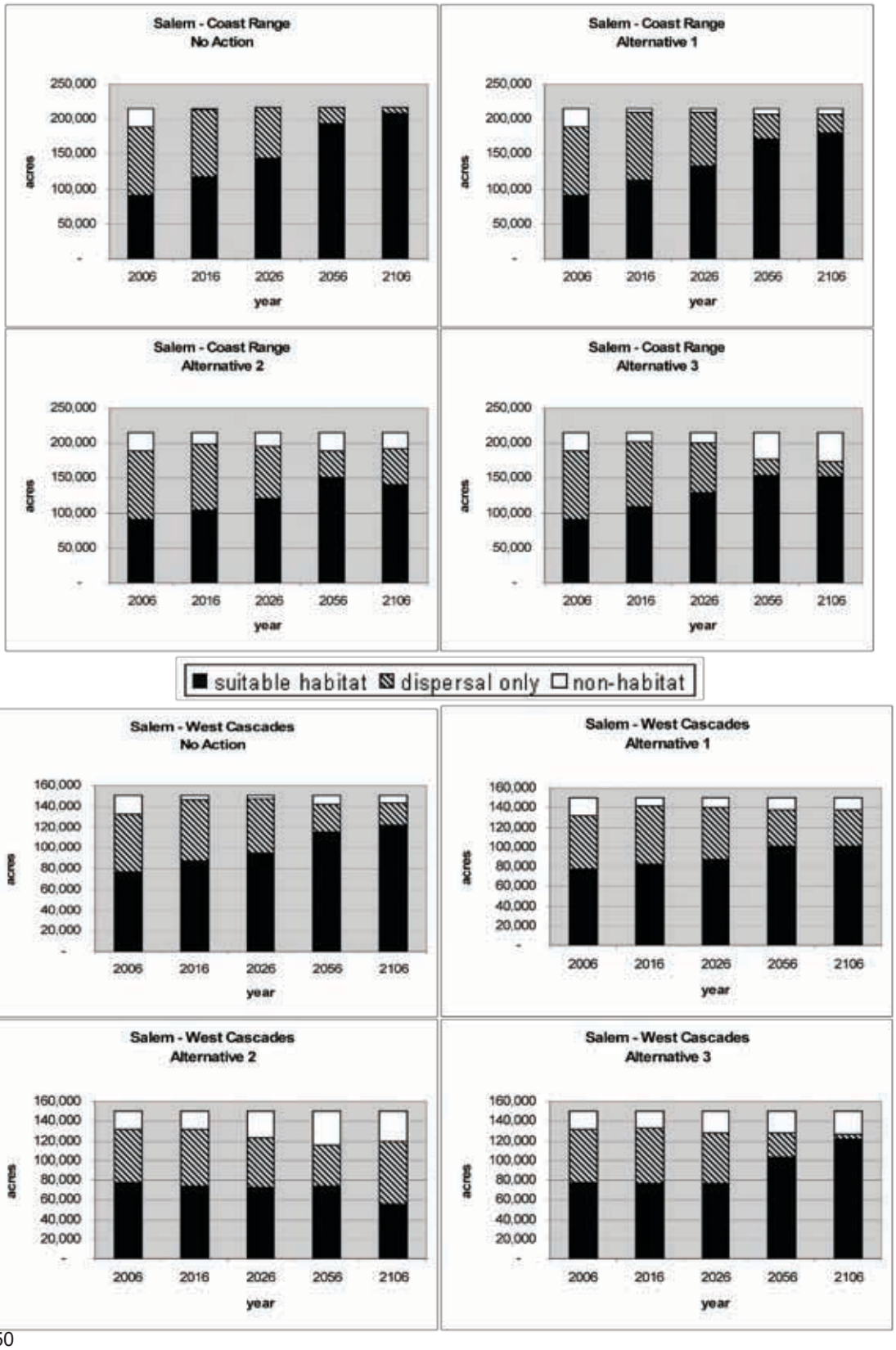
Table 253. Suitable Habitat within Critical Habitat Units OR-61 – OR-76, by alternative

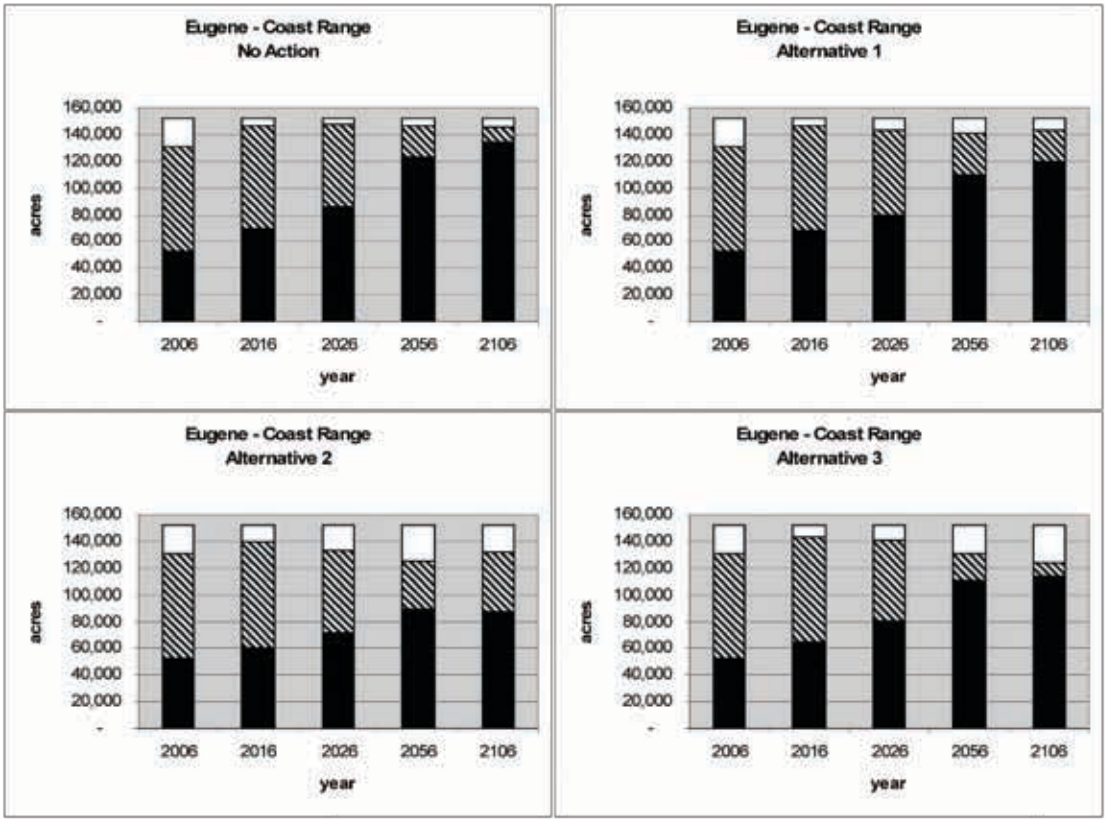
Critical Habitat Unit	Habitat-capable acres	Alternative	% of habitat-capable				
			2006	2016	2026	2056	2106
OR-61	2,462	No Action	71	72	77	83	96
		Alt 1	71	72	78	84	100
		Alt 2	71	60	57	20	13
		Alt 3	71	59	55	14	10
OR-62	45,760	No Action	59	61	61	71	89
		Alt 1	59	61	62	69	87
		Alt 2	59	60	62	71	91
		Alt 3	59	54	51	57	41
OR-63	8,004	No Action	66	64	65	61	59
		Alt 1	66	64	61	46	50
		Alt 2	66	51	39	30	37
		Alt 3	66	66	65	76	61
OR-64	5,338	No Action	60	56	59	63	70
		Alt 1	60	57	53	45	39
		Alt 2	60	43	35	34	41
		Alt 3	60	57	58	57	42
OR-65	82,184	No Action	74	77	78	83	90
		Alt 1	74	77	77	83	89
		Alt 2	74	75	76	80	84
		Alt 3	74	71	70	72	62
OR-66	4	No Action	100	100	100	100	100
		Alt 1	100	100	100	100	100
		Alt 2	100	100	100	100	100
		Alt 3	100	100	100	100	100
OR-67	18,555	No Action	61	60	70	77	75
		Alt 1	61	59	68	73	58
		Alt 2	61	54	56	56	41
		Alt 3	61	56	64	66	55
OR-72	48,573	No Action	70	76	78	86	93
		Alt 1	70	74	76	81	91
		Alt 2	70	74	75	77	79
		Alt 3	70	61	55	53	62
OR-74	26,891	No Action	55	63	64	57	59
		Alt 1	55	57	58	51	48
		Alt 2	55	58	62	52	39
		Alt 3	55	52	52	42	57
OR-75	16,985	No Action	47	56	55	43	57
		Alt 1	47	48	50	37	41
		Alt 2	47	48	52	43	40
		Alt 3	47	48	46	38	60
OR-76	418	No Action	86	91	94	94	100
		Alt 1	86	83	82	23	11
		Alt 2	86	48	82	86	95
		Alt 3	86	89	85	40	62

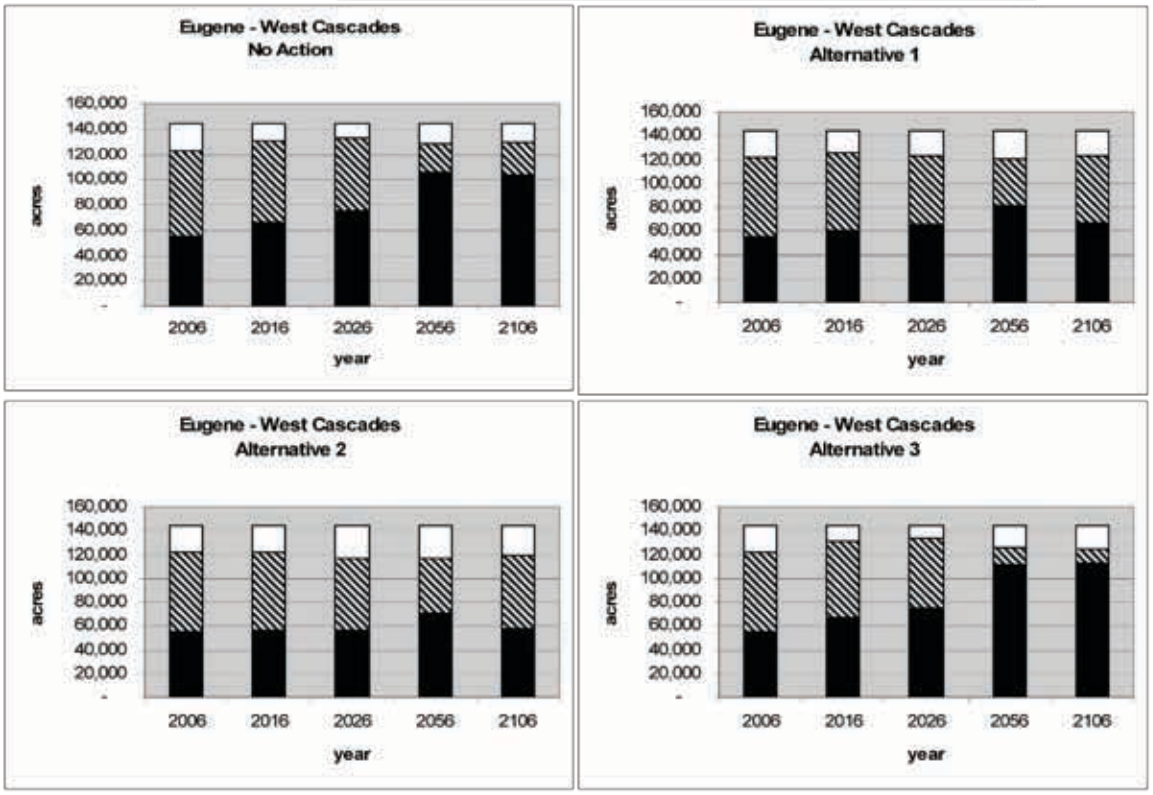
Northern Spotted Owl Dispersal Habitat by District/Province Divisions

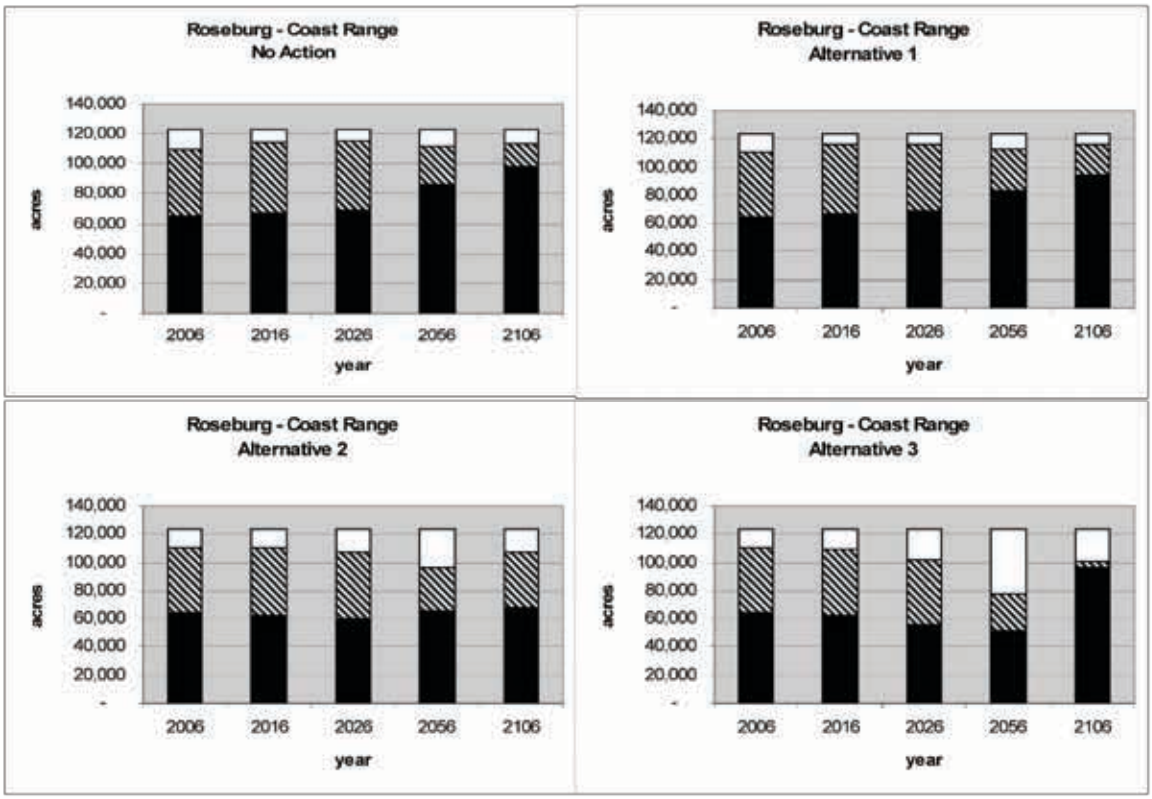
The following graphs display the quantity and quality of dispersal habitat by District/Province Divisions over time for each alternative. The quantity of dispersal habitat is the total amount of suitable habitat and dispersal habitat only. The quality of dispersal habitat is the portion of total dispersal habitat that is suitable habitat.

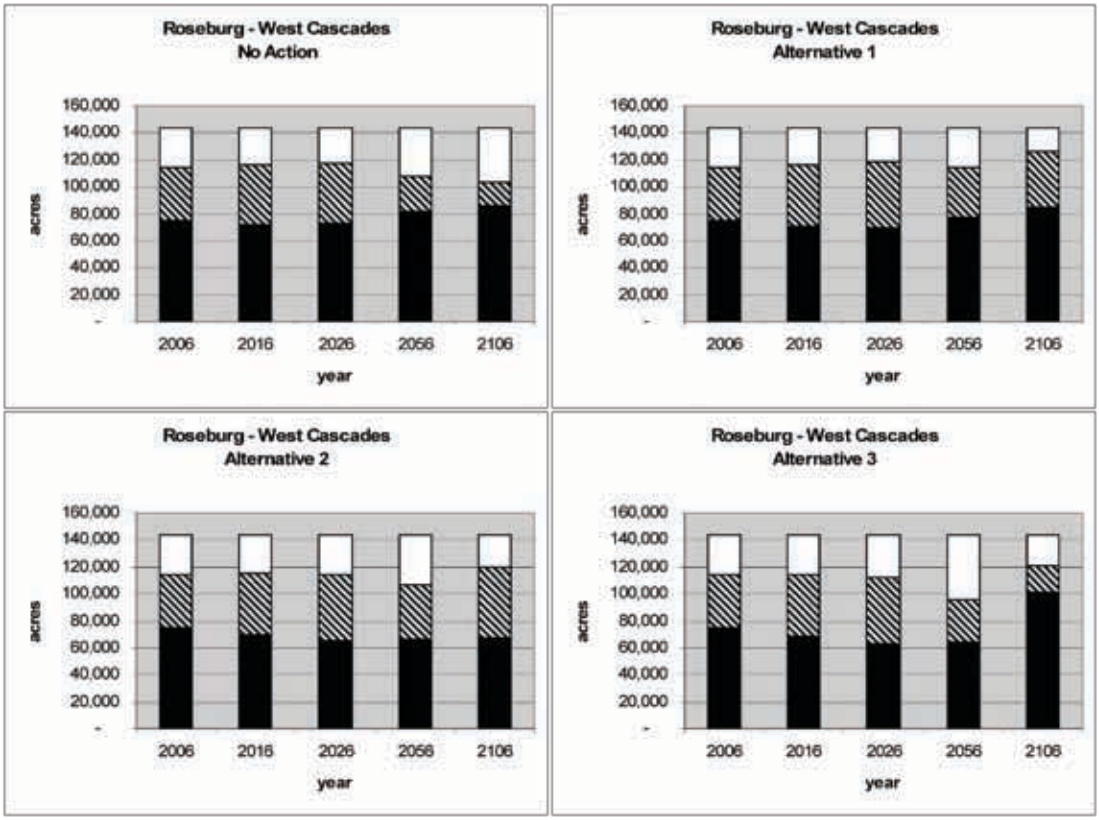
Figure 290. Northern spotted habitat by District and Province.

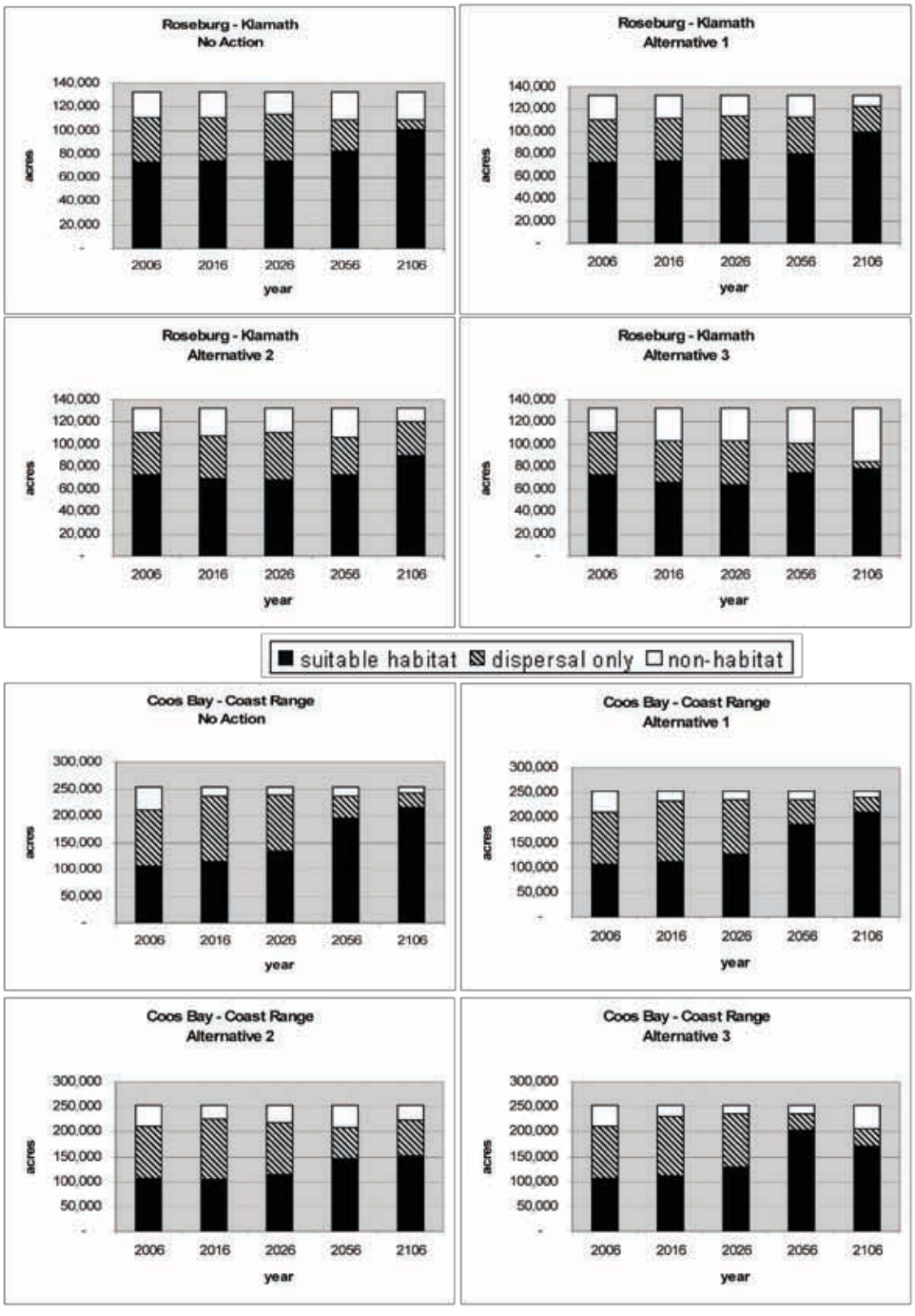


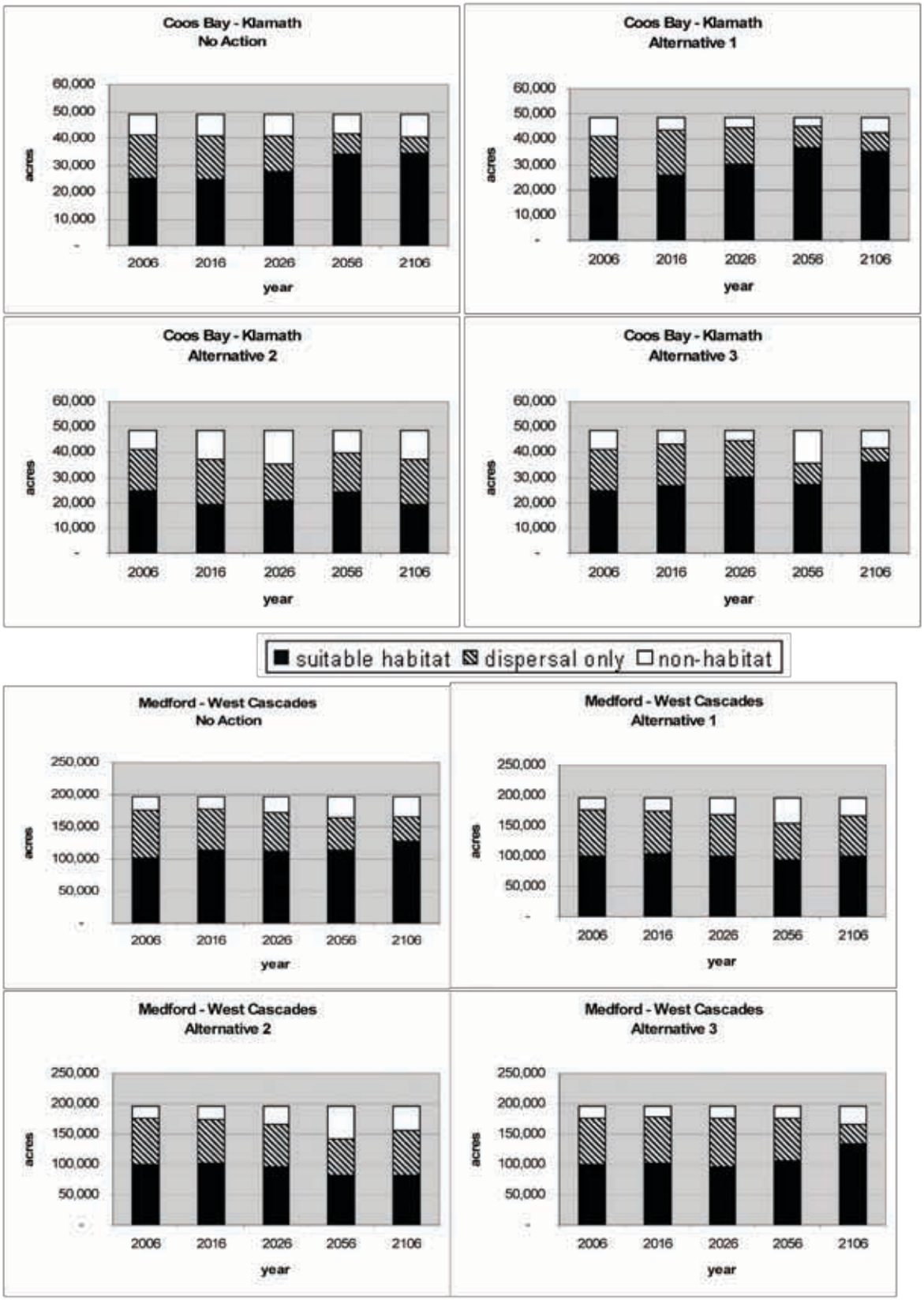

Eugene - Coast Range
No Action
Eugene - Coast Range
Alternative 1
Eugene - Coast Range
Alternative 2
Eugene - Coast Range
Alternative 3
acres
160,000
140,000
120,000
100,000
80,000
60,000
40,000
20,000
-
2006
2016
2026
2056
2106
year
suitable habitat
dispersal only
non-habitat

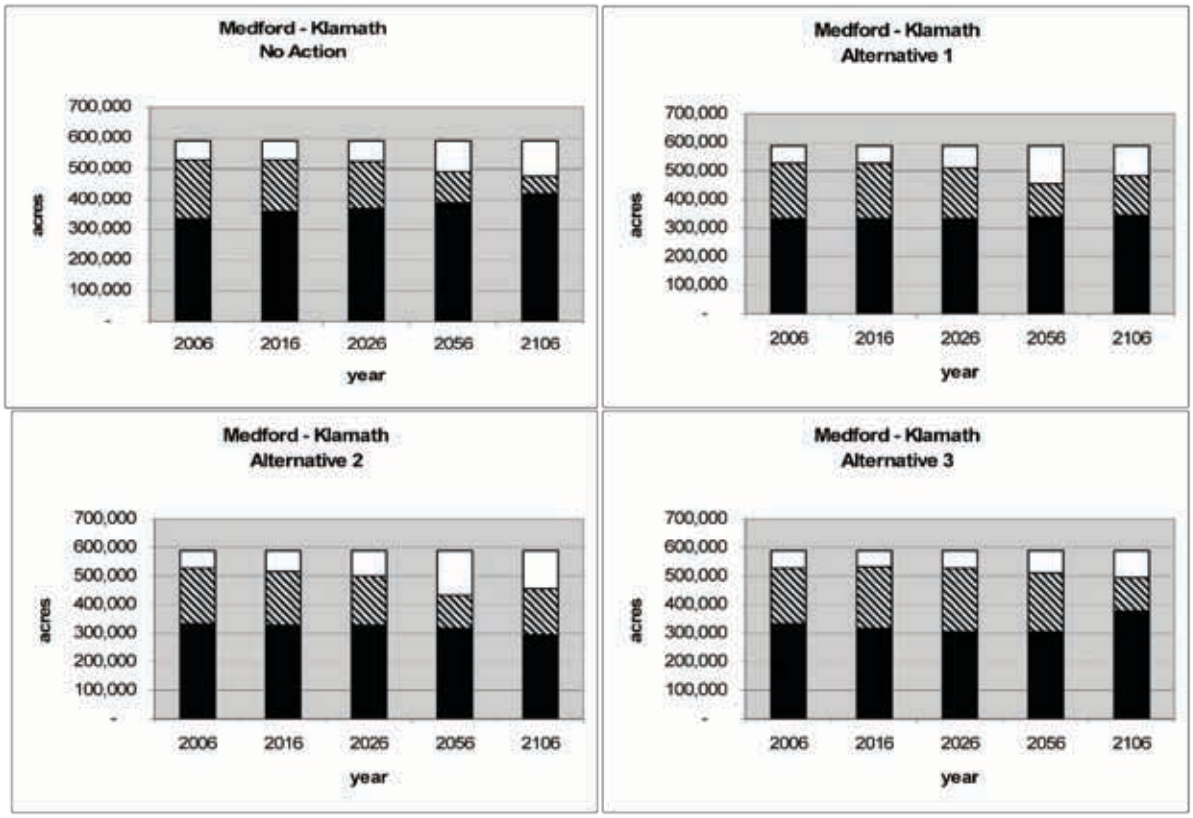

Eugene - West Cascades
No Action
Eugene - West Cascades
Alternative 1
Eugene - West Cascades
Alternative 2
Eugene - West Cascades
Alternative 3
acres
160,000
140,000
120,000
100,000
80,000
60,000
40,000
20,000
-
2006
2016
2026
2056
2106
year

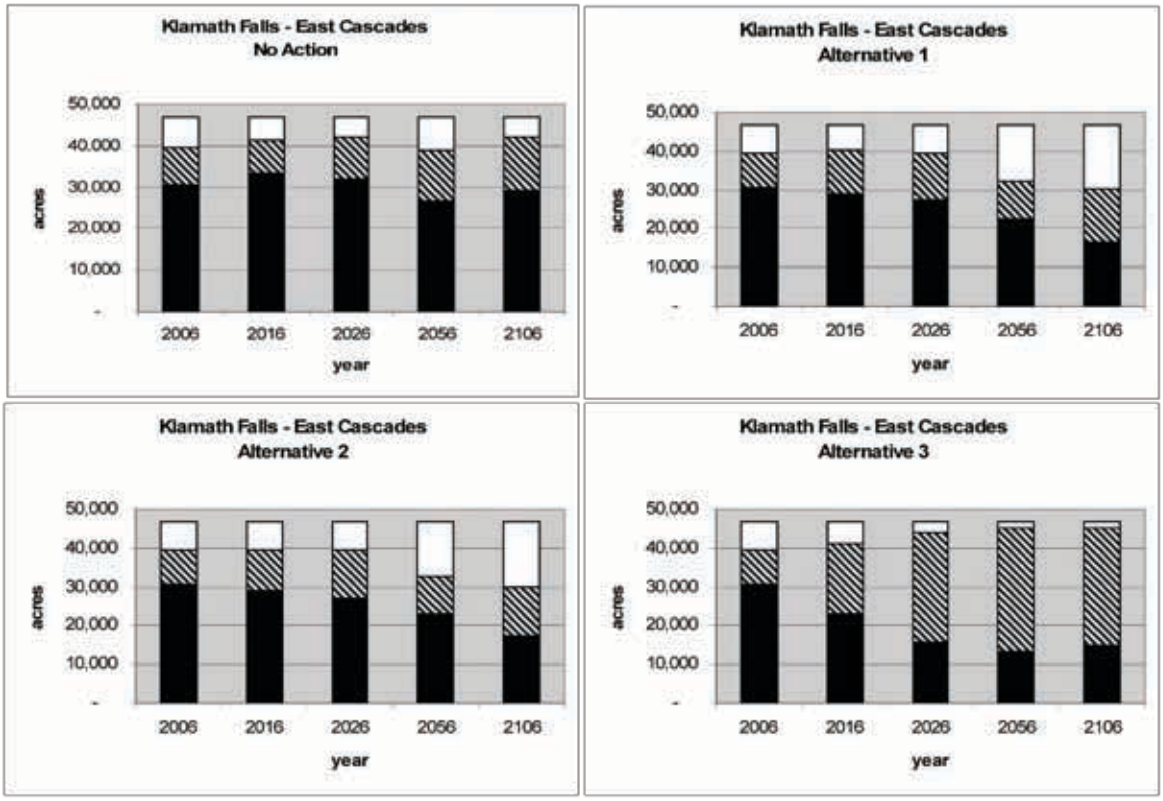

Roseburg - Coast Range
No Action
Roseburg - Coast Range
Alternative 1
Roseburg - Coast Range
Alternative 2
Roseburg - Coast Range
Alternative 3
acres
140,000
120,000
100,000
80,000
60,000
40,000
20,000
-
2006
2016
2026
2056
2106
year
suitable habitat
dispersal only
non-habitat


Roseburg - West Cascades
No Action
Roseburg - West Cascades
Alternative 1
Roseburg - West Cascades
Alternative 2
Roseburg - West Cascades
Alternative 3
acres
160,000
140,000
120,000
100,000
80,000
60,000
40,000
20,000
-
2006
2016
2026
2056
2106
year


Roseburg - Klamath
No Action
Roseburg - Klamath
Alternative 1
Roseburg - Klamath
Alternative 2
Roseburg - Klamath
Alternative 3
suitable habitat
dispersal only
non-habitat
Coos Bay - Coast Range
No Action
Coos Bay - Coast Range
Alternative 1
Coos Bay - Coast Range
Alternative 2
Coos Bay - Coast Range
Alternative 3
acres
year
2006
2016
2026
2056
2106


Coos Bay - Klamath
No Action
Coos Bay - Klamath
Alternative 1
Coos Bay - Klamath
Alternative 2
Coos Bay - Klamath
Alternative 3
suitable habitat
dispersal only
non-habitat
Medford - West Cascades
No Action
Medford - West Cascades
Alternative 1
Medford - West Cascades
Alternative 2
Medford - West Cascades
Alternative 3
acres
year
2006
2016
2026
2056
2106


Medford - Klamath
No Action
Medford - Klamath
Alternative 1
Medford - Klamath
Alternative 2
Medford - Klamath
Alternative 3
acres
700,000
600,000
500,000
400,000
300,000
200,000
100,000
-
2006
2016
2026
2056
2106
year
suitable habitat
dispersal only
non-habitat


Klamath Falls - East Cascades
No Action
Klamath Falls - East Cascades
Alternative 1
Klamath Falls - East Cascades
Alternative 2
Klamath Falls - East Cascades
Alternative 3
acres
50,000
40,000
30,000
20,000
10,000
-
2006
2016
2026
2056
2106
year

Northern Spotted Owl Habitat Classification for Alternative 3

For Alternative 3 in 2056 and 2106, stands are classified as northern spotted owl suitable habitat if they either are classified as such by the habitat classification or are classified as dispersal habitat and are also classified as Mature with Multiple Canopies or Structurally Complex forest by the structural stage classification.

The habitat classification used alone would underestimate the suitable habitat in Alternative 3, because the habitat classification depends in part on measurement of the average diameter of trees in the stand. In Alternative 3, partial harvest would create multi-cohort stands, and the resultant large number of understory trees would depress the average tree diameter of the stand as a whole, causing these partially harvested stands to be classified as dispersal habitat only (Figure 291 - Stand Conditions Resulting from Partial Harvests in Alternative 3 Compared to Regeneration Harvest in No Action). These partially harvested stands would continue to be classified only as dispersal habitat until the understory would grow large enough to no longer depress the average tree diameter of the stand as a whole, which would typically take at least 50 years. The structural stage classification does not use average diameter of trees in the stand, but instead uses the density of trees above a certain diameter (see Ecology Appendix – Structural Stage Classification). As a result, the understory trees do not cause misclassification of stands, as long as the stand retains enough large trees. The structural stage classification automatically reclassifies partially harvested stands to Stand Establishment forest until the understory would grow tall enough to pass out of the Stand Establishment stage (usually 20 – 30 years), after which the partially harvested stand is classified based on the overall stand characteristics. Therefore, even using this combing classification scheme for Alternative 3, stands that had been partially harvested in Alternative 3 would not be classified as suitable habitat for several decades after partial harvest.

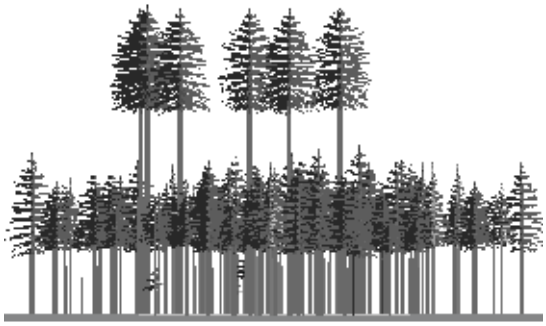
This combined classification is only used for results from the years 2056 and 2106; in the earlier years the results of the two different classification approaches are similar because the difference in classification is not apparent for several decades after the partial harvesting applied in Alternative 3. For example, in 2026, using the combined classification would increase the total amount of suitable habitat by 3.3%, which would represent 1.7% of habitat-capable acres.

Figure 291. Stand Conditions Resulting from Partial Harvests in Alternative 3 Compared to Regeneration Harvest in No Action

A. Alternative 3 Partial Harvest

Spotted owl habitat rating = Dispersal habitat (according to standard classification)
Structural stage = Mature with multiple canopies

B. No Action - Regeneration Harvest with Green Tree Retention

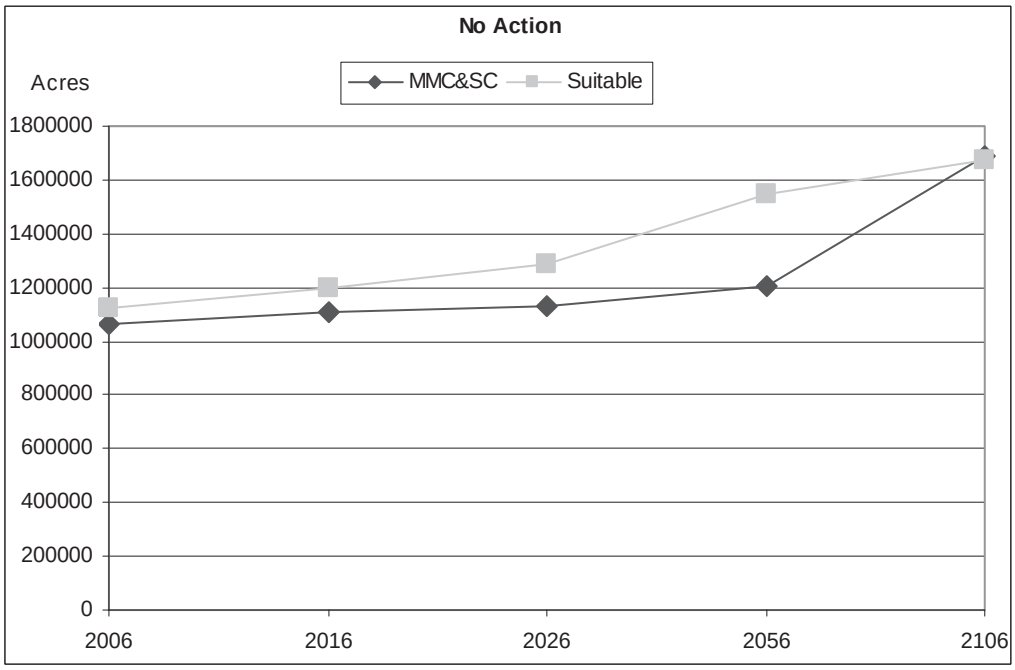


Spotted owl habitat rating = Dispersal habitat
Structural stage = Young with Structural Legacy

The combined classification might be expected to overestimate the amount of suitable habitat compared to other alternatives, because it expands the definition of suitable habitat wider than the other alternatives. However, in No Action, Alternative 1, and Alternative 2, Mature with Multiple Canopies and Structurally Complex forest is generally a subset of suitable habitat: the amount of Mature with Multiple Canopies and Structurally Complex forest is always lower than the amount of suitable habitat. Therefore, it is unlikely that the combined classification for Alternative 3 substantially overestimates the amount of suitable habitat compared to the other alternatives, and does not overestimate it enough to alter the overall trends and relative results of the alternatives.

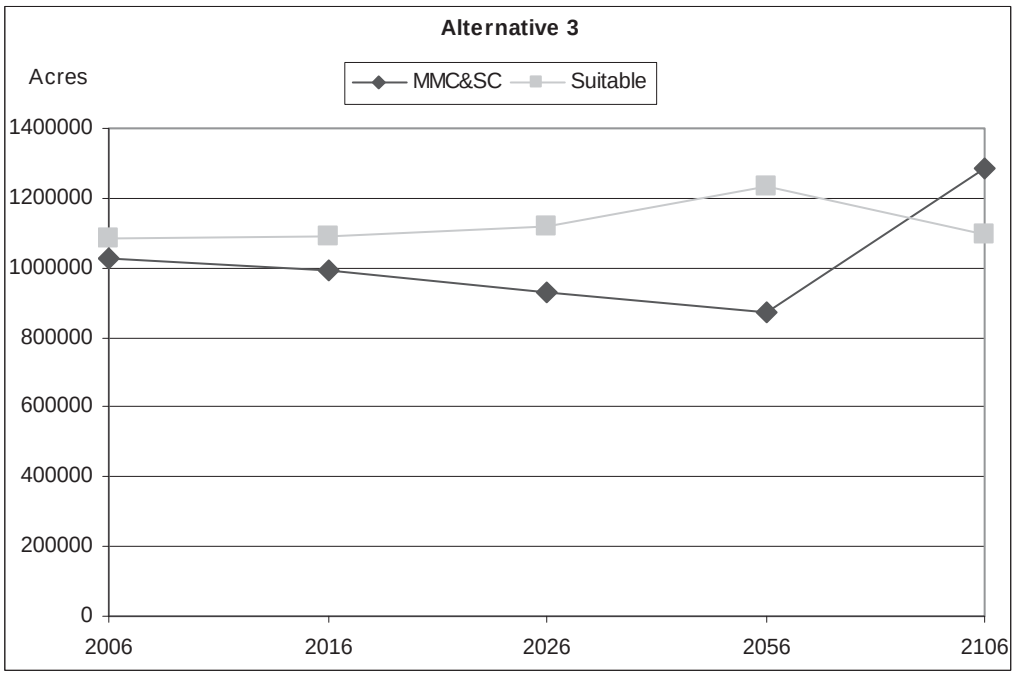
No Action provides the best comparison to Alternative 3 for classification of suitable habitat, because No Action includes green tree retention which complicated the classification. Under No Action, the amount of Mature with Multiple Canopies and Structurally Complex forest is very similar to, but always lower, than the amount of suitable habitat in the first decades. In 2056, the amount of Mature with Multiple Canopies and Structurally Complex forest is more substantially lower than the amount of suitable habitat. But in 2056, Mature with Multiple Canopies and Structurally Complex forest is very strongly a subset of suitable habitat: 93% of Mature with Multiple Canopies forest and 94% of Structurally Complex forest in 2056 under No Action is also classified as suitable habitat.

Figure 292. Comparison of Classification of Mature with Multiple Canopies and Structurally Complex Forest with Classification of Suitable Habitat – No Action



This close correlation between Mature with Multiple Canopies and Structurally Complex forest and suitable habitat in No Action, Alternative 1, and Alternative 2, is in contrast to the poor correlation between the two classifications in Alternative 3. Note that the two classifications have a different trend over time under Alternative 3.

Figure 293. Comparison of Classification of Mature with Multiple Canopies and Structurally Complex Forest with Classification of Suitable Habitat – Alternative 3



Marbled Murrelet Critical Habitat.

There are 29 marbled murrelet critical habitat units that include BLM administered lands. Critical habitat was designated by the U.S. Fish and Wildlife Service in 1996 to encompass existing Late-successional Reserves, as defined in the Northwest Forest Plan. Critical habitat units would be managed as late-successional reserves under the no action alternative and as late-successional management areas under alternative 1. By 2106 under the no action alternative and alternative 1, BLM administered lands in 14 and 19 of 29 critical habitat units would be comprised of more than 90 percent murrelet nesting habitat. All except one of these units would have increasing amounts of murrelet nesting habitat. The one exception to this upward trend would be unit CA-01-e, in which the BLM administers 14 acres. It is assumed in this analysis that the marbled murrelet critical habitat which is designated as late-successional reserves on U.S. Forest Service lands would follow similar trends to those exhibited by habitat on BLM administered lands under the no action alternative and Alternative 1.

Marbled murrelet nesting habitat would increase under alternative 2 from 218,000 acres to 287,000 acres, or from 47 to 63 percent of habitat capable forest in critical habitat units. The late-successional management areas under alternative 2 would not completely encompass marbled murrelet critical habitat and as a result 6 of 29 critical habitat units would contain greater than 90 percent nesting habitat by 2106, compared to 14 critical habitat units under the no action alternative. Marbled murrelet nesting habitat would increase 10 percent, or more, in one critical habitat unit from 2006 to 2016 while 20 critical habitat units would decrease in habitat during this time period. Nine of these 20 units would decrease in habitat more than 10 percent. Nesting habitat would decrease between 2016 and 2026 in 20 critical habitat units. Two of these 20 critical habitat units would decrease more than 10 percent. From 2006 to 2106, marbled murrelet nesting habitat would increase in 14 critical habitat units. Thirteen of these 14 critical habitat units would increase in habitat more than 10 percent. Murrelet nesting habitat would decrease in 15 critical habitat units, 10 of these units would decrease more than 10 percent.

Marbled murrelet nesting habitat would increase under alternative 3 from 217,000 acres to 269,000 acres, or from 47 to 59 percent of habitat-capable forest on BLM administered lands.

Under alternative 3, with the exception of Congressionally-withdrawn lands and riparian management areas, almost all marbled murrelet critical habitat units would be subject to regeneration harvests and partial harvests that would remove marbled murrelet nesting habitat. Under alternative 3, there would be 3 of 29 critical habitat units which would contain greater than 90 percent nesting habitat by 2106, compared to 14 units under the no action alternative and 19 units under alternative 1 and 6 units under alternative 2. Under alternative 3, marbled murrelet nesting habitat would increase more than 10 percent in one critical habitat unit from 2006 to 2106 while habitat would decrease in 14 critical habitat units in the first decade. Three of these 14 units would decrease more than 10 percent. Nesting habitat would decrease between 2016 and 2026 in 23 critical habitat units. One of these 23 units would decrease more than 10 percent. From 2006 to 2106, marbled murrelet nesting habitat would increase in 20 critical habitat units, in 10 of these units habitat would increase more than 10 percent, while habitat would decrease in 9 critical habitat units, habitat would decrease more than 10 percent in two of those nine units. Although alternative 3 opens almost all of the critical habitat units to vegetative management compared

to alternative 2, retention tree requirements in both the partial and regeneration harvests provide for much more rapid redevelopment of murrelet nesting habitat. Murrelet nesting habitat would develop up to 70 years sooner in alternative 3 compared to alternative 2, because of the role of retention trees in habitat development.

Table 254. Marbled murrelet nesting habitat summarized by critical habitat unit and alternative.

Critical Habitat Unit	Alternative	Habitat-capable (ac)	Marbled murrelet nesting habitat (ac)				
			2006	2016	2026	2056	2106
CA-01-e	Alt 1	14	10	7	6	10	8
	Alt 2	14	10	3	3	9	7
	Alt 3	14	10	10	10	8	12
	No Action	14	10	14	14	14	9
OR-01-b	Alt 1	1	1	1	1	1	1
	Alt 2	1	1	1	1	1	1
	Alt 3	1	1	1	1	1	1
	No Action	1	1	1	1	1	1
OR-01-c	Alt 1	7217	4472	4874	4903	5089	5680
	Alt 2	7217	4472	4340	3973	2991	3076
	Alt 3	7217	4472	4792	4465	3081	4497
	No Action	7217	4472	4873	4903	5089	5297
OR-02-a	Alt 1	0	0	0	0	0	0
	Alt 2	0	0	0	0	0	0
	Alt 3	0	0	0	0	0	0
	No Action	0	0	0	0	0	0
OR-02-b	Alt 1	11	1	1	1	1	4
	Alt 2	11	1	1	1	1	1
	Alt 3	11	1	1	1	1	1
	No Action	11	1	1	1	1	1
OR-02-c	Alt 1	3139	969	1332	1557	1910	2742
	Alt 2	3139	969	985	1206	1355	2148
	Alt 3	3139	969	1027	963	557	1077
	No Action	3139	969	1332	1557	1910	2114
OR-02-d	Alt 1	25584	4948	6082	6700	9143	23955
	Alt 2	25584	4948	6579	7391	11258	23667
	Alt 3	25584	4948	7041	7414	10653	17785
	No Action	25584	4948	6874	8201	14458	23688
OR-02-e	Alt 1	37256	13750	16475	17692	20158	34639
	Alt 2	37256	13750	15532	16625	18578	31857
	Alt 3	37256	13750	14709	13997	9737	18669
	No Action	37256	13750	16613	17883	20232	30462

Critical Habitat Unit	Alternative	Habitat-capable (ac)	Marbled murrelet nesting habitat (ac)				
			2006	2016	2026	2056	2106
OR-03-a	Alt 1	39	39	41	41	41	41
	Alt 2	39	39	39	39	39	39
	Alt 3	39	39	39	39	15	15
	No Action	39	39	41	41	41	41
OR-03-c	Alt 1	8087	3158	3992	3819	4165	7892
	Alt 2	8087	3158	3593	3521	4100	6786
	Alt 3	8087	3158	3624	3652	3188	5207
	No Action	8087	3158	3988	4051	5047	7542
OR-04-a	Alt 1	1283	711	729	736	803	1165
	Alt 2	1283	711	658	661	612	694
	Alt 3	1283	711	628	605	294	537
	No Action	1283	711	728	736	803	1039
OR-04-b	Alt 1	1083	893	964	1076	1076	1080
	Alt 2	1083	893	960	1072	1072	1072
	Alt 3	1083	893	959	1071	721	1068
	No Action	1083	893	964	1076	1076	1076
OR-04-c	Alt 1	13378	7560	7575	7575	7701	12059
	Alt 2	13378	7560	7452	7450	7432	10999
	Alt 3	13378	7560	6755	6465	5458	6851
	No Action	13378	7560	7582	7580	7724	11177
OR-04-d	Alt 1	20059	10832	10945	11251	11340	17555
	Alt 2	20059	10832	7755	6723	4092	5535
	Alt 3	20059	10832	10834	11156	11069	10642
	No Action	20059	10832	10945	11283	11407	16553
OR-04-e	Alt 1	50508	26602	27244	27615	29639	46806
	Alt 2	50508	26602	26780	26336	27211	42963
	Alt 3	50508	26602	24887	21442	17695	30230
	No Action	50508	26602	27429	27968	29840	46945
OR-04-f	Alt 1	20099	12133	12220	13014	13512	17531
	Alt 2	20099	12133	9482	7901	3248	3423
	Alt 3	20099	12133	11148	9212	5219	13302
	No Action	20099	12133	12220	13040	13743	18431
OR-04-g	Alt 1	15352	7374	7280	7287	7405	12759
	Alt 2	15352	7374	7034	6437	3319	4064
	Alt 3	15352	7374	6294	4901	3355	8483
	No Action	15352	7374	7082	7146	7912	12618

Critical Habitat Unit	Alternative	Habitat-capable (ac)	Marbled murrelet nesting habitat (ac)				
			2006	2016	2026	2056	2106
OR-04-i	Alt 1	79203	34727	38319	41145	46096	71373
	Alt 2	79203	34727	33995	34037	32619	47235
	Alt 3	79203	34727	34184	32490	29996	51010
	No Action	79203	34727	38410	41538	49490	70351
OR-04-j	Alt 1	55887	25062	27390	29112	32083	51859
	Alt 2	55887	25062	23712	23768	21026	25494
	Alt 3	55887	25062	25354	24338	20163	33843
	No Action	55887	25062	27740	30180	33584	50827
OR-04-k	Alt 1	25526	13379	14524	15283	16322	23694
	Alt 2	25526	13379	14234	14956	15706	21771
	Alt 3	25526	13379	13701	13541	8513	14137
	No Action	25526	13379	14637	15656	16724	22211
OR-06-a	Alt 1	39	26	26	26	26	36
	Alt 2	39	26	7	7	7	7
	Alt 3	39	26	4	4	4	26
	No Action	39	26	26	26	26	36
OR-06-b	Alt 1	49888	26052	27344	28484	29942	43864
	Alt 2	49888	26052	27034	28113	27242	38638
	Alt 3	49888	26052	26873	26206	25836	22602
	No Action	49888	26052	27509	28719	30299	42247
OR-06-c	Alt 1	4608	3508	3406	3444	3543	4447
	Alt 2	4608	3508	1526	1238	1189	1543
	Alt 3	4608	3508	2932	2461	1896	3652
	No Action	4608	3508	3486	3523	3543	4389
OR-06-d	Alt 1	16177	8407	8445	8494	9627	15545
	Alt 2	16177	8407	6551	5041	3045	3569
	Alt 3	16177	8407	6347	4959	3961	8965
	No Action	16177	8407	8405	8611	9843	15324
OR-07-a	Alt 1	2364	1466	1227	1227	1752	2127
	Alt 2	2364	1466	998	749	719	750
	Alt 3	2364	1466	1534	1580	918	1289
	No Action	2364	1466	1218	1289	1801	2114
OR-07-b	Alt 1	2168	1073	1304	1304	2047	2047
	Alt 2	2168	1073	1300	1300	2166	2167
	Alt 3	2168	1073	1302	1302	2167	2167
	No Action	2168	1073	1428	1428	2171	2171

Critical Habitat Unit	Alternative	Habitat-capable (ac)	Marbled murrelet nesting habitat (ac)				
			2006	2016	2026	2056	2106
OR-07-d	Alt 1	1839	836	836	868	1194	1723
	Alt 2	1839	836	509	442	1021	1469
	Alt 3	1839	836	837	868	1086	1565
	No Action	1839	836	836	876	1231	1752
OR-07-f	Alt 1	15595	8577	9459	9706	11030	14908
	Alt 2	15595	8577	6635	5982	6803	7271
	Alt 3	15595	8577	8589	7816	7344	10621
	No Action	15595	8577	11472	11711	13467	15016
OR-07-g	Alt 1	2078	984	1085	1085	1097	1469
	Alt 2	2078	984	829	450	367	394
	Alt 3	2078	984	1034	999	1248	835
	No Action	2078	984	1085	1085	1085	1514

Special Status Animal Species

The following table shows the Bureau Special Status Animal Species in the planning area by their habitat group and location.

Table 255. Documented and suspected occurrence of Bureau special status animal species (as of March 14, 2005) within the planning area of the Western Oregon Plan Revision.

Scientific Name	Common Name	District						
		Status [1]	Coos Bay	Eugene	Klamath Falls	Medford	Roseburg	Salem
Amphibians and Reptiles								
*Rana pretiosa**	Oregon spotted frog	FC			D	D		
*Batrachoseps wrighti**	Oregon slender salamander	BS		D				D
Chrysemys picta	Painted turtle	BS		S				S
Clemmys marmorata marmorata	Northwestern pond turtle	BS	D	D	D	D	D	S
*Plethodon stormi**	Siskiyou mountains salamander	BS				D		
Rhyacotriton kezeri	Columbia torrent salamander	BS						D
Aneides flavipunctatus	Black salamander	BA				D		
Ascaphus montanus	Inland tailed frog	BA			S			
Batrachoseps attenuatus	California slender salamander	BA	D					
Dicamptodon copei	Cope's giant salamander	BA						D
Plethodon larselli	Larch mountain salamander	BA						S
*Rana boylii**	Foothill yellow-legged frog	BA	D	D		D	D	S
*Rhyacotriton cascadae**	Cascade torrent salamander	BA		D				D
Birds								
Pelecanus occidentalis californicus	California brown pelican	FE	D	S		S		
*Brachyramphus marmoratus maroratum**	Marbled murrelet	FT	D	D		S	D	D
Charadrius alexandrinus nivosus	Western snowy plover (coastal population)	FT	D					
*Haliaeetus leucocephalus**	Bald eagle	FT	D	D	D	D	D	D
*Strix occidentalis caurina**	Northern spotted owl	FT	D	D	D	D	D	D
Eremophila alpestris strigata	Streaked horned lark (oregon cr , wv, km)	FC	D	S		D		
*Accipiter gentilis**	Northern goshawk	BS	D	D	D	D	D	D
Anser albifrons elgasi	Tule goose	BS	S		S			
Athene cunicularia hypugaea	Burrowing owl (wv, km, hp, cb, bm)	BS	D			S		

Bartramia longicauda	Upland sandpiper	BS	D					
Branta canadensis leucopareia	Aleutian canada goose (wintering)	BS	D	S				
Branta canadensis occidentalis	Dusky canada goose	BS	S	D				
Buteo regalis	Ferruginous hawk	BS			D	D		
Centrocercus urophasianus	Greater sage-grouse	BS			S			
Chordeiles minor	Common nighthawk (wv)	BS	D	D				D
Coturnicops noveboracensis	Yellow rail	BS			D			
*Falco peregrinus anatum**	American peregrine falcon	BS	D	D	D	D	D	D
Falco peregrinus tundrius	Arctic peregrine falcon	BS	D	S		S		S
Glaucidium gnoma	Northern pygmy-owl (Blue Mtns)	BS	D					
Icteria virens	Yellow-breasted chat (wv)	BS	D	D				D
Melanerpes lewis	Lewis' woodpecker (wv, km, wc, ec, cb)	BS	D	D	D	D	D	D
*Otus flammeolus**	Flammulated owl (ec, bm, br, wc, km)	BS			D	D		
Picoides albolarvatus	White-headed woodpecker (km, wc, ec, bm)	BS			D	D		
Picoides arcticus	Black-backed woodpecker (km, wc, ec, bm)	BS				D		D
Picoides tridactylus	Three-toed woodpecker (wc, ec, bm)	BS				D		D
Podiceps grisegena	Red-necked grebe (breeding pops: wc, ec)	BS			D	D		
Pooecetes gramineus affinis	Oregon vesper sparrow (wv, km, cr)	BS	D	D			D	S
*Progne subis**	Purple martin (cr, wv, km, wc, ec)	BS	D	D		S	D	D
Sturnella neglecta	Western meadowlark (wv)	BS		D				
Agelaius tricolor	Tricolored blackbird (breeding pop: wv, km, ec, hp, cb)	BA			D	D		
Ammodramus savannarum	Grasshopper sparrow (wv)	BA		D				
Cerorhinca monocerata	Rhinoceros auklet	BA	S					S
Cygnus buccinator	Trumpeter swan	BA	S		D	D		
Dolichonyx oryzivorus	Bobolink	BA	D					
Elanus leucurus	White-tailed kite	BA	D	D		D	D	
Falco columbarius	Merlin (possible breeding pop: ec, cb, br)	BA			S			
Fratercula cirrhata	Tufted puffin	BA	S					D
Histrionicus histrionicus	Harlequin duck (breeding pops: wc, ec, bm)	BA		D			D	D
Melanerpes lewis	Lewis' woodpecker	BA	D	S	D	D	D	S
Oceanodroma furcata	Fork-tailed storm petrel (breeding population)	BA	S					
Pelecanus erythrorhynchos	American white pelican (breeding pops: ec, br)	BA			D			
Ptychoramphus aleuticus	Cassin's auklet	BA	S					

Invertebrates								
Icaricia icarioides fenderi	Fender's blue butterfly	FE		D				S
Branchinecta lynchi	Vernal pool fairy shrimp	FT				D		
Speyeria zerene hippolyta	Oregon silverspot butterfly	FT						S
Euphydryas editha taylori	Whulge checkerspot (butterfly)	FC		S				S
*Polites mardon**	Mardon skipper (butterfly)	FC	S	S		D		
Acetropis americana	American grass bug	BS		S				S
Algamorda newcombiana	Newcomb's littorine snail	BS	D					
Allomyia scotti	Scott's apatanian caddisfly	BS					S	
Anodonta wahlametensis	Willamette floater (mussel)	BS						S
Chloealtis aspasma	Siskiyou short-horned grasshopper	BS		S		D		S
Cryptomastix devia	Puget oregonian (snail)	BS						D
Cryptomastix populi	Hells canyon land snail	BS						
Deroceras hesperium	Evening fieldslug	BS		S	D	D		S
Driloleirus macelfreshi	Oregon giant earthworm	BS	S					S
Fluminicola sp. nov.	Fall creek pebblesnail	BS				D		
Fluminicola sp nov.	Keene creek pebblesnail	BS				D		
Fluminicola sp nov.	Toothed pebblesnail	BS				D		
*Fluminicola sp. nov. 1**	Klamath pebblesnail	BS			D	S		
Fluminicola sp. nov. 11	Nerite pebblesnail	BS			S	D		
Fluminicola sp. nov. 3	Diminutive pebblesnail	BS			D			
Gliabates oregonius	Salamander slug	BS	D	S				D
Helisoma newberryi newberryi	Great basin ramshorn (snail)	BS			D			
*Helminthoglypta hertleini**	Oregon shoulderband (snail)	BS	S			D	D	
*Hesperarion mariae**	Tillamook westernslug	BS	S [2]	D				D
Hochbergellus hirsutus	Sisters hesperian (snail)	BS	S					
Incisalia polia maritima	Hoary elfin (butterfly)	BS	S	S				S
Lanx klamathensis	Scale lanx (snail)	BS			D	S		
Lanx subrotunda	Rotund lanx (snail)	BS	S				D	
Mitoura johnsoni	Johnson's hairstreak (butterfly)	BS						S
*Monadenia chaceana**	Chase sideband (snail)	BS			S	D	D	
Monadenia fidelis beryllica	Green sideband (snail)	BS	S				D	
Monadenia fidelis celeuthia	Travelling sideband (snail)	BS				D		
Monadenia fidelis ssp. nov.	Modoc sideband (snail)	BS			D			
Pisidium ultramontanum	Montane peaclam	BS	S			S		
Plebejus saepiolus littoralis	Insular blue butterfly	BS	D					S
Pomatiopsis binneyi	Robust walker	BS	S					
Pomatiopsis californica	Pacific walker	BS	S					S
*Pristiloma articum crateris**	Crater lake tightcoil (snail)	BS		S	S	S	D	S
Pristiloma pilsbryi	Crowned tightcoil (snail)	BS						S
Prophysaon sp. nov.	Klamath tail-dropper	BS	S				S	

Prophysaon vanattae pardalis	Spotted tail-dropper	BS	D	S			S	D
Pterostichus rothi	Roth's blind ground beetle	BS		S				S
Rhyacophila haddocki	Haddock's rhyacophilan caddisfly	BS		S				D
Vespericola sierrana	Siskiyou hesperian	BS				D		
Vespericola sp. nov.	Bald hesperian	BS		D				
Vespericola sp. nov.	Oak springs hesperian	BS		D				
Mammals								
Balaenoptera musculus	Blue whale	FE	S					
Eschrichtius robustus	Gray whale	FE	S					
Megaptera novaeangliae	Humpback whale	FE	S					
Odocoileus virginianus leucurus	Columbian white-tailed deer	FE						S
Eumetopias jubatus	Steller sea lion	FT	S					
*Martes pennanti pacifica**	Fisher	FC	S	D	S	D		
Arborimus longicaudus silvicola	Oregon red tree vole (nw or coast)	BS						D
Corynorhinus townsendii	Townsend's big-eared bat	BS	D	D	D	D	D	D
Odocoileus virginianus leucurus	Columbian white-tailed deer (Douglas County only)	BS					D	
Antrozous pallidus	Pallid bat	BA	S	S	D	D	D	S
Antrozous pallidus pacificus	Pacific pallid bat	BA	S	S		D	D	
Brachylagus idahoensis	Pygmy rabbit	BA			S			
Euderma maculatum	Spotted bat	BA			S			
Myotis thysanodes	Fringed myotis	BA	D	S	D	D	D	S
Thomomys bottae detumidus	Pistol river pocket gopher	BA	S					
Thomomys mazama helleri	Gold beach pocket gopher	BA	S					

* Species known from more than 20 sites

[1] Status Codes: FE - Federally listed as endangered; FT - Federally listed as threatened; FC -- Candidate for federal listing; BS - Bureau Sensitive; BA - Bureau Assessment.

[2] Occurrence Codes: D - Documented to occur within the district; S - Suspected to occur in the district

Appendix H. Fish

This appendix provides background on the analysis and modeling for fisheries including special status fish species, status of threatened and endangered salmonids, and intrinsic potential and large wood delivery models.

In this appendix:

Special Status Fish Species in the Planning Area 1071

Status Summaries and Evolutionary Significant Units for Threatened or Endangered Salmonids..... 1073

Intrinsic Potential Model and Large Wood Delivery Model 1082

Special Status Fish Species in the Planning Area

Fish species designated as Federally-Threatened or Endangered under the Endangered Species Act within the Planning Area, and the present status of Critical habitat designation are displayed in Table 256.

Table 256. Federally Threatened or Endangered Fish Species and Critical Habitat Designation within the Planning Area.

Species	ESU	Species Status	Critical Habitat Status
Chinook Salmon	Lower Columbia River	Threatened	Critical Habitat Designated
	Upper Willamette River	Threatened	Critical Habitat Designated
Coho Salmon	Southern Oregon/ Northern California	Threatened	Critical Habitat Designated
	Lower Columbia River	Threatened	Critical Habitat Designated
	Oregon Coast	Not warranted	N/A
Chum Salmon	Lower Columbia River	Threatened	Critical Habitat Designated
Steelhead	Lower Columbia River	Threatened	Critical Habitat Designated
	Upper Willamette River	Threatened	Critical Habitat Designated
Shortnose Sucker	Klamath Basin, Oregon	Endangered	Critical Habitat Proposed
Lost River Sucker	Klamath Basin, Oregon	Endangered	Critical Habitat Proposed
Bull Trout	Columbia River & Klamath River	Threatened	Critical Habitat Not Designated on Federal lands
Oregon Chub	Willamette River Valley	Endangered	Critical Habitat not designated

Fish species designated by the Bureau of Land Management as Bureau Sensitive or Bureau Assessment species are displayed in Table 257. For a complete list of non-status fish species endemic to the Planning Area, refer to the Oregon Natural Heritage Program website at (http://oregonstate.edu/ornhic/areas.html).

Table 257. Bureau Sensitive and Bureau Assessment Fish Species Present in the Planning Area.

Species	Status*
Millicoma Dace	Bureau Sensitive
Jenny Creek Redband Trout	Bureau Sensitive
Jenny Creek Sucker	Bureau Sensitive
Umpqua Oregon Chub	Bureau Sensitive
Miller Lake Lamprey	Bureau Sensitive
Coastal Cutthroat Trout (Columbia River/Southwest Washington)	Bureau Sensitive
Oregon Coast Coho Salmon	Bureau Sensitive
Fall Chinook Salmon (Southern Oregon Coast/California Coast)	Bureau Sensitive
Chum Salmon (Pacific Coast)	Bureau Sensitive
Spring Chinook Salmon (Southern Oregon Coast/California Coast)	Bureau Assessment
Steelhead (Klamath Mountains Province, Winter Run)	Bureau Assessment
Steelhead (Klamath Mountains Province, Summer Run)	Bureau Assessment

* **Information from BLM Special Status Species List 8/10/06.**

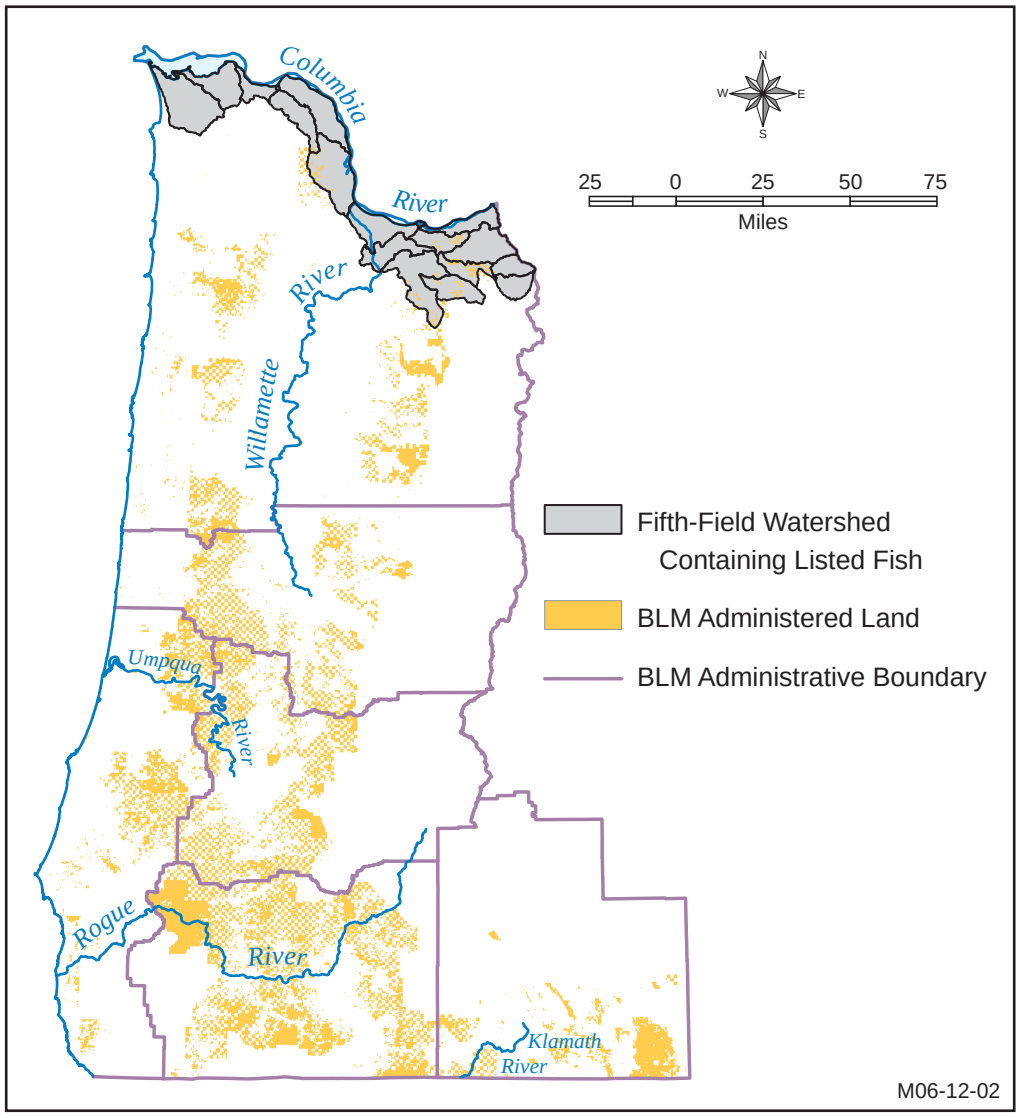
Status Summaries and Evolutionary Significant Units for Threatened or Endangered Salmonids

The following are summaries of the status of listed fish species within the plan area. Summaries for salmon and steelhead are from the National Marine Fisheries Service "Updated Status of Federally Listed ESU's of West Coast Salmon and Steelhead" (June 2005). The specific listing status of the species and the threats to the species, are given in the specific Federal Register notice for each species or group of species covered by the notice. The Federal Register notices can be found at the NMFS web site http://www.nwr.noaa.gov for anadromous fish and the U.S. Fish and Wildlife Service web site http://www.fws.gov/pacific/ for resident fish. Federal Register notices for rules regarding the designation of critical habitat can also be found at these web sites. The Federal register notices give the basic life history requirements for the listed species, the threats that caused the listing, and for critical habitat those basic requirements necessary for the survival and recovery of the species.

Lower Columbia River Chinook Salmon Evolutionary Significant Unit

The Willamette and Lower Columbia Technical Recovery Team estimated that 8 to10 historical populations in this ESU have been extirpated, most of them spring-run populations. Near loss of that important life history type remains an important Biological Review Team concern. High hatchery production continues to pose genetic and ecological risks to natural populations and to mask their performance. Most populations in this ESU have not seen as pronounced increases in recent years as occurred in many other geographic areas.

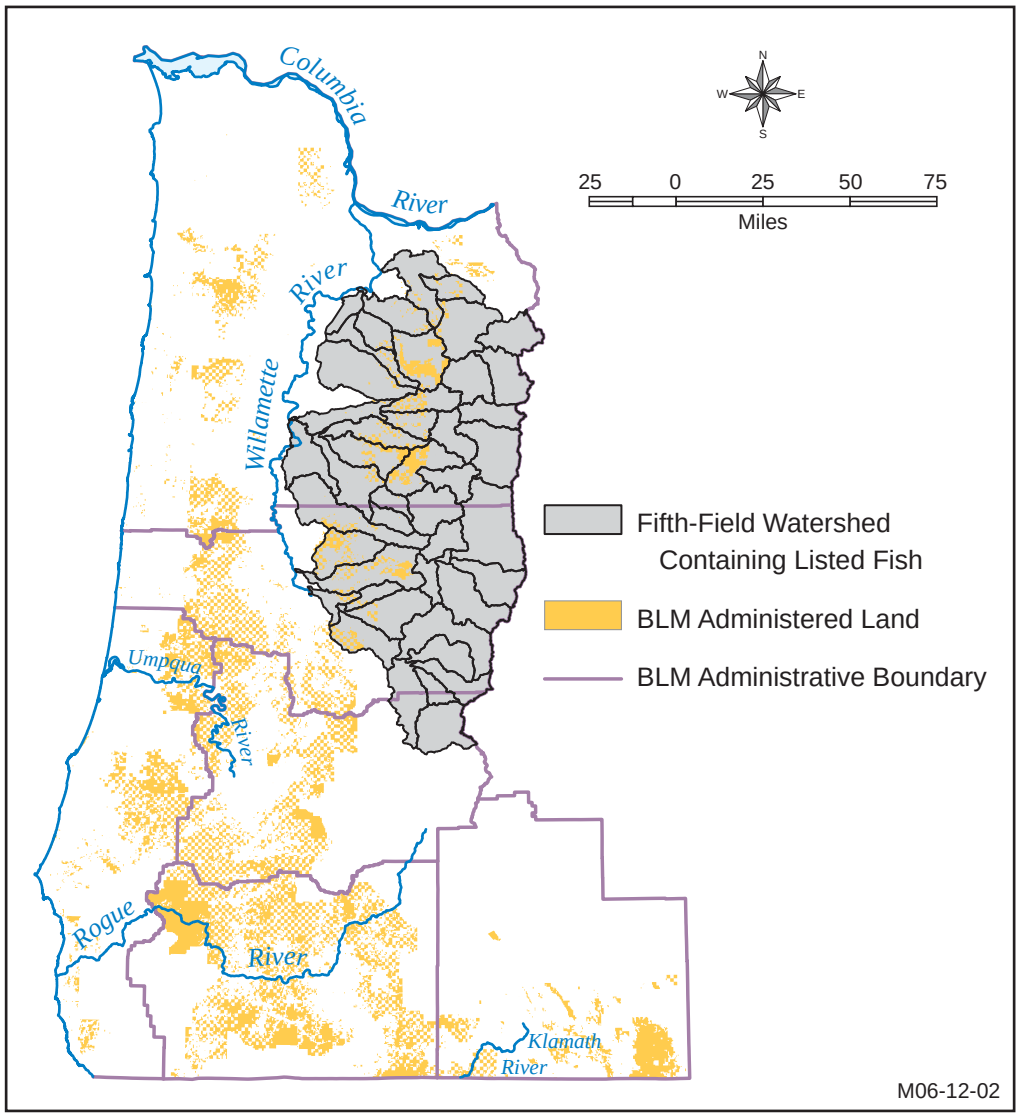
Figure 294. Historical independent Lower Columbia River Evolutionary Significant Unit early and late-fall-run Chinook salmon populations. Source: Myers et al. (2002).



Upper Willamette River Chinook Salmon Evolutionary Significant Unit

Updated status reviews and technical reports preliminary analysis indicate that most natural-origin spring-run Chinook populations are likely extirpated, or nearly so.

Figure 295. Historical populations of spring-run Chinook salmon in the Upper Willamette River Evolutionary Significant Unit. Source: Myers et al. (2002).

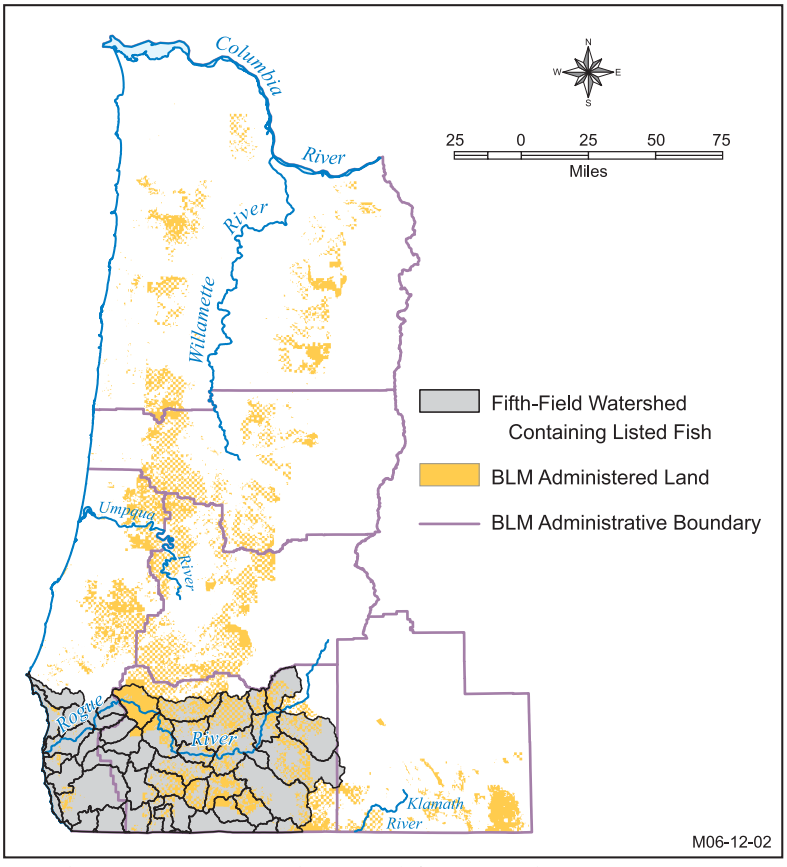


Southern Oregon/Northern California Coast Coho Salmon Evolutionary Significant Unit

Southern Oregon/Northern California Coast coho salmon Evolutionary Significant Unit exhibit low population abundance relative to historical numbers and long-term downward trends in abundance. A reliable time series of adult abundance is available only for the Rogue River. These data indicate that long-term (22-year) and short-term (10-year) trends in mean spawner abundance are trending upward in the Rogue, however, the positive trends reflect effects of reduced harvest rather than improved freshwater conditions, because trends in pre-harvest recruits are flat.

The relatively strong 2001 broodyear, likely the result of favorable conditions in both freshwater and marine environments, was viewed as a positive sign, but was a single strong year following more than a decade of generally poor years. On the positive side, extant populations can still be found in all major river basins within the Evolutionary Significant Unit, and the relatively high occupancy rate of historical streams observed in broodyear 2001 suggests that much habitat remains accessible to coho salmon.

Figure 296. Historical populations of the Southern Oregon/Northern California Coast Coho Evolutionary Significant Unit

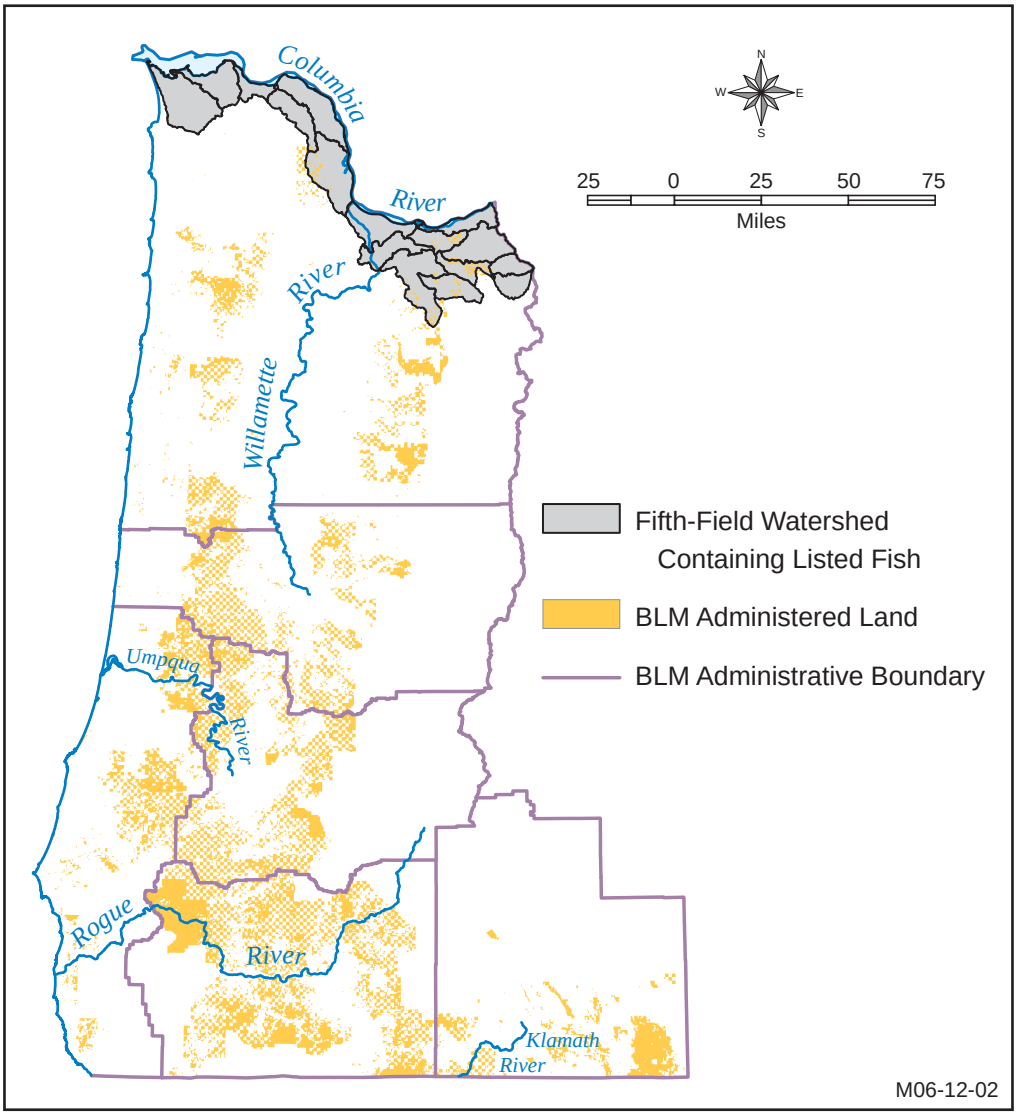


Southern Oregon Northern California Coho

Lower Columbia River Coho Salmon Evolutionary Significant Unit

In the only two populations with significant natural production (Sandy and Clackamas rivers), short- and long-term trends are negative, and productivity is down sharply from recent (1980s) levels. On the positive side, adult returns in 2000 and 2001 were up noticeably in some areas, and evidence for limited natural production has been found in some areas outside the Sandy and Clackamas rivers.

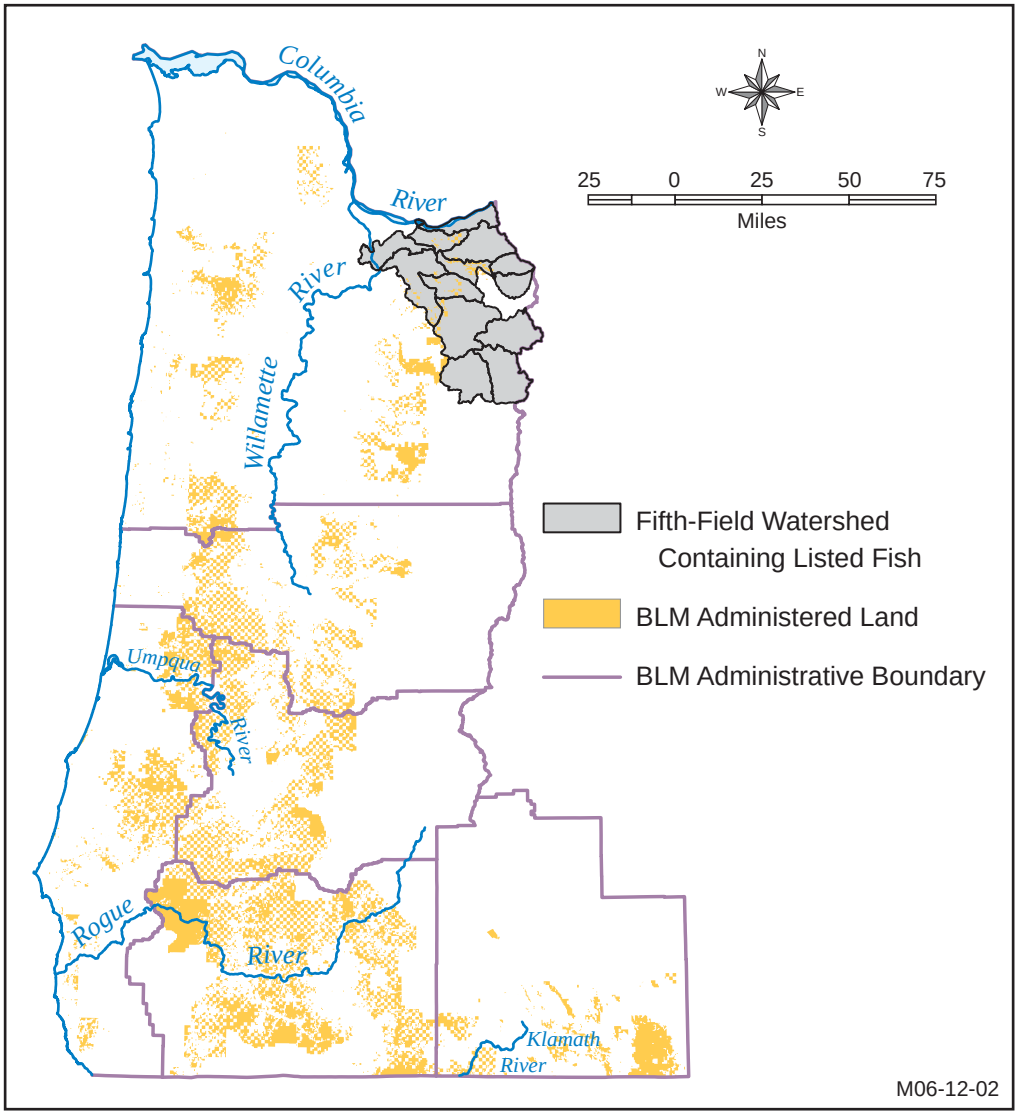
Figure 297. Tentative historical populations of the Lower Columbia River coho salmon Evolutionary Significant Unit. Source: based on work by Willamette/Lower Columbia Technical Recovery Team for Chinook salmon and steelhead (Myers et al. 2002).



Lower Columbia River Steelhead Evolutionary Significant Unit

Abundance of most populations is relatively low, and those populations for which there is adequate modeling data are estimated to have a relatively high extinction probability. Some populations, particularly summer run, have shown higher returns in the last 2 to 3 years. The Willamette and Lower Columbia Technical Review Team (Myers et al. 2002) has estimated that at least four historical populations are now extinct.

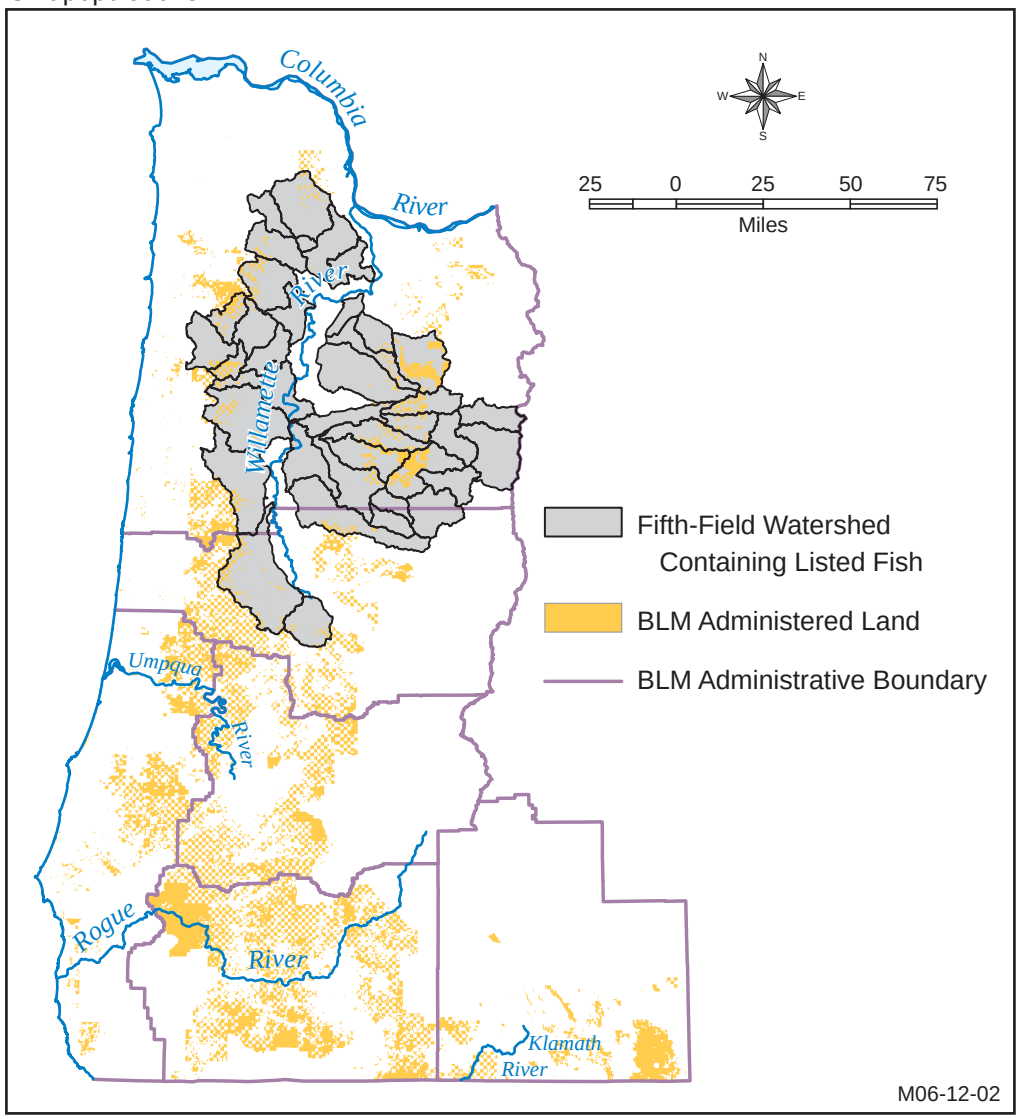
Figure 298. Historical populations of winter-run steelhead in the Lower Columbia River steelhead ESU.Source: Myers et al. (2002).



Upper Willamette River Steelhead Evolutionary Significant Unit

After a decade in which overall abundance (Willamette Falls count) hovered around the lowest levels on record, adult returns for 2001 and 2002 were up significantly, on par with levels seen in the 1980s. Still, the total abundance is small for an entire ESU, resulting in a number of populations that are each at relatively low abundance.

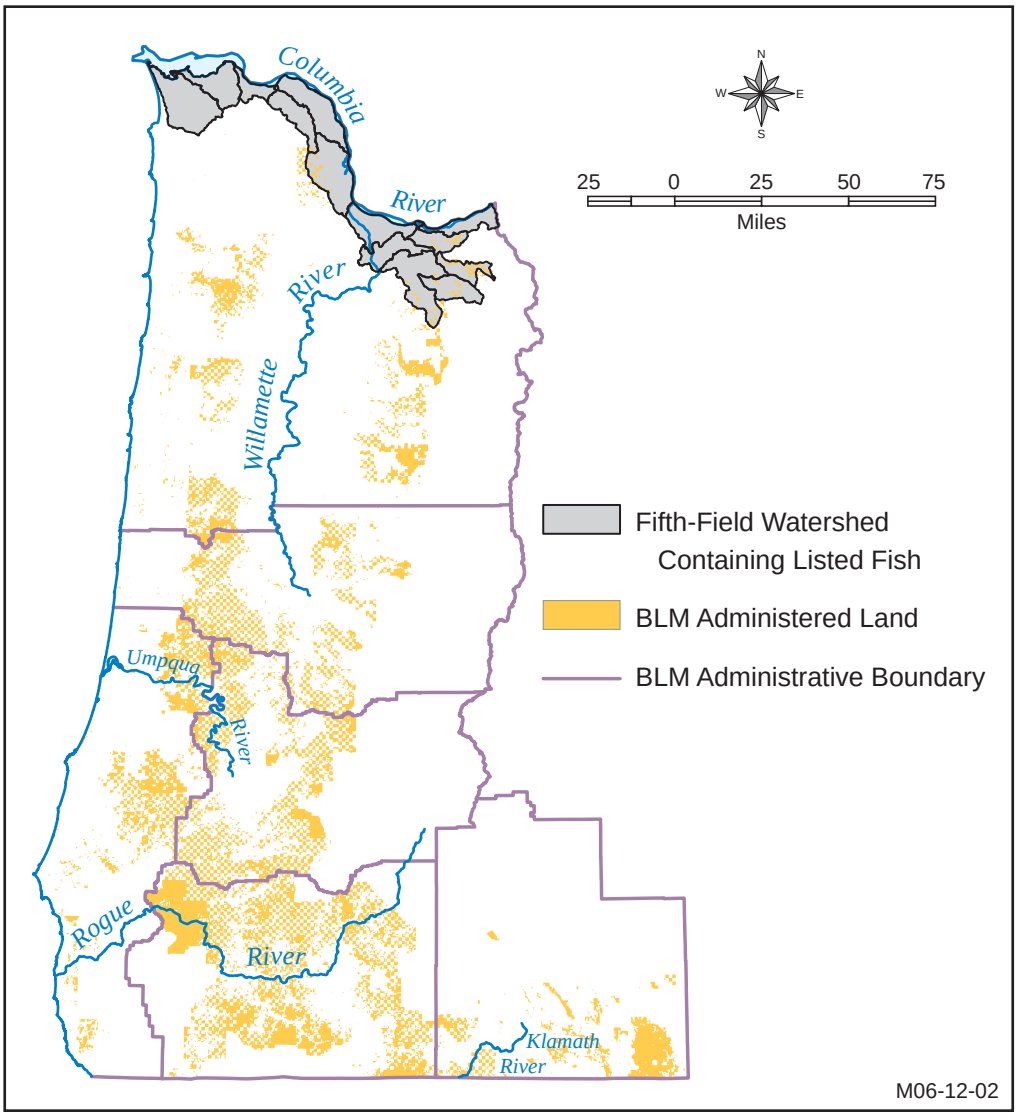
Figure 299. Map of historical Upper Willamette River steelhead Evolutionary Significant Unit populations



Columbia River Chum Salmon Evolutionary Significant Unit

Chum salmon spawn on the Oregon side of the lower Columbia Gorge in the Multnomah area, but appear to be essentially absent from other populations in the Oregon portion of the Columbia River chum salmon Evolutionary Significant Unit. With the exception of the lower Columbia Gorge population, Columbia River chum salmon are considered extirpated, or nearly so, in Oregon.

Figure 300. Historical chum salmon populations in the Columbia River chum salmon ESU.



Shortnose and Lost River Suckers

The Lost River and shortnose sucker are endemic to the Upper Klamath Basin of California and Oregon. Declining population trends for both species were noted as early as the mid-1960s, but the severity of the population declines was not evident until the early 1980s. In 1988, both Lost River and shortnose suckers were listed as endangered by the U.S. Fish and Wildlife Service.

The adult sucker monitoring program (USGS) has provided valuable information on the current status of sucker populations in the Upper Klamath Basin. Monitoring indicates there has been no significant recruitment into the adult population in the last few years (USGS).

Bull Trout

Bull trout were historically found in about 60 percent of the Columbia River Basin, but now occupy less than half of their historic range. Populations remain in portions of Oregon, Washington, Idaho, Montana and Nevada. In the Klamath River Basin, bull trout occupy only 21 percent of their historic range. While bull trout exist over a large area, their distribution and abundance has declined with several local extinctions documented. Many remaining populations are small and isolated from each other, making them more susceptible to local extinctions.

Oregon Chub

Oregon chub are endemic to the Willamette River Valley of western Oregon. Although information is scarce, historically the Oregon chub probably existed throughout the lower elevations of the Willamette River valley. The current distribution is limited to approximately 20 naturally occurring populations and 4 recently reintroduced populations. The populations are found in the Santiam River, Middle Fork Willamette River, Coast Fork Willamette River, McKenzie River, and several tributaries to the Mainstem Willamette River downstream of the Coast Fork/Middle Fork confluence. Almost all of the populations are small and isolated.

Recovery Planning

Recovery Plans for Willamette/Lower Columbia River chinook, coho, chum, and steelhead are underway. The status of the plans is currently available on the NMFS web site. Recovery Plans for Lost River and Shortnose suckers are available USFWS web site. The updated status of the various populations, a discussion of the existing limiting factors and threats to the populations will be developed in the various plans.

Intrinsic Potential Model and Large Wood Delivery Model

Intrinsic Potential Model

Intrinsic potential is a scientific, topographical approach used to determine the potential of a stream to provide high-quality habitat for salmonids. Comprehensive information on the location of stream reaches with the greatest potential to provide high-quality habitat for salmonids was generally missing for the planning area. The intrinsic potential of stream channels to provide high-quality rearing habitat was modeled for juvenile coho salmon (*Oncorhynchus kisutch*), juvenile steelhead (*O. mykiss*), and juvenile chinook salmon (*O. tshawytscha*). The initial research was conducted in the Coastal Landscape Analysis and Modeling Study (CLAMS) and was expanded for coho, steelhead and chinook on all ownerships within the planning area.

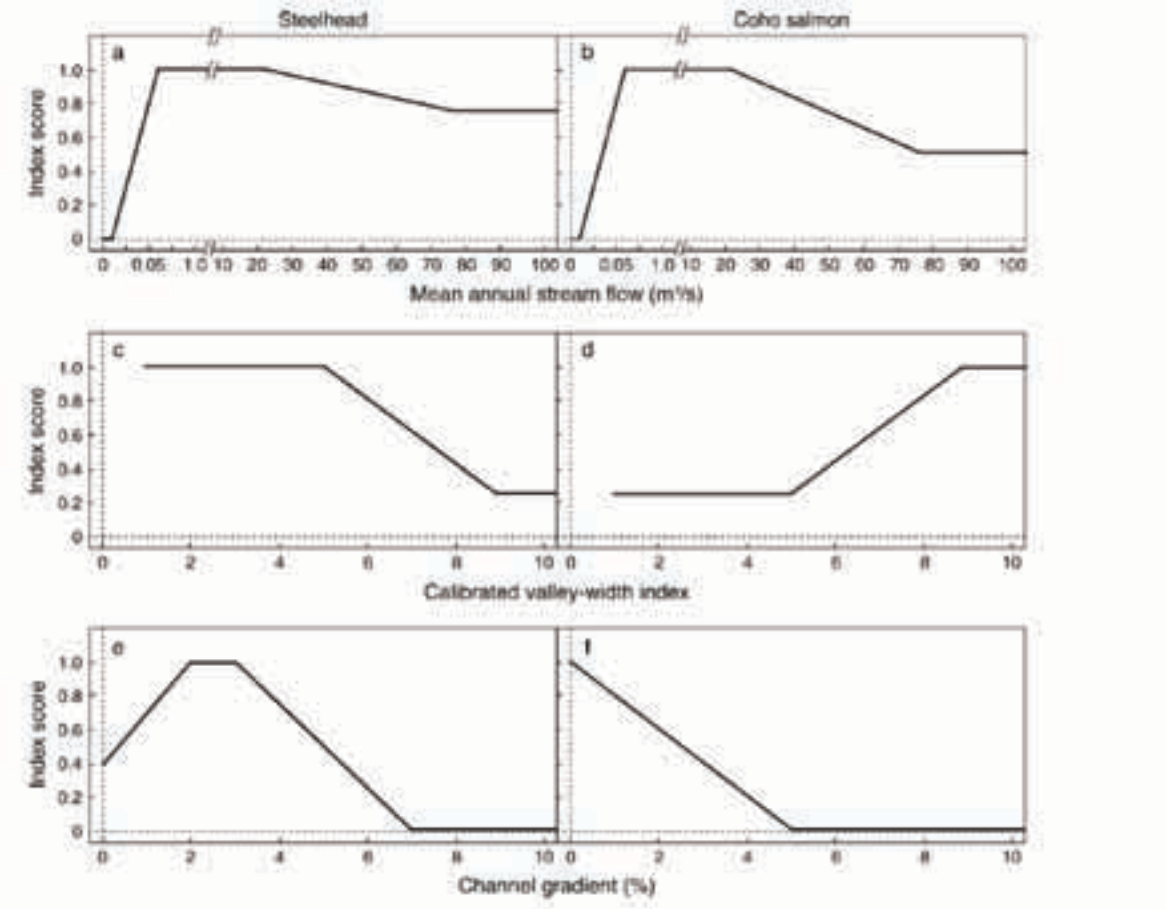
Spatial models were developed that estimate the potential of streams to provide high-quality rearing habitat for coho, steelhead and chinook. The calculated metric, termed intrinsic potential, reflects species-specific associations between fish use and persistent stream attributes; stream flow, valley constraint, and stream gradient.

The intrinsic potential for each stream reach was modeled independently for juvenile steelhead, coho, and chinook salmon from stream attributes of mean annual stream flow, valley constraint, and channel gradient. These attributes were produced in conjunction with the digital stream network from 10-m digital elevation models (DIGITAL ELEVATION MODELs) (Miller 2003). The stream network output was in an ArcView shape file format and then imported into ArcInfo (version 8.3; ESRI, Redlands, California, USA) for all subsequent processing. Stream attribute values were translated into index scores for each species (Figure 301. *Relationship between values of the three stream attributes (mean annual stream flow, calibrated valley-width index, and channel gradient*) *and the index scores that were used to calculate intrinsic potential for steelhead, coho, and chinook salmon*).

The index scores were based on empirical evidence from published studies regarding the relationship between a stream attribute and juvenile fish use. Following the most commonly applied approaches for modeling habitat suitability (Morrison et al. 1998 and Vadas and Orth 2001 in Burnett et al *in press*), intrinsic potential for each stream reach was calculated by multiplying the un-weighted species-specific index scores together and then taking the geometric mean of the product. This approach reflects the assumption that the three stream attributes are of approximately equal importance and only partially compensatory, and that the smallest index score has the greatest influence on the intrinsic potential. The index scores and intrinsic potential can range from zero to one; larger values indicating a greater potential for providing high-quality rearing habitat. Stream reaches were classified with a high species-specific intrinsic potential when the calculated

value was 0.75. Intrinsic potential is reported for a species only below naturally occurring barriers to migrating adults. (Burnett et al, *in press*)

Figure 301. Examples of relationship between values of the three stream attributes and the index scores used to calculate intrinsic potential.



Large Wood Delivery Model

The large wood delivery model is a spatially explicit, Geographic Information System-based wood recruitment model developed for this analysis to determine the potential large wood contribution to fish bearing streams from BLM-administered lands. The model determines the large wood contribution from each recruitment source:

- Riparian tree fall
- Channel migration
- Debris flow

For the wood recruitment model, metrics were developed to compare wood input rates by recruitment process and by location. A simplified set of stand types were used: Stand Establishment, Young, and Mature and Structurally Complex. For each stand type, three size classes were specified: 0-10”dbh, 10-20” dbh, and > 20” dbh. For each size class, a single average tree height was specified. As a measure of wood input, the number of trees from the large size class (dbh > 20”) from the Mature and Structurally Complex size class entering any stream was used. Inputs from smaller size classes or from the other two stand types were not included.

The distance from which falling trees could enter the channel was determined using the average tree height. To determine the input of large wood to streams the Stand Establishment and Young stand types have few or no large trees, so excluding these stand types did not affect the overall spatial and temporal patterns predicted by the models. Likewise, exclusion of the smaller size classes did not alter predicted patterns of input of large wood.

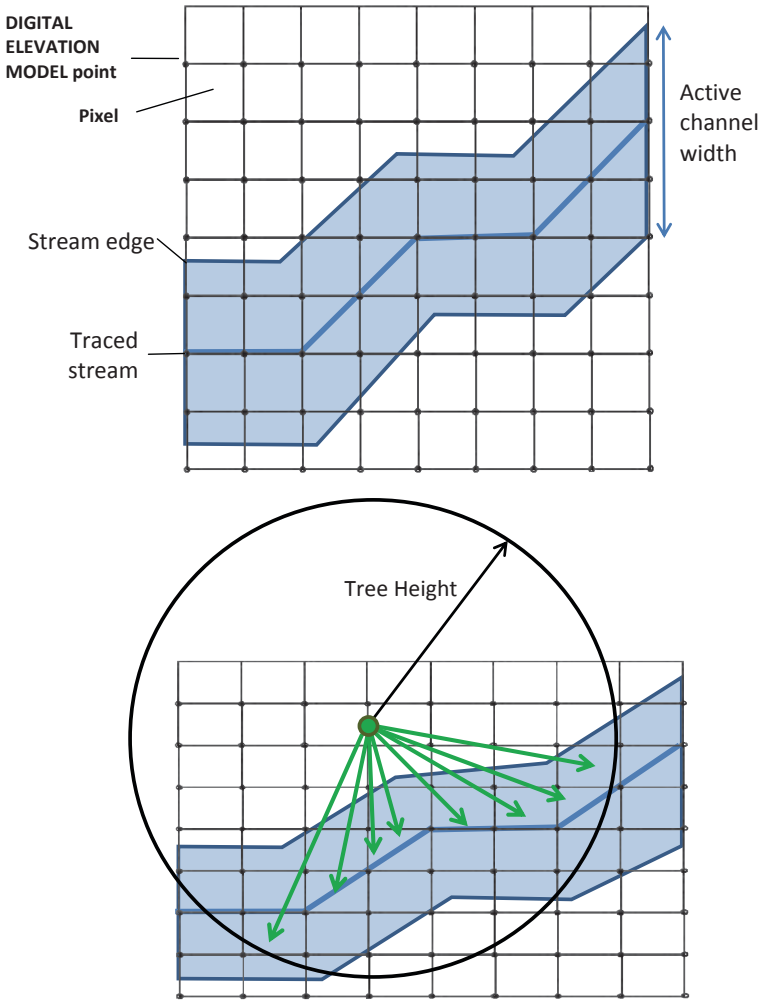
The size of the wood entering the channel is not tracked in order to simplify interpretation of model results; only trees of a particular size class, from a particular stand type, are tracked to channels. These simplifications highlight the primary spatial and temporal patterns predicted by the stand growth and wood recruitment models.

The model estimates average annual wood inputs, with no indication of temporal variability in input rates. This enables the identification of potential source areas for each recruitment processes, channel reaches potentially receiving wood from each process, and for examining spatial differences in average recruitment rates. However, the spatial pattern found for actual in-channel wood loads are very different than the pattern found for average recruitment rate: debris flow inputs, for example, occur only rarely. Hence, for any reach, the relative importance of debris flow inputs can vary dramatically over time depending on how long it has been since the last debris flow occurred. The stochastic nature of wood recruitment processes causes wood inputs to be episodic, punctuated in time a space. Patterns indicated by the wood recruitment model show where certain processes are active and how long-term average rates differ from location to location, but cannot predict how actual rates differ from year to year.

Methods

The stream channel network was traced using 10-meter Digital Elevation Models and the Western Oregon Plan Revision Geographic Information System stream fish distribution layer and Ground Transportation Road Network was used to determine fish bearing stream channels and all road and stream crossings.

Figure 302. Using Digital Elevation Models to delineate stream. For each Digital Elevation Model point, all stream-edge segments are found within one tree height.



For each stream-edge segment, the probability that a tree at the Digital Elevation Model point hits the segment when it falls was determined. Input information included the following and was repeated for every Digital Elevation Model point:

- Fall direction (closest edge segment)
- Angle subtended
- Distance to stream edge
- Slope at Digital Elevation Model point

Figure 303. Determining tree fall using DEMs.

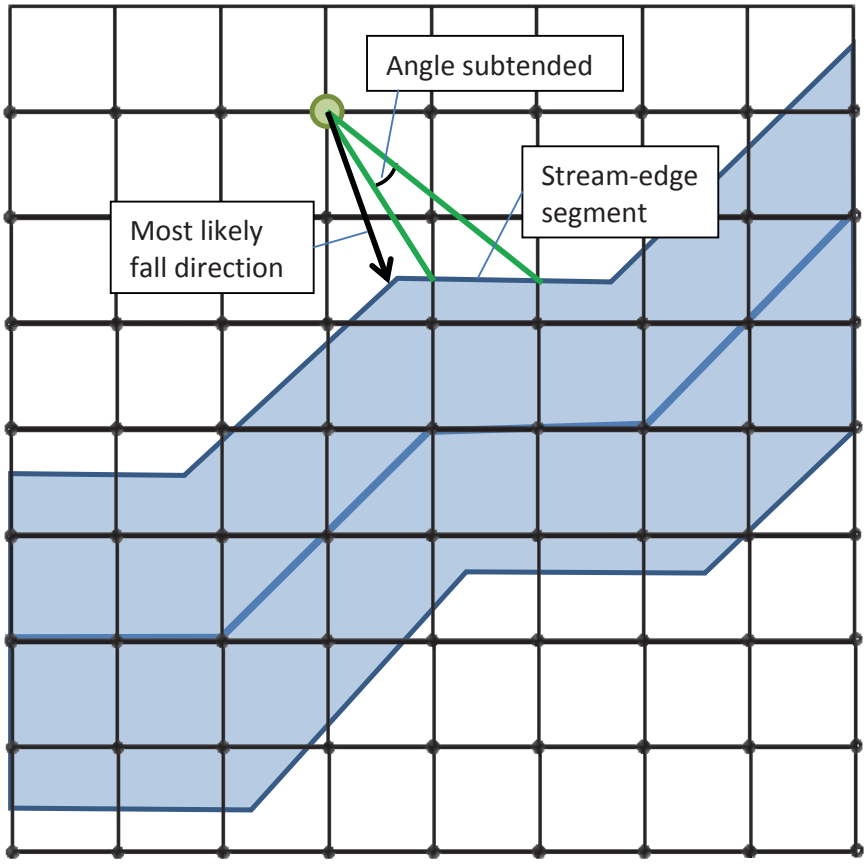
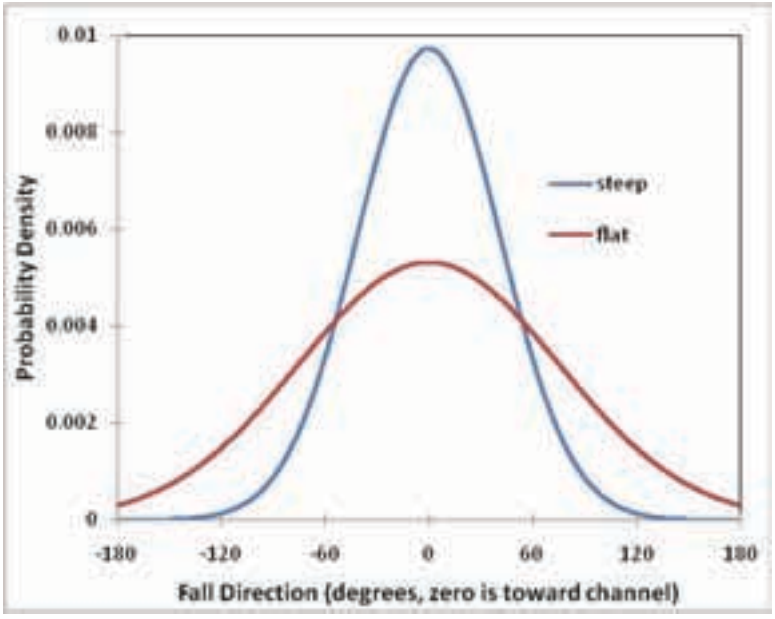


Figure 304. Probability that a falling tree at a DEM point hits a stream segment.



From these inputs, the following is determined for every Digital Elevation Model point:

- A list of every stream segment potentially hit by a falling tree from that point
- For each segment, the probability that the falling tree will cross the channel edge

For each stream-edge segment, the probability that a tree at the Digital Elevation Model point hits the segment when it falls was determined. Input information included the following and was repeated for every Digital Elevation Model point:

- Fall direction (closest edge segment)
- Angle subtended
- Distance to stream edge
- Slope at Digital Elevation Model point

From these inputs, the following is determined for every Digital Elevation Model point:

- A list of every stream segment potentially hit by a falling tree from that point
- For each segment, the probability that the falling tree will cross the channel edge

For each stream segment the following is determined:

- A list of every Digital Elevation Model point from which a falling tree might cross the segment

Each Digital Elevation Model point is associated with a 100-m2 pixel, and each pixel has an associated forest cover type (from OPTIONS growth and yield model):

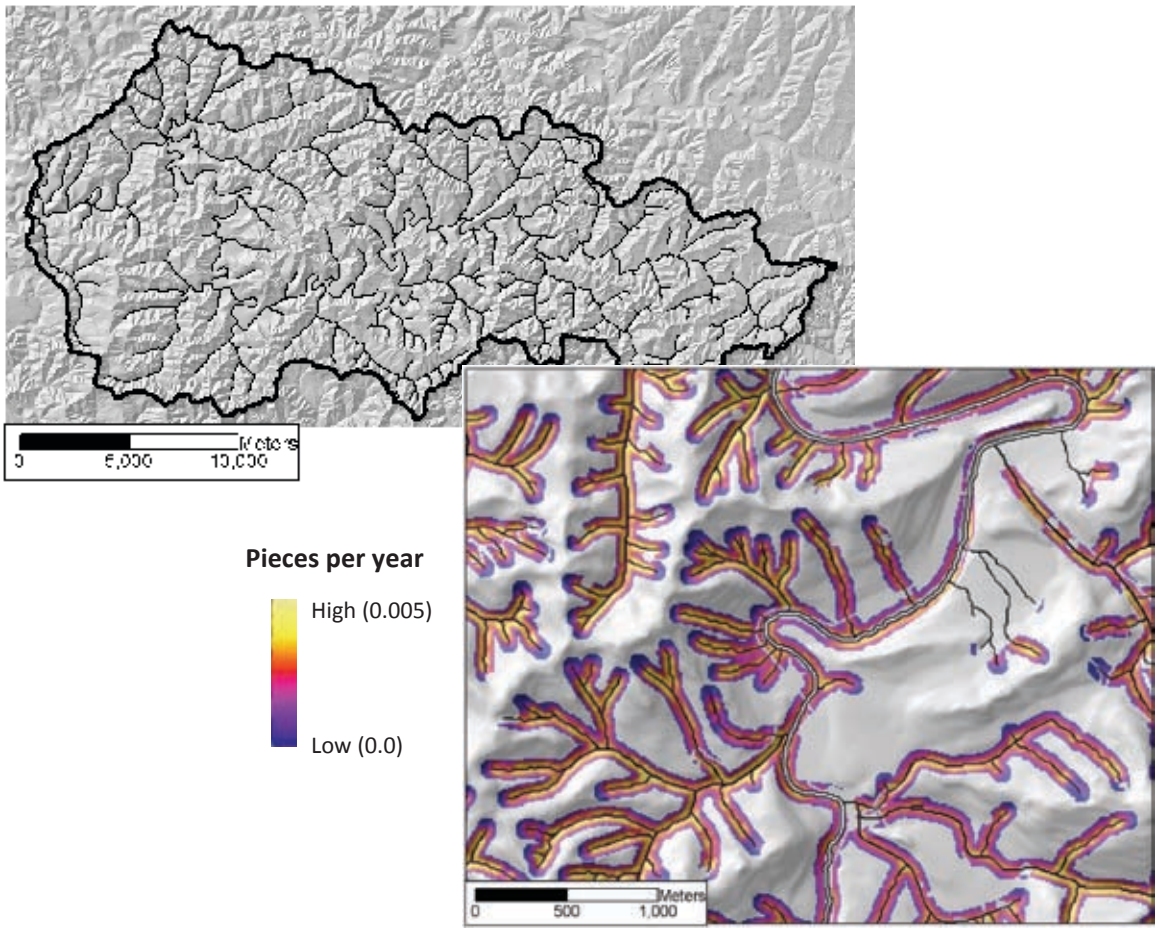
- Stand Establishment
- Young
- Mature
- Structurally Complex

Each forest cover type has an associated stand table divided into tree-size classes. For each tree-size class the following is used:

- stem density,
- diameter at breast height range
- average tree height
- mortality rate

With this information, for each corner of the pixel, the probability that a tree falls and that it hits a stream-edge segment is calculated. This probability is integrated over the area of the pixel to calculate the annual probability that a tree within the pixel falls and hits a stream-edge segment and is repeated for every segment potentially hit by a falling tree from within the pixel.

Figure 305. Tree fall from riparian areas dependent on: forest cover, hillslope gradient, distance to stream channel, and channel planform geometry.



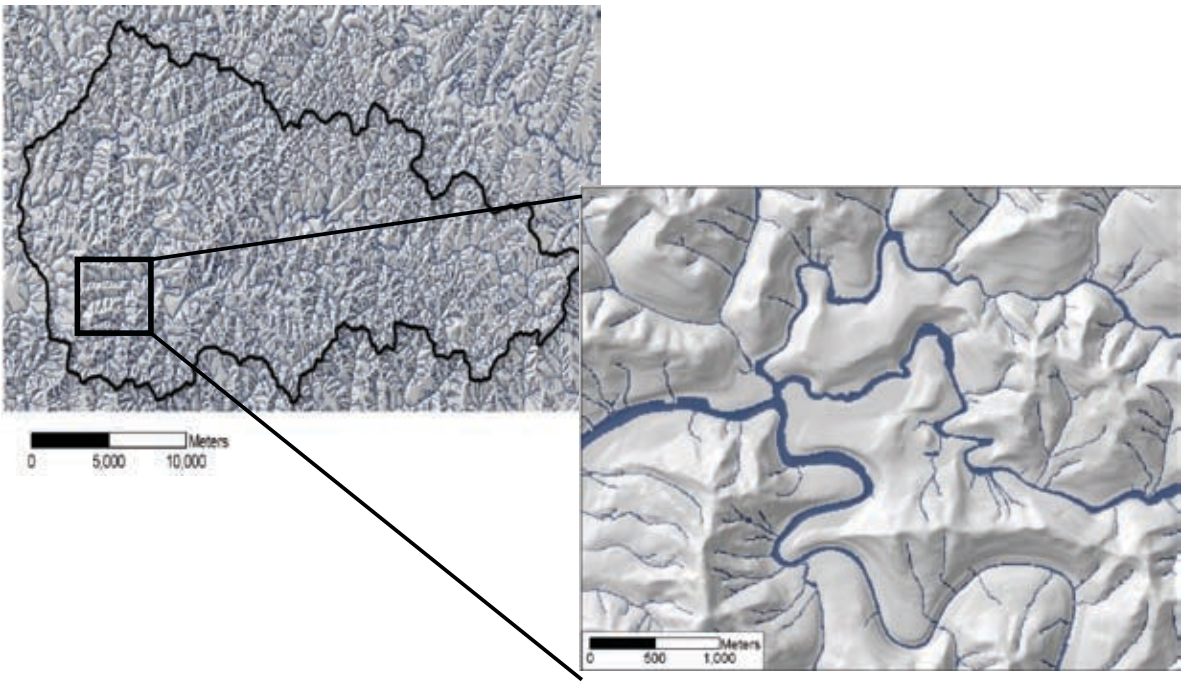
Channel Migration

To determine the large wood input from a channel migration zone the following factors were determined:

- Valley floor extent
- Valley floor composition and vegetation

To determine the channel migration zone, potential floodplain areas were delineated and a constant probability was applied of floodplain occupation (e.g. channel migration across the entire floodplain every 100 years). Wood recruitment was determined from stand tables with trees available for recruitment from each valley-floor pixel and assigning each valley-floor pixel a specified annual probability of being exhumed by the migrating channel (e.g., 0.01).

Figure 306. Identification of valley-floor pixels: within a specified elevation of the channel; within a specified slope relative to the channel slope; all pixels flagged meeting these criteria with the identification of the reach to which they drain.



Debris Flow

The model uses topographic characteristics from 10-meter Digital Elevation Models to identify all debris-flow initiation points across the landscape (Miller and Burnett, 2007) and identify the travel path from each source pixel to a fish bearing stream channel (Burnett and Miller, 2007; Miller and Burnett, in review). The Ground Transportation Road Network Geographic Information System layer was used with the travel path to determine road stream crossings and wood routing barriers. Each conditional probability that each Digital Elevation Model pixel was traversed by a debris flow was determined. All relative probabilities were multiplies to give a specified mean recurrence interval for all 3rd and higher-order channels (350 years).

For each Digital Elevation Model pixel, a mean annual probability of being traversed by a debris flow is determined. Starting from each debris-flow source pixel, the potential wood is accumulated pixel by pixel along each debris-flow source track

The proportion of wood taken from each pixel is determined by:

- Mean debris flow track width (from Oregon Department of Forestry data)
- The probability of no debris-flow deposition in the pixel

The proportion of accumulated wood deposited in each pixel is determined by the relative downslope decrease in debris-flow traversal probability (e.g., if traversal probability decreases by 20%, 20% of the accumulated wood is deposited)

Sources for debris flow wood:

- Standing trees (from stand tables)
- Down wood (calculated as per riparian)
- Wood deposited by previous debris flows

The amount of deposited wood that gets picked up by the next debris flow is determined by the probability that the wood is still in the channel when the next debris flow comes along (1 – (1-PDF)R); where PDF is annual probability of debris flow traversal and R is (1/PDF), the recurrence interval. This is equal to ~0.63 for all values of PDF. The assumption is that only buried wood survives (surface wood decays) and that 30% of the wood is buried. That gives ~20% of previously deposited wood available for future debris flow scour. This amount was multiplied by the probability of scour to estimate the amount of previously deposited wood picked up by debris flows.

Figure 307. Debris flow source areas for wood are widely distributed, but most of the wood accumulated by debris flows is scoured from low-order channels.

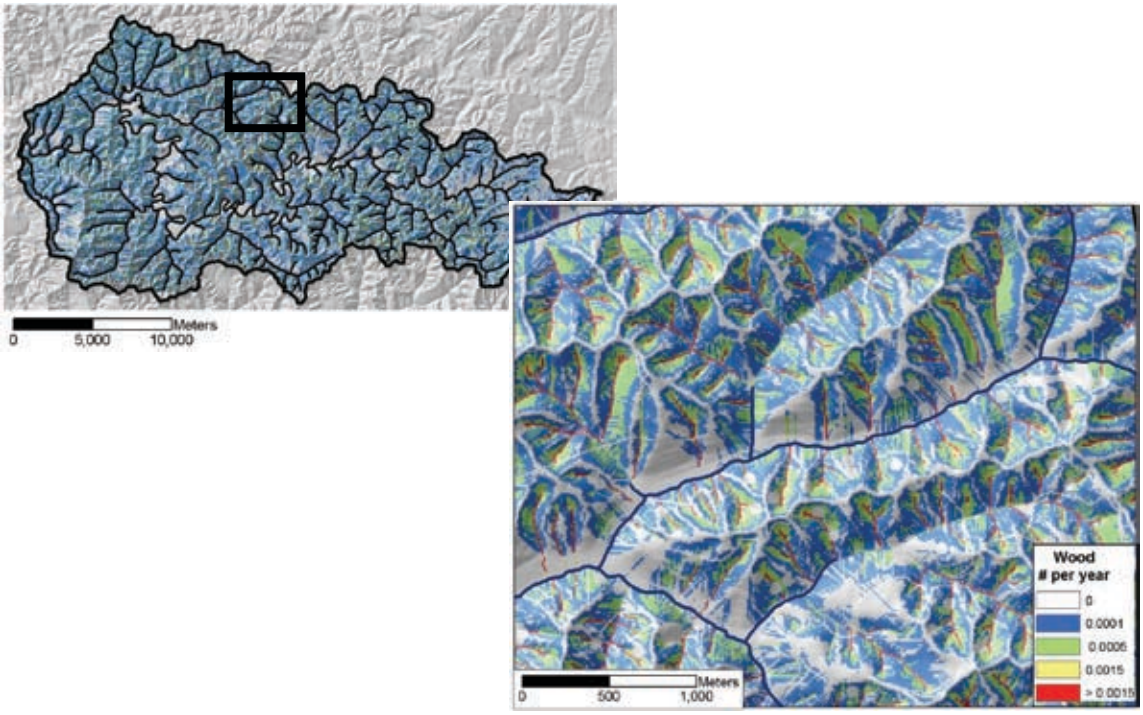
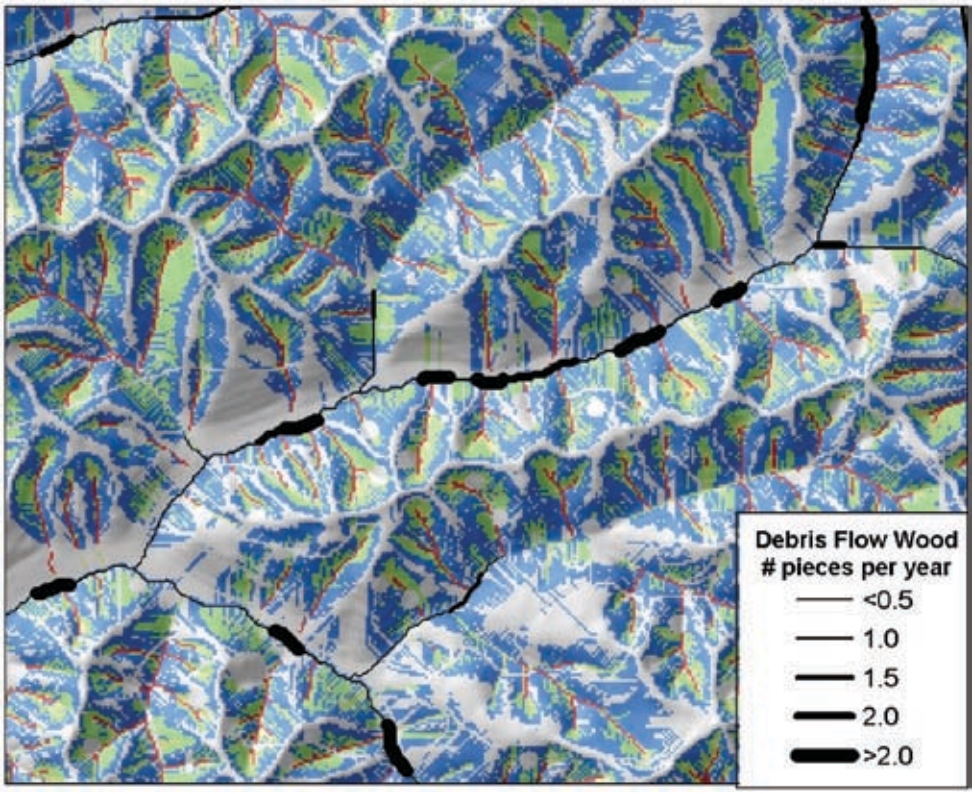


Figure 308. Debris flow inputs to fish-bearing streams occur at these low-order channel junctions.



Fish Productivity Index

A fish productivity index was developed for assessing the effects of wood recruitment on fish habitat. The index is used to assess potential fish habitat within a basin. The index is based on the assumption that available habitat is proportional to available channel area; (e.g., large channels can support more fish than small channels). Channel surface area is estimated as the product of channel width and channel length, determined from channel courses traced from a 10-m Digital Elevation Model. The available channel area is then modified using a species-specific measure of intrinsic habitat potential (Burnett et al. in press): an index that varies between zero and one as a function of channel gradient, mean annual flow, channel width, and valley width. (Both mean annual flow and channel width are calibrated functions of drainage area and mean annual precipitation, (Clarke et al. in review)).

A similar approach was used by Lawson et al. (Lawson et al. 2004) to estimate channel area available for coho production for basins in western Oregon. Summed over all channels in a basin, this index provides a simple, albeit course, measure of available habitat. It takes into account the channel length within a basin (channel density) and the habitat potential of those channels (via the intrinsic potential index). It can be used to rank basins in terms of potential habitat availability as discerned from these simple, topographically based criteria.

The potential effects of wood are incorporated into the index by the proportion of estimated wood recruitment relative to a potential maximum recruitment rate. This maximum rate is calculated for all forested areas in mature and structurally complex stands. This proportion, calculated for each reach, varies between zero and one. This proportion is related to effects on habitat based on the role of wood in creating pools. Although this is not the only function served by woody debris, it is an important one for which data exists from which to infer effects of wood on one aspect of habitat.

Pool spacing varies inversely with the number of pieces of large wood found in a channel (Montgomery et al. 1995, Beechie and Sibley 1997). Beechie and Sibley (1997), using data from northwest Washington, report a relationship between mean pool spacing, the number of pieces of wood per unit channel length, and channel gradient:

pool spacing (pools per channel width) = 2.7 - 4.6(slope x LWD/m) + 1.6(slope)

A minimum spacing of two pools per channel width occurred at a wood loading of 0.4 pieces per meter. Higher wood loadings did not result in smaller pool spacing. The assumption is that the maximum potential wood recruitment rate, obtained when all forested areas are in mature and structurally complex stands, results in this minimum spacing, which corresponds to the maximum number of pools. The maximum pool spacing, corresponding to the minimum number of pools, occurs when there is no wood. These endpoints, a minimum spacing of two pools per channel width and a maximum given by 2.7 + 1.6(slope) provide the potential range in the number of pools within a reach. This equation implies that the proportional change in the number of pools in a reach between full wood loading and no wood loading is:

Pmin = 2/(2.7+1.6*slope). Where: pmin is the proportion of the maximum number of pools expected in a reach; the maximum occurs when the reach is fully loaded with wood, the minimum (Pmin) occurs when there is no wood.

At zero slope this ratio is 74%; for a 5% channel, the ratio is approximately 19%. The ratio is an index of wood recruitment. If wood recruitment for a reach is equal to that calculated for a uniform mature and structurally complex forest cover (the maximum value), the index value is one. If recruitment is zero, the index value is given by Pmin. The index value for recruitment rates between the maximum and zero varies linearly from one to Pmin based on the proportion of the maximum recruitment rate. Potential habitat availability for each reach is then multiplied by the resulting wood index value. As wood recruitment rate goes to zero, the potential habitat availability is reduced by Pmin.

Appendix I. Water

This appendix provides supplemental material for the topics discussed within the chapters of this draft environmental impact statement that are related to water resources and riparian areas that are on BLM-administrated lands.

In this appendix:

Water Planning Criteria **1095**

Source Water Watersheds for Public Water Systems **1120**

Best Management Practices **1132**

Water Planning Criteria

Analytical Question # 1

How do the alternatives affect peak flow estimates that exceed detection limits within the rain dominated hydroregion?

Analytical Assumptions

- Hydroregions are a physical classification of landscapes based on the form of precipitation with elevation, as predominantly rain, rain and snow, or snow. In the rain dominated hydroregion, removal of basal area is used as a surrogate for reductions in leaf area. Removal of basal area is expected to affect peak flows to varying degrees (Grant et al 2007 In Review).
- Ziemer (1981, 1998) found a non-statistical increase (4%) in peak flow for 80 year old conifer stands that were harvested where, 50% of the basal area was retained.
- Within the rain dominated hydroregion the effect of increased peakflow is roughly proportional to area cut. Patch size or arrangement is not a factor in explaining greater flow volume or differences in timing. In this analysis, 40% basal area removed is set as a 6th field watershed response threshold for events with return periods of >2years, where the percent change in peakflow is expected to be greater than the detection limit (Grant et al 2007 In Review).
- Research indicates the largest percent increases in peak flows apply to 100% regeneration harvested watersheds where all the basal area is removed, within the rain dominated hydroregion. For partial reductions in basal area by thinning, the inter-relationships of forest tree size, stocking, distribution and age affect leaf area, but not necessarily hydrologic processes. The 6th field watershed response threshold of 40% basal area removed, will be calculated by using the following assumptions:
- For BLM lands, the 10-year projection derived data layers will be used as a surrogate to determine basal area removed, using the acres of the ecology description attributes of stand establishment with legacy and stand establishment without legacy. For other lands, acres of less than 30% vegetative crown closure reclassed from the 1996 Interagency Vegetation Mapping Project TM will be used as a surrogate for removal of basal area. Any cell meeting this description is binned as basal area removed.
- For other lands, it is assumed that the percentage of basal area removed is the same for all planning time periods by 6th field watershed.
- This analytical procedure is viewed as a screening process to determine probable watersheds at risk for peak flow enhancement from removal of basal area in the precipitation dominated hydroregion. The output changes, depending on the climate, elevation and forest cover relationships.

Analytical Methodology and Technique

The technique relies on ARC GIS processes for analyzing spatial data. Logical and mathematical operations will be written as scripts, based on watershed analysis methodologies.

Step 1 –
Using the Hydroregions derived data layer (Planning Criteria #2 step 3), exclude any 6th field watersheds from further analysis that contain < 70% rain dominated areas. Mask the area of the remaining 6th filed watersheds that are not rain dominated. Build a new selected set labeled "Rain Dominated".

Step 2 –
For other lands, determine "Existing Condition Hydrologic Maturity" for forest vegetation by reclassing the 1996 classified Interagency Vegetation Mapping Project TM (IVMP) imagery. Table 258 will be used to construct the derived data layer.

Table 258. Vegetation Hydrologic Maturity Assignment to Land Cover Class.

Hydrologic Maturity	Land Cover Classes
Minimum Hydrologic Maturity	<30% total crown closure

Step 3 –
Intersect "Current Condition Hydrologic Maturity" (step 2) with the Rain Dominated 6th field watersheds selected set (step 1). Intersect the alternatives' 10-year projections vegetation structural stages with the Rain Dominated 6th field watersheds selected set (step 1).

Step 4 –
For BLM, use the alternatives' 10-year projections, to calculate the acres of basal area removed. Include the stand establishment ecology polygons (acres), with the attributes stand establishment with legacy and stand establishment without legacy for each rain dominated 6th field watershed.

Step 5 –
For other lands, calculate the acres of each rain dominated 6th field watershed that is minimum hydrologic maturity (step #2, Table 258).

Step 6 –
Sum the total basal area removed in acres, by each 6th field watershed, for the existing condition and each alternative (steps 4 and 5). Calculate total 6th field watershed acres, and basal area removed as a percent of the total.

Step 7 –
Conduct reference analysis. Replace the alternatives' 10-year projections coverage with the same attributes in step-4 with the no harvest and maximum harvest on commercial forest lands projections.

Analytical Conclusions

Rank the precipitation dominated 6th field watersheds that exceed 40% basal area removed as sensitive for peak flow increase.

Data Needs

- Classified 1996 imagery from the Interagency Vegetation Mapping Project TM (IVMP), including new openings under 10 years of age, current to 2005.
- GIS-derived data layer of hydroregions.
- GIS-derived data layer of vegetation hydrologic maturity.
- Watershed GIS coverage (for determining area and 6th field watersheds)
- By alternative, GIS-derived spatial data layer of 10-year projections stand establishment (acres).

Data Display

- Figure showing 6th field watersheds where basal area removed exceeds 40%, for the existing condition and with the application of each alternative's 10-year projection.

Analytical Question # 2

How do the alternatives affect peak flow estimates that exceed detection limits within the rain-on-snow hydroregion?

Analytical Assumptions

- Hydroregions are a physical classification of landscapes based on the form of precipitation with elevation, as predominantly rain, rain and snow, or snow. Rain-on-snow areas where shallow snow accumulations can come and go have been reported by Harr (1981, 1992) to be in the elevation range of 1200-3600 feet in western Oregon and from 2500 to 5000 feet in the southern Oregon Cascades (Lindell, pers.com.).
- The subwatershed level (USGS Sixth-field Hydrologic Unit Code) was chosen for the analysis, because it better approximates the BLM forest land pattern, and tributary streams are more sensitive to vegetation and runoff-related changes. This analysis level can also be viewed as an additional margin of safety in terms of describing effects.
- Forest openings commonly receive greater snow accumulation (2 to 3 times more snow water equivalent) than adjacent forests (Harr 1992). These openings also receive greater wind speeds and twice the amount of heat during rain-on-snow events, which provides greater melt compared to the mature forest (Harr 1981, 1992;

Storck 1997). Regeneration harvest or forest conversion will provide additional melt contributions under rain-on-snow conditions (Harr 1981, Storck 1997).

- Rain-on-snow occurrences normally correspond with a streamflow return period of 2 to 8 to years where pre-logging and post-logging regressions were significantly different (Harr 1992).
- Basin characteristics regression analysis with gauged watersheds of long-term record is an appropriate method of describing peak flows of various exceedance probabilities for unregulated streams in ungauged watersheds. Harris and Hubbard (1979) flood frequency equations were chosen as reference points; because they cover the various hydrologic regions in the plan area and have long-term records (10-70 years). The base period of streamflow data collection for use in the analysis was prior to maximum forest conversion in many watersheds. The data set may include some chance rain-on-snow events.
- The 2-year, 24-hour precipitation intensity is assumed to coincide with the 2-year, 24-hour discharge.
- U.S. Army Corps of Engineers studies (USACE 1956, 1998) show that the principal melt component in a rain-on-snow event is convection/condensation melt. This component is far larger than long-wave and short-wave radiation melt, rain melt, and ground melt. In a typical USACE rain-on-snow example, convection/condensation melt accounts for 70 percent of daily snowmelt quantities. Ground wind speed, warm air temperatures and nearly equivalent dewpoint temperatures are the drivers in the convection/condensation melt term.
- Basin characteristics regression analysis with gauged watersheds of long-term record is an appropriate method of describing peak flows of various exceedance probabilities for unregulated streams in ungauged watersheds. Harris and Hubbard (1979) flood frequency equations were chosen as reference points; because they cover the various hydrologic regions in the plan area and have long-term records (10-70 years). The base period of streamflow data collection for use in the analysis was prior to maximum forest conversion in many watersheds. The data set may include some chance rain-on-snow events.
- For other lands, it is assumed that the percentage of basal area removed is the same for all planning time periods by 6th field watershed.
- This analytical procedure is viewed as a screening process to determine probable watersheds at risk for peak flow enhancement from rapid melt of shallow snowpacks. The output changes, depending on the climate, elevation and forest cover relationships.

Analytical Methodology and Technique

The technique relies on ARC GIS GRID processes for analyzing spatial data. Logical and mathematical operations were written as scripts, based on watershed analysis methodologies. The analytical technique is an empirical approach patterned in part from the Washington State Department of Natural Resources Standard Methodology for Conducting Watershed Analysis 1997, (v. 4.0), Appendix C.

Step 1 -
Construct "Flood-Frequency Precipitation" data layer. Obtain precipitation frequency data for the 2-year 24-hour storm for the plan area (NOAA 1973) in raster format available online: [http://www.nws.noaa.gov/ohd/hdsc/noaaatlas2.htm]

Step 2 -
Intersect watershed boundaries with "Flood-Frequency Precipitation" data. Intersect the BLM watershed GIS theme with the flood-frequency precipitation derived data layer at the 6th-field HUC level.

Step 3 -
Determine "Hydroregions." Construct a derived data layer to include elevation bands of rain-dominated areas that are below the rain-on-snow zone; rain-on-snow zone (also called transitional) and snow-dominated zone that are above the rain-on-snow zone. District hydrologists will assign lower and upper elevation bounds for the rain-on-snow zone for all 6th-field watersheds wholly or partly contained in the plan area, based on the following criteria:

Lower Bounds of the Rain-On-Snow Zone

Use National Resources Conservation Service SNOWTEL data for January 1 snow accumulation elevation (Greenburg and Welch 1998), and local hydrologist observation, which may vary from 1200-2500 feet.

Upper Bounds of the Rain-On-Snow Zone

Use regionally established upper limit from hydrologist observation or literature or the onset of frozen soils, which may vary from 3600-5000 feet.

Step 4 -
Filter the "Hydroregions" derived data layer. Filter by 6th-field watershed, and exclude any subwatersheds from further analysis that contain only rain areas or only permanent snow areas or <10% rain-on-snow (transitional) areas. Make a new derived data layer labeled "Rain-on-Snow" selected from the set.

Step 5 –
Using the Rain-on-Snow selected set to separate the remaining 6th field watersheds by flood region (Harris and Hubbard 1979), online: [http://water.usgs.gov/software/nff_manual/or/oregon_AFrame_3.gif]

Step 6 -
Calculate 2-Year 24-Hour Streamflow, and the 5-Year 24-Hour Streamflow from USGS basin characteristics regression analysis method (Harris and Hubbard 1979) using GIS scripts.

2-Year 24-Hour Streamflow

Coast Region: $Q_{0.5}=4.59A^{0.96}(ST+1)^{-0.45}I^{1.91}$

Willamette Region: $Q_{0.5}=8.70A^{0.87}I^{1.71}$

Rogue-Umpqua Region: $Q_{0.5}=24.2A^{0.86}(ST+1)^{-1.16}I^{1.15}$

High Cascades: $Q_{0.5}=4.75A^{0.90}(ST+1)^{-0.62}(101-F)^{0.11}I^{1.17}$

where: $Q^{0.5}$= discharge in cubic feet per second (CFS) for a 2-year 24-hour recurrence interval event:

A = drainage area in square miles

ST = area of lakes and ponds in percent

F = forest cover in percent

I = 2-year 24-hour precipitation intensity in inches

5-Year 24-Hour Streamflow

Coast Region: $Q_{0.2}=6.27A^{0.95}(ST+1)^{-0.45}I^{1.95}$

Willamette Region: $Q_{0.2}=15.6A^{0.88}I^{1.55}$

Rogue-Umpqua Region: $Q_{0.2}=36A^{0.88}(ST+1)^{-1.25}I^{1.15}$

High Cascades: $Q_{0.2}=8.36A^{0.86}(ST+1)^{-0.81}(101-F)^{0.08}I^{1.30}$

where: $Q^{0.2}$= discharge in cubic feet per second (CFS) for a 5-year 24-hour recurrence interval event,

A = drainage area in square miles

ST = area of lakes and ponds in percent

F = forest cover in percent

I = 2-year 24-hour precipitation intensity in inches

Area of lakes and ponds include natural lakes, ponds, and impoundments. Forest cover is the watershed area greater than 10% forest cover, and is the hydrologic maturity cover classes A and B (step 7).

Step 7 –
Determine "Existing Condition Hydrologic Maturity" for forest vegetation, by reclassing the 1996 classified Interagency Vegetation Mapping Project TM (IVMP) imagery. The table below will be used to construct the derived data layer.

Table 259. Vegetation Hydrologic Maturity Assignment to Land Cover Class.

	Hydrologic Maturity	Land Cover Classes
A	Hydrologically Mature	>70% total crown closure AND <75% of the crown in hardwoods or shrubs
B	Intermediate Hydrologic Maturity	10%-70% total crown closure AND <75% of the crown in hardwoods or shrubs
C	Minimum Hydrologic Maturity	<10% total crown closure AND/OR >75% of the crown in hardwoods or shrubs
D	Non-Forested	Agricultural and Grazing Lands Open Water Lakes, Ponds, Reservoirs Inundated Wetlands Other naturally occurring open areas

Source: Department of Natural Resources, Hydrologic Change Module

Step 8 -
Intersect "Existing Condition Hydrologic Maturity" with the "Rain-on-Snow" 6th field watersheds selected set (step 4).

Step 9 -
Estimate snow depth and snow water equivalent to create an "Estimated Snow-water Equivalent" derived data layer.

Obtain the Topographic Data theme for Rain-on-Snow" 6th field watersheds selected set (step 4) and build a raster (cell) derived data layer.

Solve the following two snow water equivalent (SWE) equations for the topographic data theme by writing scripts (Greenburg and Welch 1998):

Northwest Oregon SWE =0.009*Elevation-21.66 *R

Southwest Oregon SWE =0.006*Elevation-19.53*R

where: SWE = February 1 snow-water equivalent in inches.
Elevation = elevation in feet.
R = snowwater equivalent ratio to adjust for cover types

The division between northwest and southwest Oregon regions (for equations) will be determined by an eastward line following the southern edge of the Siuslaw subbasin in the Coast Range to the southern edge of the Willamette subbasin through the Willamette Valley and the Cascades. The line is formed by watersheds:

Lower Siuslaw River	1710020608
Upper Siuslaw River	1710020601
Upper Coast Fork Willamette	1709000203
Row River	1709000201
Hills Creek Reservoir	1709000105
Upper Middle Fork Willamette	1709000101

Snow water equivalent (SWE) values calculated are assumed to represent snow accumulation in hydrologically mature forests; these must be modified to account for variations in accumulation between different land use/cover types.

Table 260. Vegetation hydrologic maturity and snow water equivalent ratios.

	Vegetation Hydrologic Maturity (step 7)	Snow-water Equivalent Ratio (R)
A	Hydrologically Mature	1
B	Intermediate Hydrologic Maturity	1.5
C	Minimum Hydrologic Maturity	2
D	Non-Forested	2

Populate the two snow water equivalent scripts with the snow-water equivalent ratios (R) for the existing condition for the northwest and southwest Oregon areas using classified IVMP data (Step 7), as seen in the table above.

Step 10 -
Determine One-Day Snowmelt for a 24 hour design storm for the existing condition by writing scripts. This procedure uses equations from the U.S. Army Corp of Engineers (1998).

For heavily forested or partly forested areas (step 7 land cover classes A and B):

$M = (0.074 + 0.007P)(T - 32) + 0.05$

For minimum forest or open areas (step 7 land cover classes C and D):

$M = (0.029 + 0.0084kv + 0.007P)(T - 32) + 0.09$

where: M = snowmelt, in/day
v = wind velocity, miles per hour
P_r = rate of precipitation, in./day
T_a = temperature of saturated air, at 10-feet level, °F
k = basin wind coefficient. Use 0.4 for heavily to partly forested areas (hydrologic maturity land cover classes A, and B), and 0.9 for open areas (hydrologic maturity land cover class C and D).

Calculate snowmelt in each hydrologic maturity land cover cell for the existing condition. If the calculated snowmelt (M) for a given scenario exceeds the estimated snow equivalent (SWE), set M = SWE; also, if T_a is ≤ 32 °F, M = 0.

Temperature

Storm temperature varies primarily with elevation. Determine the average storm temperature (Ta °F) for each cell area based on generalized regional lapse-rate equations:

Western Oregon = 50 - (.0033 * E)

where: E = elevation in feet

Wind speed

Local wind speed primarily depends on the vegetative cover, with mature forest canopies significantly reducing the wind speed at the interface between the snowpack and the air. Daily average windspeed (mph) with a 50% exceedance rate (% of days) for an average storm for western Oregon will be used. This corresponds to an estimated 15 mph.

Precipitation

Rate of precipitation is calculated, using the 2 year 24 hour precipitation, in. (step 1).

Step 11 –
Calculate water available for runoff.

Perform a zonal mean for each 6th field watershed:

$$M = \frac{A_1M_1+A_2M_2+\ldots A_nM_n}{A_1+A_2+\ldots A_n}$$

where: M = snowmelt, in.
A = area, acres

Calculate water available for runoff for the existing condition by:

WAR = M + P

where: WAR = water available for runoff, in./day
M = snowmelt, in./day
P = 2-year 24-hour precipitation, in.

Add the snowmelt (M) to the 2-year 24-hour precipitation (P) and track for each 6th-field watershed in the 'Rain-on-Snow" derived data layer (step 4).

Step 12 –
Estimate peak flow for the existing condition. Estimate peak flows for each 6th field watershed (filtered set, step 4) by substituting the water available for runoff value (step 11) for the existing condition into the 2-year 24-hour streamflow regression equations (step 6) for the precipitation term. Compare the result with the 5-year 24-hour streamflow and indicate where it is exceeded.

Step 13 –
Estimate peak flow for the alternatives. Repeat steps 7 to 12 for the 10-year projection by reclassing the expected condition of vegetation (step 7). Intersect the ecology stand establishment with attribute without legacy from the Options model derived data layer for the 10-year projection for each alternative with the "Existing Condition Hydrologic Maturity" for forest vegetation. Substitute cover class C for these areas.

Step 14 –
Conduct reference analysis. Replace the alternatives 10-year projections with the no harvest and maximum harvest on commercial forest lands reference analysis derived data layers. Order the analysis as in step 13.

Step 15 –
As a sensitivity analysis for the design storm, one standard error of the estimate will be applied to the USACE snowmelt equation for temperature and wind speed. For temperature, use 55 - (.0033 * E), where E = elevation in feet. For windspeed, use 25 mph. Modify scripts and rerun the analysis.

Analytical Conclusions

- Rank those subwatersheds that exceed the 5-year 24-hour peakflow as sensitive for estimated peak flow increase.

Data Needs

- National Oceanic and Atmospheric Administration (NOAA) 2-year 24-hour Precipitation Frequency map of Oregon. Available in GIS raster format online: [http://www.nws.noaa.gov/ohd/hdsc/noaaatlas2.htm]
- USGS Flood Regions. Available in GIS raster format online: [http://water.usgs.gov/software/nff_manual/or/oregon_AFrame_3.gif]
- U.S. Weather Service Windspeed Frequency.
- Classified 1996 imagery from the Interagency Vegetation Mapping Project TM (IVMP), including new openings under 10 years of age, existing to 2005.
- GIS-derived data layer of hydroregions.
- GIS-derived data layer of vegetation hydrologic maturity.
- GIS-derived data layer of snow-water equivalent.
- GIS-derived data layer of snowmelt.
- Topography GIS coverage.
- Watershed GIS coverage.
- Waterbodies GIS coverage.
- By alternative, GIS derived data layer of 10-year projection stand establishment.

Data Display

- Figure of hydroregions for the plan area.
- Figure showing 6th-field subwatersheds where the 2-year 24-hour peakflow exceeds the 5-year 24-hour peakflow for the existing condition, for each alternative's 10-year projection.

Analytical Question #3

How will the alternatives affect road sources of fine sediment delivery to stream channels?

Analytical Assumptions

This analysis is based on use of a reference road. The analytical technique is an empirical approach patterned in part from the Washington State Department of Natural Resources Standard Methodology for Conducting Watershed Analysis 1997, (v. 4.0), Appendix B.

The reference road will use the following assumptions: An in-sloped road with a ditch; moderate traffic (pickups sedans, and log haul <50% of the time); cut-slope gradient 1:1 (horizontal to vertical) and fill-slope gradient 1.5:1; initial ground cover density of zero on cut and fill slopes; sustained grade of 5-7 percent; and an average cross-drain spacing of 500 feet.

Proportions of the total long-term average road erosion rates attributed to the components of the standard road prism (Swift 1984, Burroughs and King 1989, Sullivan and Duncan 1980, Megahan unpublished data) are:

- Road Tread 40%
- Cutslope and Ditch 40%
- Fillslope 20%

Roads differ in their inherent erodibility, or erosion potential, due to the geology, or parent material on which they are constructed as seen in Table 261. Sediment yields from older roads with undisturbed ditches are much smaller than sediment yields from newer roads or roads with disturbed ditches. Maintenance of ditchlines can increase sediment yields.

Table 261. Basic Erosion Rates.

		Road Age	
General Category	**Geologic Parent Material**	**New 0-2 Years**	**Old > 2 Years**
High	Mica schist, Volcanic ash, Highly weathered sedimentary	110	60
High/Moderate	Quartzite, Course-grained granite	110	30
Moderate	Fine-grained granite Moderately weathered rock Sedimentary rocks	60	30
Low	Competent granite, Basalt, Metamorphic rocks, Relatively unweathered rocks	20	10

(Note: Numbers represent erosion rates in tons/acre of road prism/year.)

Sources: Kochendorfer, J. N. and J. D. Helvey 1984; Hayden et al. 1991; Megahan and Kidd 1972; Reid and Dunne 1984; Sullivan and Duncan, U.S. Forest Service unpublished data.

The basic erosion rate for road erodibility is decreased by vegetative cover and surface roughness on cut and fills slopes. Table 262 shows reduction factors from the basic erosion rate.

Table 262. Groundcover Correction Factor for Cut and Fill Slopes

Ground Cover Density Factor	Factor
>80%	0.18
50%	0.37
30%	0.53
20%	0.63
10%	0.77
0%	1.00

Sources: Megahan 1991, Burroughs and King 1989, Megahan unpublished data.

The basic erosion rate for road erodibility is decreased by road tread surfacing. Table 263 shows reduction factors based on types of surfacing.

Table 263. Factors for Road Tread Surfacing.

Surfacing Material Factor	Factor
Paved	0.03
Gravel, greater than 6 inches deep	0.2
Native soil/rock	1.00

The basic erosion rate for road erodibility is increased by road traffic and wet weather haul on natural surface and gravel roads. Table 264 shows erodibility increase factors based on precipitation bands and traffic level.

Table 264. Traffic and Precipitation Factor.

	Annual Precipitation		
Traffic Use/Road Category	**<47 inches**	**47 inches – 118 inches**	**>118 inches**
Heavy Traffic/Active Mainline	20	50	120
Moderate Traffic/Active Secondary	2	4	10
Light Traffic/Non Active	1	1	1

Sources: Reid and Dunne 1984; Sullivan and Duncan unpublished

Sediment Delivery

- Sediment delivery to streams is affected by the road drainage system design including road prism shape, proximity of the road to the stream channel, and length of road draining directly into a stream at crossings.
- Sediment delivery to streams by road segment: Assume that a road segment does not deliver if the road does not cross a stream channel.
- Sediment delivery to streams by ditches: Assume 100% delivery of sediment to streams from the road prism and cutslope before application of factors.

- Sediment delivery to streams by diffuse sources: Assume 10% delivery of sediment to streams from the cutslope before application of factors.
- Best Management Practices can substantially reduce sediment delivery from roads.

Sediment Delivery Distance

- Roads near ridges have little direct effect on sediment delivery to streams.
- Generalized distances for sediment filtration effectiveness occur much sooner (25-100 feet) for diffuse sources of sediment delivery compared to concentrated sources (200 feet), such as road ditch lines draining into the riparian area (CH2MHill 1999).
- Wemple (1998 cited in Jones et al 2000) found that road segments that have stream connection pathways such as roadside ditches have potential to deliver surface eroded sediment to streams. Road segments not connected to streams by ditch lines or gullies or having more than 25 to 100 feet of filtering forest floor duff and vegetation (depending on slope, soil properties, and surface roughness) between them and a stream are usually not at risk of delivering sediment to streams.
- Below culverts, sediment travel distance in streams decreases with increasing roughness, such as debris and obstructions (Brake et al. 1997).
- Concentrated and diffuse sources of sediment delivery in this analysis are assumed to be within 200 feet of stream channels.

Road Traffic

- Frequent heavy truck traffic can grind resistant road surfacing such as gravels into smaller particles that can wash into ditchlines during rainstorms. Material type, traffic level and rate determine the quantity of sediment available for transport, while the rainfall determines the transport capacity (Reid and Dunne 1984).

Analytical Methodology and Technique

The technique relies on ARC GIS GRID processes for analyzing spatial data. Logical and mathematical operations were written as scripts, based on watershed analysis methodologies. The analysis is performed by fifth-field watersheds within the plan area.

Step 1 -
Build a basic erosion rate (BER) data layer from the BLM GIS Geology theme by matching the parent materials in the Table 261 Basic Erosion Rates, to the theme mapped designations with input from Geologist and Soil Scientist.

Step 2 -
Build a derived data layer labeled "Streams" from the BLM GIS Watercourses data theme that includes all intermittent and perennial streams.

Step 3 -
Buffer the Streams derived data layer (Step 2) to 200 feet and make a new derived data layer labeled "Sediment Delivery Buffer".

Step 4 -
Intersect and clip BLM GIS GTRN (roads) data theme with the sediment delivery buffer derived data layer (step 3) for all lands. Label new derived data layer "Stream Proximity Roads".

Step 5 –
Refine the stream proximity roads derived data layer (step 4) and exclude road segments that do not cross stream channels. Road segment origin must be further than 30 feet from streams to be excluded.

Step 6 -
Build a table of specific vegetative correction factors by fifth-field watershed using Table 262 Groundcover Correction Factor for Cut and Fill Slopes.

Step 7 -
Use selected Prism Climate Model outputs to build a derived data layer labeled "Average Annual Precipitation" by fifth-field watershed. From the Oregon Climate Service PRISM Products page, online: [http://www.ocs.orst.edu/prism/products/] select the 30-arcsec (800m) normal grids for precipitation for the period 1971-2000.

Step 8 -
Calculate the traffic factor from Table 261, Traffic and Precipitation Factors by intersecting the precipitation dominated and rain-on-snow hydro region (from peakflow planning criteria) with the average annual precipitation data layer (step 7) and develop a new data layer labeled "Traffic factors." Classify into three precipitation bands: <47", 47-118" and >118" from Table 264. Assign traffic factors for moderate traffic where <47" equal 2, 47-118" equal 4, and >118" equal 10.

Step 9 –
For each road segment, add attributes to the data tables for the stream proximity roads derived data layer selected set (step5). Calculate the road segment lengths by surface type within the BLM GIS GTRN roads data layer for BLM and other ownerships and add to the data tables. BLM includes BLM controlled roads and private roads in the planning area from BLM GIS GTRN (roads) theme.

Step 10 -
For each road segment within the stream proximity roads derived data layer selected set (step5) build a logical calculation sequence as scripts to determine potential sediment delivery from the cut slope, road tread and fill slope (calculations 1, 2 and 3) by:

Existing Condition

Return basic erosion rate (BER) value from the basic erosion rate derived data layer of > two year old road age (step 1).

Return road surface type factor (RST) (from Table 178).

Return ground cover density (GCD) factor (step 6).

Return traffic factor (TF) (step 8).

Calculate:

1 [BER * PCD * GCD] * [((cutslope width) + (ditch width) + (road prism width - road tread width / 2)) * road length]/ 43560

2 *where RST = 0.03:* [BER * RT * road surface type factor * [road tread width * road length]/43560

else: [BER * RT * RST] * [TF] * [road tread width * road length]/43560

3 [(BER * FS * GCD) * 0.10] * [((fillslope width) + (road prism width - road tread width / 2)) * road length]/43560

Sum 1, 2 and 3.

Alternative 10 Year Projection

Repeat existing condition calculation except:

Step 1,
Table 258. Return basic erosion rate (BER) value from the basic erosion rate derived data layer of < 2 year old road age.

Step 9.
Calculate the road segment lengths for permanent aggregate and natural surface road for the 10 year projection. No paved roads are planned.

Develop a ratio:

$$\frac{\textbf{length of road in the sediment delivery buffer (step 3)}}{\textbf{length of road in the 10 year projection sample}}$$

Multiply this ratio by:

Table 265. Projected Permanent Roads by Alternative[1]

Alternative	Rocked Roads (miles)	Natural Roads (miles)
No Action	250.31	94.49
Alternative 1	384.98	128.44
Alternative 2	494.55	109.64
Alternative 3	393.66	131.95

[1] Based on Dave DeMoss road construction estimates for timber volume per foot of road for sum of regeneration harvests, thinning and partial cuts for all districts.

Develop a ratio:

$$\frac{\textbf{potential sediment delivery in the sediment delivery buffer}}{\textbf{length of road in the sediment delivery buffer (feet)}}$$

Multiply this ratio by the adjusted road length. Convert to potential sediment delivery; tons/mile/year.

Step 11 –
Calculate data for display table.

Sum miles of stream proximity roads (inside the sediment delivery buffer) for each Alternative by surface type; paved, aggregate and natural for BLM and other land ownerships for each watershed. Sum all watersheds.

Calculate potential sediment delivery for each alternative in tons per mile of road by surface type: paved, aggregate and natural for BLM and other land ownerships for each watershed. Sum categories for all watersheds.

Calculate potential sediment delivery in tons mile^2/year for BLM and other land ownerships for each watershed. Sum potential sediment delivery for all watersheds for BLM and other land ownerships and divide by the respective landbase.

Table 266. Factor definition table.

Factor	Factor Definition
BER	Basic erosion rate in tons/acre/year
PCD	Proportion of cutslope and ditch erosion to the roaded cross section; 0.40
RT	Proportion of road tread erosion to the roaded cross section; 0.40
FS	Proportion of fill slope erosion to the roaded cross section; 0.20
GCD	Groundcover density factor (0.18-1.0)
RST	Road surface type factor; 0.03 paved, 0.2 gravel and 1.0 native surface
TF	Traffic factor within precipitation dominated area for annual precipitation <47 inches equal 20, 47-118 inches equal 50 , >118 inches equal 120
Cut slope width	Cut slope width in feet; generalized 15 feet
Ditch width	Ditch width in feet; generalized 3 feet
Road tread width	Road tread width in feet; generalized 14 feet
Road prism width	Road prism width in feet; generalized 20 feet
Fill slope width	Fill slope width in feet; generalized 10 feet
Road length	Road length in feet, up gradient of stream crossings to the buffer limit
43560	Factor to convert ft^2 to acres

Analytical Conclusions

- Rank of alternatives by their effect on road sources of fine sediment delivery to stream channels.
- Comparison of sediment delivery to that which occurs under the existing condition.

Data Needs

- Proposed new road 10-year projection, by alternative.
- GIS derived data layer of basic erosion rate.
- GIS derived data layer of stream proximity roads derived data layer for the existing condition.
- GIS derived data layer of stream proximity 10-year projection roads for each alternative.
- Prism Model of average annual precipitation for the precipitation hydro region.

Data Display

Populate the following table:

Table 267. Potential sediment delivery, by Alternative from roads.

Alternative	Roads Contributing to Sediment Delivery[2] miles		Potential Sediment Delivery[3] tons/mile/year		Potential Sediment Delivery[4] tons/mile[2]/year	
Existing[1]	**BLM**	**Other**	**BLM**	**Other**	**BLM**	Other
Natural						
Aggregate						
Paved						
Total						
No Action New Roads, 10-year projection	**BLM**		**BLM**		**BLM**	
Natural						
Aggregate						
Paved						
Total						
Alternative 1 New Roads, 10-year projection						
Natural						
Aggregate						
Paved						
Total						
Alternative 2 New Roads, 10-year projection						
Natural						
Aggregate						
Paved						
Total						
Alternative 3 New Roads,10-year projection						
Natural						
Aggregate						
Paved						
Total						

[1] BLM includes BLM controlled roads and private roads in the planning area from BLM GIS GTRN (roads) theme.
[2] Includes road segments within 200 feet of a stream channel.
[3] Averaged per mile of road by surface type for each 5th field watershed and averaged for the planning area.
[4] Potential sediment delivery in tons/year for each 5th field watershed divided by each 5th field watershed area for BLM and other lands and averaged for the planning area.

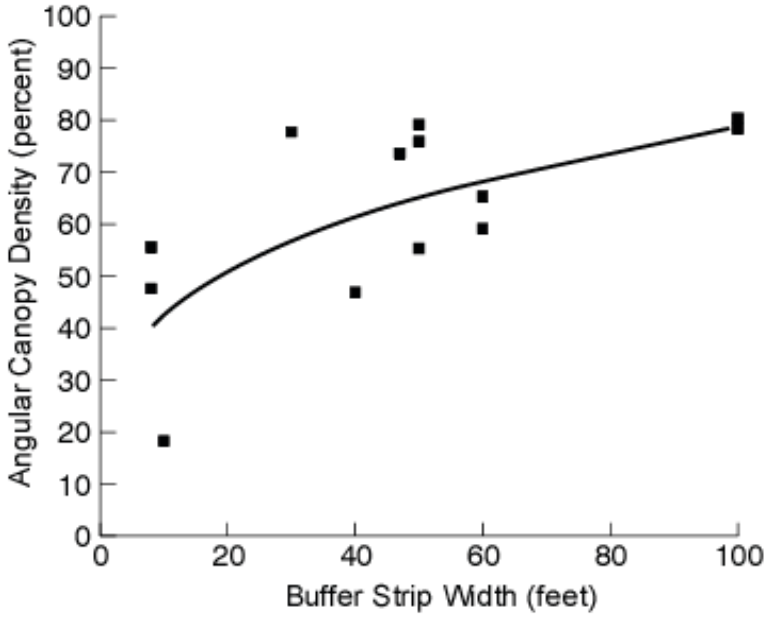
Analytical Question # 4

To what extent will each alternative maintain effective shade along streams, lakes and wetlands?

Analytical Assumptions

- Maintaining streamside shade is a surrogate for meeting the Department of Environmental Quality (DEQ) temperature standard. Northwest Forest Plan Temperature Total Maximum Daily Load (TMDL) Implementation Strategies (2005) demonstrate how retention and variable retention areas meet shade goals and the DEQ temperature standard. These are described as primary and secondary shade zones. The derivation of these zones is based on factors including seasonality of streams, topography, forest vegetation, and solar physics.
- Perennial streams are considered in this analysis, because of the influence that forest shade has on maintaining cool water temperatures during the summer.
- Mountainous topography can block solar radiation through parts of the day along many stream segments.
- Forest trees near stream channels and dense stands can block solar radiation and cast shadows across the stream. Angular canopy density (ACD) is the measure of canopy closure as projected in a straight line from the stream surface to the sun, as it varies through the day. The ACD value for a given buffer depends on the spacing of forest crowns. As vegetation becomes more open through wider spacing, more width of vegetation is needed to achieve the same ACD for the similar vegetation with closer spacing. Higher ACD is achieved with lower sun angles and higher canopy density.

Figure 309. Angular canopy density (ACD) and buffer widths for small streams in western Oregon (Brazier and Brown 1972). It illustrates that a buffer strip width of 60 feet will result in an angular canopy density of 65 percent.



Effective shade is the total amount of radiant energy prevented from reaching a stream in a solar day. Because sun path and azimuth changes throughout the day forest vegetation has different efficiencies in blocking radiation for different time periods. As seen in Figure 312 (below), most solar heating occurs between 10:00 a.m. and 2:00 p.m. Park (1993) has shown that the width of primary riparian streamside areas will vary as a function of tree height and terrain slope as viewed in the Primary Shade Zone Table, included below after Figure 312.

The planning criteria assume the secondary shade zone is defined as the outer edge of the primary shade zone to 100 feet. There is marginal improvement of ACD past 100 feet (Figure 309 above). Significant temperature rises do not occur when effective shade is ≥ 80% (Figures 310 and 311 below).

Figure 310. Angular canopy density (ACD) and stream shade (Park 1991).

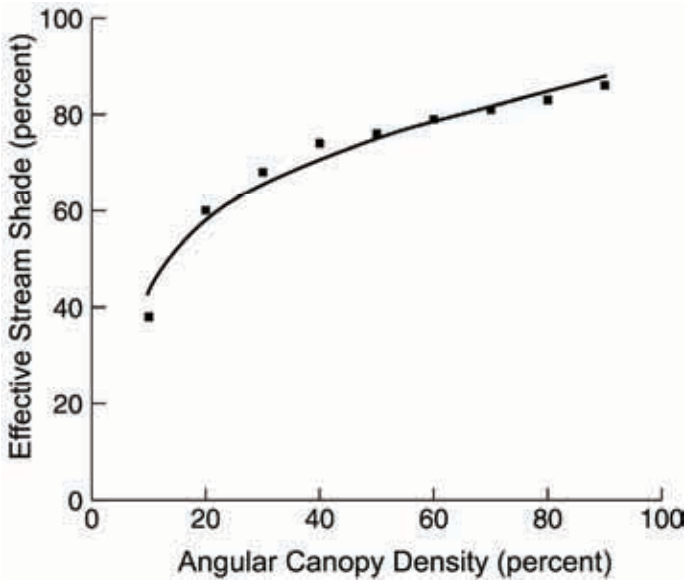


Figure 311. Effective Stream Shade and Change in Stream Temperature

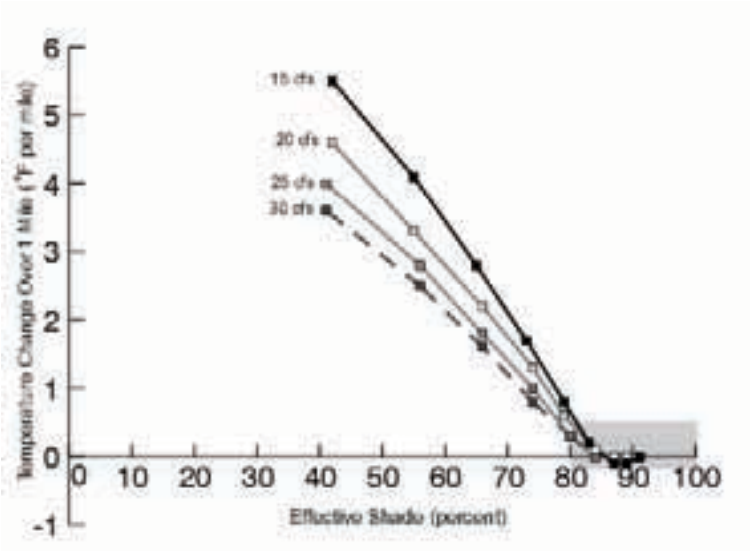


Figure 312. Solar Pathfinder (43° to 49° N Lat., Boyd 1999).

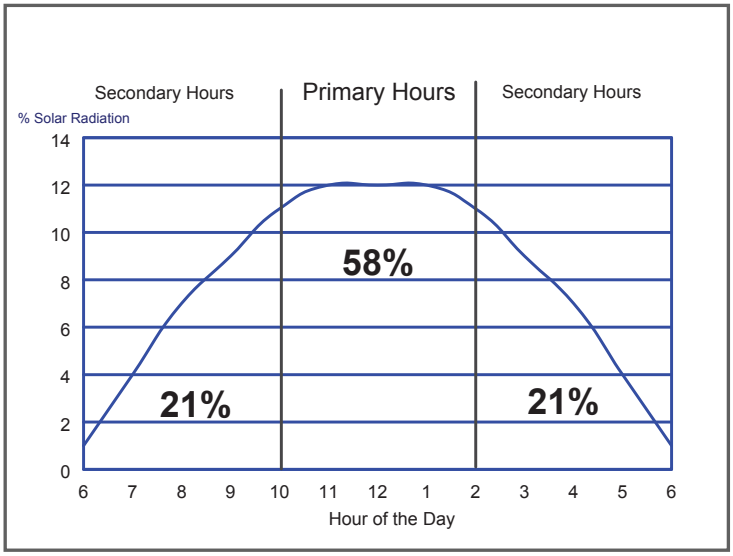


Table 268. Primary Shade Zone Distance of Riparian Trees (In Feet)

height of tree	Hill slope <30%	Hill slope 30 to 60%	HILL SLOPE >60%
Trees < 20 feet	12	14	15 feet
Trees 20 to 60 feet	28	33	55 feet
Trees >60 to 100 feet	50	55	60 feet

Source: Northwest Forest Plan Temperature TMDL Implementation Strategies, 2005.

Forest treatments are assumed to fully meet effective shade and water quality standards within primary and secondary shade zones along streams, lakes, and wetlands when the following criteria are met:

- Table 268 will be used to determine the width of the primary shade zone. Vegetation thinning in the primary shade zone will not result in less than 80% effective shade.
- Vegetation thinning in the secondary shade zone will not result in less than 50% canopy closure post harvest.

For modeling purposes, 60 feet width will be used to define the boundary of the primary shade zone for all combinations of topography and vegetation, and 100 feet will be used to define the boundary of the secondary shade zone.

Analytical Methodology and Technique

Step 1 -
Reclassify the watercourses GIS theme to derive a perennial stream data layer.

Step 2 -
Buffer the perennial streams, lakes, and wetlands to 60 feet. Label this derived data layer "Primary Shade Zone".

Step 3 -
Buffer the perennial streams, lakes, and wetlands to 100 feet.

Step 4 -
Intersect the Primary Shade Zone derived data layer (step 2) with the derived data layer derived (step 3). Label the difference between the Primary Shade Zone and the boundary of 100 feet "Secondary Shade Zone".

Step 5 -
Intersect the Primary Shade Zone with each alternative's primary riparian retention area. Calculate the miles of perennial stream not meeting the primary shade zone.

Step 6 -
Intersect the Secondary Shade Zone with each alternative riparian variable management riparian area that meets 50% canopy closure post harvest. Calculate the miles of perennial stream not meeting the secondary shade zone.

Analytical Conclusion

- Rank of alternatives by the extent that each alternative riparian area meets the primary and secondary shade zones on BLM-managed lands.

Data Needs

- GIS Watercourses data theme
- GIS derived data layer or detailed description of each alternative's full riparian retention and variable retention areas.

Data Display

Table 269. Comparison of Alternatives Not Meeting Effective Shade for Perennial Streams.

Alternative	Perennial Streams Not Meeting Primary Shade Zones (Miles)	% of Total Perennial Stream	Perennial Stream Not Meeting Secondary Shade Zones (Miles)	%of Total Perennial Stream
No Action				
Alternative 1				
Alternative 2				
Alternative 3				

Source Water Watersheds for Public Water Systems

The following table contains a list of source water watersheds for public water systems in the planning area. In many cases, the BLM administers a small portion of the watersheds.

Table 270. Source water watersheds with BLM-administered lands in the planning area.

PWS_ID[1]	PWS NAME	SOURCE	POPULATION SERVED	BLM ACRES	OTHER ACRES
4100003	ADAIR VILLAGE WATER SYSTEM	WILLAMETTE RIVER		8144	
4100003	ADAIR VILLAGE WATER SYSTEM	WILLAMETTE RIVER			226461
4100003	**ADAIR VILLAGE WATER SYSTEM**	**SUBTOTAL**	**650**	**8144**	**226461**
4100152	CITY OF BROWNSVILLE	CALAPOOIA RIVER		5254	
4100152	CITY OF BROWNSVILLE	CALAPOOIA RIVER			94920
4100152	**CITY OF BROWNSVILLE**	**SUBTOTAL**	**1500**	**5254**	**94920**
4100157	CANBY UTILITY BOARD	MOLALLA RIVER		2892	
4100157	CANBY UTILITY BOARD	MOLALLA RIVER			84687
4100157	**CANBY UTILITY BOARD**	**SUBTOTAL**	**12000**	**2892**	**84687**
4100169	CITY OF CANYONVILLE	CANYON CREEK		13247	
4100169	CITY OF CANYONVILLE	CANYON CREEK			9408
4100169	**CITY OF CANYONVILLE**	**SUBTOTAL**	**1265**	**13247**	**9408**
4100171	CITY OF CARLTON	PANTHER CREEK		1070	
4100171	CITY OF CARLTON	PANTHER CREEK			1003
4100171	**CITY OF CARLTON**	**SUBTOTAL**	**1570**	**1070**	**1003**
4100187	CLACKAMAS RIVER WATER-CLACKAMAS	CLACKAMAS RIVER		8399	
4100187	CLACKAMAS RIVER WATER-CLACKAMAS	CLACKAMAS RIVER			159669
4100187	**CLACKAMAS RIVER WATER-CLACKAMAS**	**SUBTOTAL**	**90000**	**8399**	**159669**
4100199	BEAVER WATER DISTRICT	BEAVER CREEK		1649	
4100199	BEAVER WATER DISTRICT	BEAVER CREEK			17000
4100199	**BEAVER WATER DISTRICT**	**SUBTOTAL**	**500**	**1649**	**17000**
4100202	COLTON WATER DISTRICT	JACKSON CREEK		598	

PWS_ID[1]	PWS NAME	SOURCE	POPULATION SERVED	BLM ACRES	OTHER ACRES
4100202	COLTON WATER DISTRICT	JACKSON CREEK			1536
4100202	**COLTON WATER DISTRICT**	**SUBTOTAL**	**1200**	**598**	**1536**
4100213	CITY OF COQUILLE	COQUILLE RIVER		67076	
4100213	CITY OF COQUILLE	RINK CREEK		0	
4100213	CITY OF COQUILLE	COQUILLE RIVER			248930
4100213	CITY OF COQUILLE	RINK CREEK			429
4100213	**CITY OF COQUILLE**	**SUBTOTAL**	**4300**	**67076**	**249359**
4100225	CITY OF CORVALLIS	SOUTH FORK ROCK CREEK		52	
4100225	CITY OF CORVALLIS	GRIFFITH CREEK			1051
4100225	CITY OF CORVALLIS	NORTH FORK ROCK CREEK			2155
4100225	CITY OF CORVALLIS	SOUTH FORK ROCK CREEK			3177
4100225	CITY OF CORVALLIS	WILLAMETTE RIVER			40593
4100225	**CITY OF CORVALLIS**	**SUBTOTAL**	**50101**	**52**	**46975**
4100236	CITY OF COTTAGE GROVE	LAYING CREEK		80	
4100236	CITY OF COTTAGE GROVE	ROW RIVER		37205	
4100236	CITY OF COTTAGE GROVE	LAYING CREEK			36989
4100236	CITY OF COTTAGE GROVE	PRATHER CREEK			3482
4100236	CITY OF COTTAGE GROVE	ROW RIVER			160279
4100236	**CITY OF COTTAGE GROVE**	**SUBTOTAL**	**8500**	**37285**	**200750**
4100239	LONDON WATER CO-OP	BEAVER CREEK		253	
4100239	LONDON WATER CO-OP	BEAVER CREEK			615
4100239	**LONDON WATER CO-OP**	**SUBTOTAL**	**50**	**253**	**615**
4100246	CITY OF CRESWELL	COAST FORK WILLAMETTE RIVER		26141	
4100246	CITY OF CRESWELL	COAST FORK WILLAMETTE RIVER			96969
4100246	**CITY OF CRESWELL**	**SUBTOTAL**	**3380**	**26141**	**96969**
4100248	CITY OF DALLAS	RICKREAL CREEK		2874	
4100248	CITY OF DALLAS	RICKREAL CREEK			15092

PWS_ID[1]	PWS NAME	SOURCE	POPULATION SERVED	BLM ACRES	OTHER ACRES
4100248	**CITY OF DALLAS**	**SUBTOTAL**	**12900**	**2874**	**15092**
4100250	MILO ACADEMY	LICKEY CREEK		227	
4100250	MILO ACADEMY	SOUTH UMPQUA RIVER		10090	
4100250	MILO ACADEMY	LICKEY CREEK			251
4100250	MILO ACADEMY	SOUTH UMPQUA RIVER			11365
4100250	**MILO ACADEMY**	**SUBTOTAL**	**195**	**10317**	**11616**
4100254	CITY OF DEPOE BAY	NORTH DEPOE BAY CREEK		7	
4100254	CITY OF DEPOE BAY	SOUTH DEPOE BAY CREEK		29	
4100254	CITY OF DEPOE BAY	NORTH DEPOE BAY CREEK			521
4100254	CITY OF DEPOE BAY	ROCKY CREEK			3396
4100254	CITY OF DEPOE BAY	SOUTH DEPOE BAY CREEK			2736
4100254	**CITY OF DEPOE BAY**	**SUBTOTAL**	**1060**	**36**	**6653**
4100260	CITY OF DRAIN	ALAN CREEK		235	
4100260	CITY OF DRAIN	BEAR CREEK		1133	
4100260	CITY OF DRAIN	ALAN CREEK			415
4100260	CITY OF DRAIN	BEAR CREEK			2235
4100260	**CITY OF DRAIN**	**SUBTOTAL**	**1145**	**1368**	**2650**
4100276	CITY OF ELKTON	UMPQUA RIVER		64481	
4100276	CITY OF ELKTON	UMPQUA RIVER			251660
4100276	**CITY OF ELKTON**	**SUBTOTAL**	**170**	**64481**	**251660**
4100279	CITY OF ESTACADA	CLACKAMAS RIVER (ESTACADA)		5714	
4100279	CITY OF ESTACADA	CLACKAMAS RIVER (ESTACADA)			341992
4100279	**CITY OF ESTACADA**	**SUBTOTAL**	**1910**	**5714**	**341992**
4100287	EUGENE WATER & ELECTRIC BOARD	MCKENZIE RIVER		25805	
4100287	EUGENE WATER & ELECTRIC BOARD	MCKENZIE RIVER			708818
4100287	**EUGENE WATER & ELECTRIC BOARD**	**SUBTOTAL**	**150,000**	**25805**	**708818**
4100297	FALLS CITY WATER DEPARTMENT	GLAZE CREEK		360	

PWS_ID[1]	PWS NAME	SOURCE	POPULATION SERVED	BLM ACRES	OTHER ACRES
4100297	FALLS CITY WATER DEPARTMENT	TEAL CREEK		186	
4100297	FALLS CITY WATER DEPARTMENT	GLAZE CREEK			288
4100297	FALLS CITY WATER DEPARTMENT	TEAL CREEK			2386
4100297	**FALLS CITY WATER DEPARTMENT**	**SUBTOTAL**	**1045**	**546**	**2674**
4100301	HECETA WATER DISTRICT	CLEAR LAKE			615
4100301	**HECETA WATER DISTRICT**	**SUBTOTAL**	**4500**		**615**
4100302	SILTCOOS HEIGHTS	SILTCOOS LAKE		825	
4100302	SILTCOOS HEIGHTS	SILTCOOS LAKE			38863
4100302	**SILTCOOS HEIGHTS**	**SUBTOTAL**	**125**	**825**	**38863**
4100317	CITY OF GATES	NORTH SANTIAM RIVER		2624	
4100317	CITY OF GATES	NORTH SANTIAM RIVER			238707
4100317	**CITY OF GATES**	**SUBTOTAL**	**535**	**2624**	**238707**
4100323	CITY OF GLENDALE	COW CREEK		37197	
4100323	CITY OF GLENDALE	MILL CREEK		42	
4100323	CITY OF GLENDALE	SECTION CREEK		426	
4100323	CITY OF GLENDALE	COW CREEK			80664
4100323	CITY OF GLENDALE	MILL CREEK			429
4100323	CITY OF GLENDALE	SECTION CREEK			575
4100323	**CITY OF GLENDALE**	**SUBTOTAL**		**37665**	**81669**
4100324	KERNVILLE-GLENEDEN-LINCOLN BCH W D	DRIFT CREEK		1861	
4100324	KERNVILLE-GLENEDEN-LINCOLN BCH W D	DRIFT CREEK			20376
4100324	**KERNVILLE-GLENEDEN-LINCOLN BCH W D**	**SUBTOTAL**		**1861**	**20376**
4100326	GLIDE WATER ASSOCIATION	NORTH UMPQUA RIVER		60943	
4100326	GLIDE WATER ASSOCIATION	NORTH UMPQUA RIVER			367586
4100326	**GLIDE WATER ASSOCIATION**	**SUBTOTAL**	**900**	**60943**	**367586**
4100333	CITY OF GOLD HILL	ROGUE RIVER		34045	
4100333	CITY OF GOLD HILL	ROGUE RIVER			249777
4100333	**CITY OF GOLD HILL**	**SUBTOTAL**	**1,115**	**34045**	**249777**

PWS_ID[1]	PWS NAME	SOURCE	POPULATION SERVED	BLM ACRES	OTHER ACRES
4100342	CITY OF GRANTS PASS	ROGUE RIVER		69042	
4100342	CITY OF GRANTS PASS	ROGUE RIVER			101888
4100342	**CITY OF GRANTS PASS**	**SUBTOTAL**	**26,000**	**69042**	**101888**
4100359	CORBETT WATER DISTRICT	NORTH FORK GORDON CREEK		324	
4100359	CORBETT WATER DISTRICT	SOUTH FORK GORDON CREEK		46	
4100359	CORBETT WATER DISTRICT	NORTH FORK GORDON CREEK			1773
4100359	CORBETT WATER DISTRICT	SOUTH FORK GORDON CREEK			1761
4100359	**CORBETT WATER DISTRICT**	**SUBTOTAL**	**2910**	**370**	**3534**
4100379	HILLSBORO-FOREST GROVE-BEAVERTON	NORTH FORK TRASK RIVER (BARNEY RESERVOIR)		600	
4100379	HILLSBORO-FOREST GROVE-BEAVERTON	TUALATIN RIVER		2817	
4100379	HILLSBORO-FOREST GROVE-BEAVERTON	NORTH FORK TRASK RIVER (BARNEY RESERVOIR)			4681
4100379	HILLSBORO-FOREST GROVE-BEAVERTON	TUALATIN RIVER			112489
4100379	**HILLSBORO-FOREST GROVE-BEAVERTON**	**SUBTOTAL**	**65100**	**3416**	**117170**
4100408	CITY OF JEFFERSON	NORTH SANTIAM RIVER		30953	
4100408	CITY OF JEFFERSON	NORTH SANTIAM RIVER			223196
4100408	**CITY OF JEFFERSON**	**SUBTOTAL**	**2245**	**30953**	**223196**
4100466	LANGLOIS WATER DISTRICT	FLORAS CREEK		3099	
4100466	LANGLOIS WATER DISTRICT	FLORAS CREEK			35926
4100466	**LANGLOIS WATER DISTRICT**	**SUBTOTAL**	**250**	**3099**	**35926**
4100473	CITY OF LEBANON	SOUTH SANTIAM CANAL		4508	
4100473	CITY OF LEBANON	SOUTH SANTIAM CANAL			73732
4100473	**CITY OF LEBANON**	**SUBTOTAL**	**11000**	**4508**	**73732**

PWS_ID[1]	PWS NAME	SOURCE	POPULATION SERVED	BLM ACRES	OTHER ACRES
4100483	LINCOLN CITY WATER DISTRICT	SCHOONER CREEK		310	
4100483	LINCOLN CITY WATER DISTRICT	SCHOONER CREEK			9284
4100483	**LINCOLN CITY WATER DISTRICT**	**SUBTOTAL**	**13527**	**310**	**9284**
4100493	LYONS MEHAMA WATER DISTRICT	NORTH SANTIAM RIVER		15262	
4100493	LYONS MEHAMA WATER DISTRICT	NORTH SANTIAM RIVER			73059
4100493	**LYONS MEHAMA WATER DISTRICT**	**SUBTOTAL**	**1670**	**15262**	**73059**
4100497	MCMINNVILLE WATER AND LIGHT	HASKINS RESERVOIR		691	
4100497	MCMINNVILLE WATER AND LIGHT	MCGUIRE RESERVOIR		20	
4100497	MCMINNVILLE WATER AND LIGHT	HASKINS RESERVOIR			1235
4100497	MCMINNVILLE WATER AND LIGHT	MCGUIRE RESERVOIR			4259
4100497	**MCMINNVILLE WATER AND LIGHT**	**SUBTOTAL**	**2100**	**711**	**5494**
4100513	MEDFORD WATER COMMISSION	ROGUE RIVER		69729	
4100513	MEDFORD WATER COMMISSION	ROGUE RIVER			231481
4100513	**MEDFORD WATER COMMISSION**	**SUBTOTAL**	**83,454**	**69729**	**231481**
4100520	MILL CITY WATER DEPARTMENT	NORTH SANTIAM RIVER		1594	
4100520	MILL CITY WATER DEPARTMENT	NORTH SANTIAM RIVER			17810
4100520	MILL CITY WATER DEPARTMENT	SUBTOTAL	1800	1594	17810
4100534	CITY OF MOLALLA	MOLALLA RIVER		43125	
4100534	CITY OF MOLALLA	MOLALLA RIVER			86867
4100534	**CITY OF MOLALLA**	**SUBTOTAL**	**3100**	**43125**	**86867**
4100548	CLARKS BRANCH WTR. ASSOCIATION	SOUTH UMPQUA RIVER		31450	
4100548	CLARKS BRANCH WTR. ASSOCIATION	SOUTH UMPQUA RIVER			52653
4100548	**CLARKS BRANCH WTR. ASSOCIATION**	**SUBTOTAL**	**140**	**31450**	**52653**

PWS_ID[1]	PWS NAME	SOURCE	POPULATION SERVED	BLM ACRES	OTHER ACRES
4100549	TRI-CITY WATER DISTRICT	SOUTH UMPQUA RIVER		36492	
4100549	TRI-CITY WATER DISTRICT	SOUTH UMPQUA RIVER			70005
4100549	**TRI-CITY WATER DISTRICT**	**SUBTOTAL**	**3500**	**36492**	**70005**
4100550	CITY OF MYRTLE CREEK	SOUTH UMPQUA RIVER		424	
4100550	CITY OF MYRTLE CREEK	SPRINGBROOK SPRINGS A		100	
4100550	CITY OF MYRTLE CREEK	SPRINGBROOK SPRINGS B		67	
4100550	CITY OF MYRTLE CREEK	SOUTH UMPQUA RIVER			3804
4100550	CITY OF MYRTLE CREEK	SPRINGBROOK SPRINGS A			187
4100550	CITY OF MYRTLE CREEK	SPRINGBROOK SPRINGS B			228
4100550	**CITY OF MYRTLE CREEK**	**SUBTOTAL**	**3,460**	**591**	**4219**
4100551	CITY OF MYRTLE POINT	NORTH FORK COQUILLE RIVER		81975	
4100551	CITY OF MYRTLE POINT	NORTH FORK COQUILLE RIVER			98932
4100551	**CITY OF MYRTLE POINT**	**SUBTOTAL**	**2715**	**81975**	**98932**
4100581	CITY OF OAKLAND	CALAPOOYA CREEK		5056	
4100581	CITY OF OAKLAND	CALAPOOYA CREEK			59857
4100581	**CITY OF OAKLAND**	**SUBTOTAL**	**954**	**5056**	**59857**
4100603	PANTHER CREEK WATER DISTRICT	PANTHER CREEK		35	
4100603	PANTHER CREEK WATER DISTRICT	PANTHER CREEK			1071
4100603	**PANTHER CREEK WATER DISTRICT**	**SUBTOTAL**	**550**	**35**	**1071**
4100624	CITY OF PHILOMATH PUBLIC WORKS	MARY'S RIVER		1084	
4100624	CITY OF PHILOMATH PUBLIC WORKS	MARY'S RIVER			84926
4100624	**CITY OF PHILOMATH PUBLIC WORKS**	**SUBTOTAL**	**4000**	**1084**	**84926**

PWS_ID[1]	PWS NAME	SOURCE	POPULATION SERVED	BLM ACRES	OTHER ACRES
4100657	PORTLAND BUREAU OF WATER WORKS	BULL RUN		60	
4100657	PORTLAND BUREAU OF WATER WORKS	BULL RUN			65523
4100657	**PORTLAND BUREAU OF WATER WORKS**	**SUBTOTAL**	**831000**	**60**	**65523**
4100672	CITY OF POWERS	BINGHAM CREEK		16	
4100672	CITY OF POWERS	SOUTH FORK COQUILLE RIVER		234	
4100672	CITY OF POWERS	BINGHAM CREEK			163
4100672	CITY OF POWERS	SOUTH FORK COQUILLE RIVER			93877
4100672	**CITY OF POWERS**	**SUBTOTAL**	**700**	**250**	**94039**
4100706	CITY OF RIDDLE	COW CREEK		83338	
4100706	CITY OF RIDDLE	COW CREEK			109130
4100706	**CITY OF RIDDLE**	**SUBTOTAL**	**1,303**	**83338**	**109130**
4100707	LAWSON ACRES WATER ASSOCIATION	COW CREEK		2363	
4100707	LAWSON ACRES WATER ASSOCIATION	COW CREEK			4661
4100707	**LAWSON ACRES WATER ASSOCIATION**	**SUBTOTAL**	**75**	**2363**	**4661**
4100712	CITY OF ROGUE RIVER	ROGUE RIVER		25273	
4100712	CITY OF ROGUE RIVER	ROGUE RIVER			43689
4100712	CITY OF ROGUE RIVER	SUBTOTAL	2000	25273	43689
4100717	ROBERTS CREEK WATER DISTRICT	SOUTH UMPQUA RIVER			3095
4100717	**ROBERTS CREEK WATER DISTRICT**	**SUBTOTAL**	**6500**	**0**	**3095**
4100719	UMPQUA BASIN WATER ASSOCIATION	NORTH UMPQUA RIVER		1214	
4100719	UMPQUA BASIN WATER ASSOCIATION	NORTH UMPQUA RIVER			32269
4100719	**UMPQUA BASIN WATER ASSOCIATION**	**SUBTOTAL**	**8500**	**1214**	**32269**
4100720	CITY OF ROSEBURG-WINCHESTER	NORTH UMPQUA RIVER		24682	
4100720	CITY OF ROSEBURG-WINCHESTER	NORTH UMPQUA RIVER			106472
4100720	**CITY OF ROSEBURG-WINCHESTER**	**SUBTOTAL**	**30000**	**24682**	**106472**

PWS_ID[1]	PWS NAME	SOURCE	POPULATION SERVED	BLM ACRES	OTHER ACRES
4100731	SALEM PUBLIC WORKS	NORTH SANTIAM RIVER AND IG		934	
4100731	SALEM PUBLIC WORKS	NORTH SANTIAM RIVER AND IG			16221
4100731	**SALEM PUBLIC WORKS**	**SUBTOTAL**	**170000**	**934**	**16221**
4100789	CITY OF SANDY	ALDER CREEK		633	
4100789	CITY OF SANDY	ALDER CREEK			3769
4100789	**CITY OF SANDY**	**SUBTOTAL**	**5030**	**633**	**3769**
4100792	CITY OF SCAPPOOSE	GOURLAY		550	
4100792	CITY OF SCAPPOOSE	LAZY CREEK		377	
4100792	CITY OF SCAPPOOSE	SOUTH FORK SCAPPOOSE CREEK		1477	
4100792	CITY OF SCAPPOOSE	GOURLAY			879
4100792	CITY OF SCAPPOOSE	LAZY CREEK			337
4100792	CITY OF SCAPPOOSE	SOUTH FORK SCAPPOOSE CREEK			2413
4100792	**CITY OF SCAPPOOSE**	**SUBTOTAL**	**3500**	**2404**	**3629**
4100808	COUNTRY VIEW MH ESTATES	ROGUE RIVER		94370	
4100808	COUNTRY VIEW MH ESTATES	ROGUE RIVER			639475
4100808	**COUNTRY VIEW MH ESTATES**	**SUBTOTAL**	**112**	**94370**	**639475**
4100811	CITY OF SHERIDAN	SOUTH YAMHILL RIVER		14950	
4100811	CITY OF SHERIDAN	SOUTH YAMHILL RIVER			120465
4100811	**CITY OF SHERIDAN**	**SUBTOTAL**	**5200**	**14950**	**120465**
4100821	CITY OF SILETZ	SILETZ RIVER		13670	
4100821	CITY OF SILETZ	TANGERMAN CREEK		1	
4100821	CITY OF SILETZ	SILETZ RIVER			117918
4100821	CITY OF SILETZ	TANGERMAN CREEK			296
4100821	**CITY OF SILETZ**	**SUBTOTAL**	**1100**	**13671**	**118214**
4100823	CITY OF SILVERTON	ABIQUA CREEK		1776	
4100823	CITY OF SILVERTON	ABIQUA CREEK			29894
4100823	**CITY OF SILVERTON**	**SUBTOTAL**	**5480**	**1776**	**29894**
4100843	STAYTON WATER SUPPLY	NORTH SANTIAM RIVER		0	

PWS_ID[1]	PWS NAME	SOURCE	POPULATION SERVED	BLM ACRES	OTHER ACRES
4100843	STAYTON WATER SUPPLY	NORTH SANTIAM RIVER			4537
4100843	**STAYTON WATER SUPPLY**	**SUBTOTAL**	**5630**	**0**	**4537**
4100847	CITY OF SUTHERLIN	CALAPOOYA CREEK NON-PAREIL		5055	
4100847	CITY OF SUTHERLIN	COOPER CREEK		480	
4100847	CITY OF SUTHERLIN	CALAPOOYA CREEK NON-PAREIL			49629
4100847	CITY OF SUTHERLIN	COOPER CREEK			2456
4100847	**CITY OF SUTHERLIN**	**SUBTOTAL**	**6360**	**5535**	**52086**
4100851	CITY OF SWEET HOME	SOUTH SANTIAM RIVER		31600	
4100851	CITY OF SWEET HOME	SOUTH SANTIAM RIVER			329872
4100851	**CITY OF SWEET HOME**	**SUBTOTAL**	**7235**	**31600**	**329872**
4100926	CITY OF WALDPORT	ECKMAN CREEK		40	
4100926	CITY OF WALDPORT	NORTH FORK WEIST CREEK		29	
4100926	CITY OF WALDPORT	ECKMAN CREEK			2756
4100926	CITY OF WALDPORT	NORTH FORK WEIST CREEK			169
4100926	CITY OF WALDPORT	SOUTH FORK WEIST CREEK			193
4100926	CITY OF WALDPORT	SUBTOTAL	3000	69	3118
4100953	CITY OF WILLAMINA WATER DEPARTMENT	WILLAMINA CREEK		15010	
4100953	CITY OF WILLAMINA WATER DEPARTMENT	WILLAMINA CREEK			37480
4100953	CITY OF WILLAMINA WATER DEPARTMENT	SUBTOTAL	1760	15010	37480
4100957	WINSTON-DILLARD WATER DISTRICT	SOUTH UMPQUA RIVER		28316	
4100957	WINSTON-DILLARD WATER DISTRICT	SOUTH UMPQUA RIVER			83243
4100957	WINSTON-DILLARD WATER DISTRICT	SUBTOTAL	6500	28316	83243
4100958	CITY OF YONCALLA	ADAMS CREEK		494	
4100958	CITY OF YONCALLA	ADAMS CREEK			709
4100958	CITY OF YONCALLA	WILSON CREEK			474
4100958	CITY OF YONCALLA	SUBTOTAL	1095	494	1183

PWS_ID[1]	PWS NAME	SOURCE	POPULATION SERVED	BLM ACRES	OTHER ACRES
4100968	CITY OF YAMHILL	TURNER CREEK		963	
PWS_ID[1]	PWS NAME	SOURCE	POPULATION SERVED	BLM ACRES	OTHER ACRES
4100968	CITY OF YAMHILL	TURNER CREEK			1955
4100968	CITY OF YAMHILL	SUBTOTAL	1500	963	1955
4100971	CITY OF CAVE JUNCTION	EAST FORK ILLINOIS RIVER		15476	
4100971	CITY OF CAVE JUNCTION	EAST FORK ILLINOIS RIVER			107511
4100971	CITY OF CAVE JUNCTION	SUBTOTAL	1,440	15476	107511
4100985	HILLSBORO-CHERRY GROVE	TUALATIN RIVER		952	
4100985	HILLSBORO-CHERRY GROVE	TUALATIN RIVER			14613
4100985	HILLSBORO-CHERRY GROVE	SUBTOTAL	250	952	14613
4101092	USFS TILLER RANGER STATION	USFS TILLER RANGER STATION		10566	
4101092	USFS TILLER RANGER STATION	USFS TILLER RANGER STATION			277963
4101092	USFS TILLER RANGER STATION	SUBTOTAL	1092	10566	277963
4101095	USFS WOLF CREEK JOB CORPS	LITTLE RIVER		2405	
4101095	USFS WOLF CREEK JOB CORPS	LITTLE RIVER			55405
4101095	USFS WOLF CREEK JOB CORPS	SUBTOTAL	250	2405	55405
4101174	BUELL-RED PRAIRIE WATER ASSN	GOOSENECK CREEK		959	
4101174	BUELL-RED PRAIRIE WATER ASSN	GOOSENECK CREEK			98
4101174	BUELL-RED PRAIRIE WATER ASSN	SUBTOTAL	980	959	98
4190416	FORT JAMES OPERATING CO.	COLUMBIA RIVER		819	
4190416	FORT JAMES OPERATING CO.	COLUMBIA RIVER			86153

PWS_ID[1]	PWS NAME	SOURCE	POPULATION SERVED	BLM ACRES	OTHER ACRES
4190416	FORT JAMES OPERATING CO.	SUBTOTAL	750	819	86153
4192139	TILLER ELEMENTARY, SD #15	SOUTH UMPQUA RIVER		386	
4192139	TILLER ELEMENTARY, SD #15	SOUTH UMPQUA RIVER			54592
4192139	TILLER ELEMENTARY, SD #15	SUBTOTAL	60	386	54592
PWS_ID[1]	PWS NAME	SOURCE	POPULATION SERVED	BLM ACRES	OTHER ACRES
4192152	POPE & TALBOT, INC.,	WILLAMETTE RIVER		77011	
4192152	POPE & TALBOT, INC.,	WILLAMETTE RIVER			1167276
4192152	POPE & TALBOT, INC.,	SUBTOTAL	800	77011	1167276
4192674	USFS STAR RANGER STATION	APPLEGATE RIVER		4402	
4192674	USFS STAR RANGER STATION	APPLEGATE RIVER			115722
4192674	**USFS STAR RANGER STATION**	**SUBTOTAL**	**25**	**4402**	**115722**
4194300	ROSEBURG FOREST PROD-DILLARD	SOUTH UMPQUA RIVER		3823	
4194300	ROSEBURG FOREST PROD-DILLARD	SOUTH UMPQUA RIVER			25041
4194300	**ROSEBURG FOREST PROD-DILLARD**	**SUBTOTAL**	**2000**	**3823**	**25041**

1 Department of Environmental Quality Public Water System identification number for surface drinking water watersheds.

Best Management Practices

Introduction

This section defines the best management practices (i.e., methods and measures) that were developed for the needs of the lands within the western Oregon planning area to comply with the requirements of the Clean Water Act.

Purpose

Best management practices (BMPs) are required by the federal Clean Water Act to reduce nonpoint source pollution to the maximum extent practicable. BMPs are considered the primary mechanisms for achieving Oregon's water quality standards. Oregon's narrative criteria, which include numeric standards, are designed to protect designated beneficial uses (such as salmonid spawning and rearing, resident fish and aquatic life, domestic water supplies, and water-contact recreation).

BMPs are defined as methods, measures, or practices selected on the basis of site-specific conditions to ensure that water quality will be maintained at its highest practicable level. BMPs include, but are not limited to, structural and nonstructural controls, operations, and maintenance procedures. BMPs can be applied before, during, and after pollution-producing activities to reduce or eliminate the introduction of pollutants into receiving waters (40 CFR 130.2, EPA Water Quality Standards Regulation).

These BMPs are commonly employed practices used in a variety of situations to maintain or improve water quality. Selection of specific BMPs needed to meet the Clean Water Act are made by soil and water professionals during project-level analyses.

Organization and Use

The BMPs in this appendix are organized by the following management activities:

- roads and landings
- timber harvest activities
- silvicultural activities
- fire and fuels management
- surface source water for drinking water
- recreation
- grazing

- minerals exploration and development
- spill prevention and abatement
- restoration

The tables that follow this introduction identify the input variables, causal mechanisms, and water quality standards (referenced by the Oregon Administrative Rules number) that are associated with each BMP. Those BMPs that are necessary for typical situations have been included. When applied, BMPs are expected to prevent water quality degradation and to meet water quality standards.

Causal mechanisms help explain the outcomes or the process through which an outcome occurs.

Narrative criteria

For information about Oregon's water quality standards and narrative criteria, start at http://www.blm.gov/nstc/WaterLaws/oregon2.html.

Resource aspects of land management activities normally have many facets that require site-specific BMP design. Therefore, there may be some repetition of the BMPs between sections of the following tables as some BMPs stand alone while others are used in combination or reference another section in order to address the needs of individual management activities.

Management of locatable minerals is governed by regulations found in 43 CFR 3809. BMPs for locatable minerals include language from 43 CFR 3809 that requires operators to prevent unnecessary and undue degradation from mining operations.

Some BMPs that relate to instream activities involving removal/fill may coincidently be similar to applicable practices in DEQ water quality permits and 401 certifications. These BMPs are not specific permit requirements, but rather demonstrate the process by which nonpoint source pollution from instream activities would be controlled. Appropriate practices in this appendix could be selected by the permitting agencies and included in specific permits or 401 certifications.

Application of Best Management Practices

It is not intended that all of the BMPs listed will be selected for any specific management action. BMPs are selected and implemented as necessary and practical, based on site-specific conditions. BMPs at times require adjustment to meet project and soil conditions within differing climatic and physiographic regions. Specialists may consider baseline environmental conditions, type of activity, proximity to water, disturbance level, direct, indirect, and cumulative effects and timing. Therefore, BMPs may be modified in order to match effective BMP controls to the project design.

Oregon Administrative Rules

For the rules related to water quality standards, search at http://arcweb.sos.state.or.us/banners/rules.htm.

BMPs must be applied in a manner that is consistent with all Resource Management Plan objectives. The overall goal is not to adhere strictly to a particular set of BMPs, but to meet water quality objectives when implementing management actions. Describing non-point pollution causal mechanisms allows specialists to exercise discretion as to what will work best in a particular situation. While this Appendix does not provide an exhaustive list of BMPs, the included BMPs are believed to cover most project activity situations in the Plan area. Additional nonpoint source control measures may be identified during the interdisciplinary process when evaluating site-specific management actions.

43 CFR 3809

For the complete BLM regulation, search for 3809 at http://www.blm.gov/search or see http://www.blm.gov/nhp/news/regulatory/3730/3809.html.

BMPs will be adjusted as necessary with feedback from monitoring or other sources of information.

Review and update of this Appendix will be accomplished through plan maintenance.

Roads and Landings

See *Summary of Water Quality Standards* for additional details about the standards and regulations that are associated with the best management practices.

Table 271. Best management practices for roads and landings

Best Management Practices for Roads and Landings	Input Variables and Causal Mechanisms	Water Quality Standards and Regulations
Location		
Locate roads on stable locations without sediment delivery potential to streams (e.g., ridge tops, stable benches or flats, and gentle-to-moderate side-slopes). And avoid headwalls, old slump benches, geologic bedding planes, seeps, and steep channel-adjacent side slopes.	• Coarse Sediment, Fine Sediment, and Organic Debris: Failures from roads built across unstable landforms that may slide into stream channels • Coarse and Fine Sediment: Alters channel form, which warms stream temperatures due to either increased widening or deepening (incising) channels becoming disconnected from the flood plain hyporheic zone	• Statewide Narrative Criteria Road Building Waste Materials OAR 340-041-0007 • Temp OAR 340-041-0028 • Turbidity OAR 340-041-0036
Locate new permanent roads outside of Riparian Management Areas, unless construction is under existing reciprocal road right-of-way agreements.	• Coarse and Fine Sediment: Surface erosion or ravel, due to lack of adequate vegetative cover, or nearness to stream channels that may deliver. • Temperature: Roads located adjacent to streams, causing opening in forest canopy that may reduce local stream shade.	• Temperature OAR 340-041-0028 • Turbidity OAR 340-041-0036
Locate temporary road construction outside of Riparian Management Areas. Do not locate temporary roads parallel to stream channels and avoid new stream crossings.	• Coarse and Fine Sediment: Surface erosion or ravel, due to lack of adequate vegetative cover, or nearness to stream channels that may deliver. • Temperature: Roads located adjacent to streams, causing opening in forest canopy that may reduce local stream shade.	• Temp OAR 340-041-0028 • Turbidity OAR 340-041-0036
Locate roads so as to lower cutbank heights and slope angles where ditchlines deliver run-off directly to stream channels.	Coarse and Fine Sediment: Erosion from exposed soils on cut banks	• Statewide Narrative Criteria Road Building Waste Materials OAR 340-041-0007 • Turbidity OAR 340-041-0036

Best Management Practices for Roads and Landings	Input Variables and Causal Mechanisms	Water Quality Standards and Regulations
Locate roads and landings outside of Jurisdictional Wetlands.	Coarse and Fine Sediment: Surface erosion or ravel, due to lack of adequate vegetative cover, or nearness to stream channels that may deliver	• Antidegradation OAR 340-04I-0004 • Statewide Narrative Criteria Road Building Waste Materials OAR 340-041-0007 • Turbidity OAR 340-041-0036
Locate new landings outside of Riparian Management Areas or at least 200 ft from waterbodies (whichever is greater) and avoid expanding existing landings in Riparian Management Areas when sediment delivery to stream channels could occur.	• Coarse Sediment, Fine Sediment, and Temperature: Surface erosion or ravel, due to lack of adequate vegetative cover or nearness to stream channels that may deliver • Temperature: Increase landing size or shape, causing opening in forest canopy that may reduce local stream shade	• Statewide Narrative Criteria Road Building Waste Materials OAR 340-041-0007 • Temperature OAR 340-041-0028 • Turbidity OAR 340-041-0036
Locate landings in areas with low risk for landslides.	Coarse Sediment, Fine Sediment, and Organic Debris: Failures from landings sited on unstable landforms that may slide into stream channels	• Statewide Narrative Criteria Road Building Waste Materials OAR 340-041-0007 • Turbidity OAR 340-041-0036
Locate excavated material disposal areas outside Riparian Management Areas, floodplains, and unstable areas that could transport sediment to waterbodies.	Coarse and Fine Sediment: Surface erosion or ravel, due to lack of adequate vegetative cover, or nearness to stream channels that may deliver	• Statewide Narrative Criteria Road Building Waste Materials OAR 340-041-0007 • Turbidity OAR 340-041-0036
General Construction		
Design roads no wider than needed for the specific use.	Coarse and Fine Sediment: Surface erosion from wet weather, due to lack of adequate vegetative cover that may deliver to a stream channel	• Statewide Narrative Criteria Road Building Waste Materials OAR 340-041-0007 • Turbidity OAR 340-041-0036
Limit road and landing construction, reconstruction, or renovation activities to the dry season, generally from May into October. When conditions permit operations outside of the dry season, keep erosion control measures concurrent with ground disturbance to the extent that the affected area can be rapidly stormproofed if weather conditions deteriorate.	Coarse and Fine Sediment: Surface erosion from wet weather, due to lack of adequate vegetative cover that may deliver to a stream channel	• Statewide Narrative Criteria Road Building Waste Materials OAR 340-041-0007 • Turbidity OAR 340-041-0036

Best Management Practices for Roads and Landings	Input Variables and Causal Mechanisms	Water Quality Standards and Regulations
End-haul excavated material to minimize side-casting of waste material if side slopes generally exceed 60 percent, or where side-cast material may enter waterbodies, wetlands, or floodplains.	Coarse Sediment, Fine Sediment, and Organic Debris: Fill run-out or failures from roads built across steep landforms that may slide into stream channels	• Statewide Narrative Criteria Road Building Waste Materials OAR 340-041-0007 • Turbidity OAR 340-041-0036
Conduct pioneer road construction to avoid the deposition of materials in waterbodies, floodplains, or wetlands.	Coarse and Fine Sediment: Pioneer road construction earthwork, with some downslope movement or drifting of unconsolidated soil medium towards waterbodies, floodplains, or wetlands	• Statewide Narrative Criteria Road Building Waste Materials OAR 340-041-0007 • Turbidity OAR 340-041-0036
Use controlled blasting techniques.	Coarse and Fine Sediment: Blasting with radial movement of unconsolidated soil medium or rock fragments, towards waterbodies, floodplains, or wetlands	• Statewide Narrative Criteria Road Building Waste Materials OAR 340-041-0007 • Turbidity OAR 340-041-0036
Use only soil and rock materials in permanent road fills. Build up fills by layering; compact between 85 and 95 percent maximum density. Provide for additional fill drainage (e.g. use geo-textile fabrics, etc.) in landslide prone areas.	Coarse Sediment, Fine Sediment, and Organic Debris: Failures from roads with inadequate fill construction, or without proper drainage, that may slide into stream channels	• Statewide Narrative Criteria Road Building Waste Materials OAR 340-041-0007 • Turbidity OAR 340-041-0036
Use temporary sediment containment structures (e.g. silt fencing).	Coarse and Fine Sediment: New earthwork, lacking vegetative cover, that may erode and deliver to waterbodies, floodplains, or wetlands	• Statewide Narrative Criteria Road Building Waste Materials OAR 340-041-0007 • Statewide Narrative Criteria Sediment, Adverse Deposits OAR 340-041-0007 • Turbidity OAR 340-041-0036
Surface roads if they would be subject to traffic during wet weather.	Coarse and Fine Sediment: Road tread erosion, increased by traffic, especially during wet weather on susceptible soil types, causing rilling or rutting, and delivery to a stream channel	• Statewide Narrative Criteria Road Building Waste Materials OAR 340-041-0007 • Turbidity OAR 340-041-0036
Stabilize bare soil from construction prior to fall rains.	Coarse and Fine Sediment: Vegetative and organic ground cover, decreasing soil detachment, transport and delivery to stream channels	• Statewide Narrative Criteria Road Building Waste Materials OAR 340-041-0007 • Turbidity OAR 340-041-0036
Seed and mulch cut and fill slopes, ditchlines, and waste disposal areas where soil will support seed growth upon construction completion.	Coarse and Fine Sediment: Vegetative and organic ground cover, decreasing soil detachment, transport and delivery to stream channels	• Statewide Narrative Criteria Road Building Waste Materials OAR 340-041-0007 • Turbidity OAR 340-041-0036

Best Management Practices for Roads and Landings	Input Variables and Causal Mechanisms	Water Quality Standards and Regulations
Clear channels/ditches above culverts prior to fall rains.	Coarse and Fine Sediment: Culvert inlets becoming plugged with floatable organic debris, resulting in water ponding against the road fill, and headcutting and loss of the fill at the crossing or diversion and/or gullying down the road ditchline and loss of the road fill at another site, with sediment delivery to waterbodies, floodplains, or wetlands	• Statewide Narrative Criteria Road Building Waste Materials OAR 340-041-0007 • Statewide Narrative Criteria Sediment, Adverse Deposits OAR 340-041-0007 • Turbidity OAR 340-041-0036
Correct special drainage problems (e.g., high water table, seeps) that effect stability of road subgrade through the use of perforated drains, geotextiles, or drainage bays.	Coarse and Fine Sediment: Saturated fills or wet areas that could fail or erode and deliver sediment to waterbodies, floodplains and wetlands	• Statewide Narrative Criteria Road Building Waste Materials OAR 340-041-0007 • Turbidity OAR 340-041-0036
Conduct slope rounding on tops of cut slopes in clayey soils to reduce sloughing and surface ravel.	Coarse and Fine Sediment: Erosion from exposed soils on cut and fill slopes. Road tread erosion, increased by traffic, especially during wet weather on susceptible soil types, causing rilling or rutting, and delivery to a stream channel.	• Antidegradation OAR 340-041-0004(1) • Biocriteria OAR 340-041-0011 • Statewide Narrative OAR 340-041-0007(1)&(13) • Turbidity OAR 340-041-0036
Windrow slash at the base of newly constructed fill slopes to catch sediment.	Coarse and Fine Sediment: Erosion from exposed soils on cut and fill slopes. Road tread erosion, increased by traffic, especially during wet weather on susceptible soil types, causing rilling or rutting, and delivery to a stream channel.	• Antidegradation OAR 340-041-0004(1) • Biocriteria OAR 340-041-0011 • Statewide Narrative OAR 340-041-0007(1)&(13) • Turbidity OAR 340-041-0036
Surface Drainage		
Provide effective drainage away from the road surface in maintained ditches on crown and ditch roads.	Coarse and Fine Sediment: Effective road surface drainage to the forest floor, preventing sediment delivery to stream channels	• Statewide Narrative Criteria Road Building Waste Materials OAR 340-041-0007 • Statewide Narrative Criteria Sediment, Adverse Deposits OAR 340-041-0007 • Turbidity OAR 340-041-0036
In-slope low traffic volume roads where the road footprint or underlying soil formation is very rocky, not erodible or subject to failure.	Coarse and Fine Sediment: Effective road surface drainage to the forest floor, preventing sediment delivery to stream channels	• Statewide Narrative Criteria Road Building Waste Materials OAR 340-041-0007 • Statewide Narrative Criteria Sediment, Adverse Deposits OAR 340-041-0007 • Turbidity OAR 340-041-0036

Best Management Practices for Roads and Landings	Input Variables and Causal Mechanisms	Water Quality Standards and Regulations
Out-slope low traffic volume roads to provide surface drainage on road gradients less than 8 percent, where an inside ditch is not planned.	Coarse and Fine Sediment: Effective road surface drainage to the forest floor, preventing sediment delivery to stream channels	• Statewide Narrative Criteria Road Building Waste Materials OAR 340-041-0007 • Statewide Narrative Criteria Sediment, Adverse Deposits OAR 340-041-0007 • Turbidity OAR 340-041-0036
Use rolling drainage dips and/or lead-off ditches as options in lieu of culverts for low traffic volume roads with less than 10 percent gradient or where blocking roads is a road management objective.	Coarse and Fine Sediment: Effective road surface drainage to the forest floor, preventing sediment delivery to stream channels	• Statewide Narrative Criteria Road Building Waste Materials OAR 340-041-0007 • Statewide Narrative Criteria Sediment, Adverse Deposits OAR 340-041-0007 • Turbidity OAR 340-041-0036
Locate surface water drainage measures (water bars, rolling dips, etc.) where water might accumulate, or where there is an outside berm that prevents drainage from exiting the roadway. Install during the dry season.	Coarse and Fine Sediment: Effective surface drainage to the forest floor, preventing sediment delivery to stream channels	• Statewide Narrative Criteria Road Building Waste Materials OAR 340-041-0007 • Statewide Narrative Criteria Sediment, Adverse Deposits OAR 340-041-0007 • Turbidity OAR 340-041-0036
Roll the grade in erodible and unstable soils to reduce surface water volume and velocities.	Coarse and Fine Sediment: Effective surface drainage to the forest floor, preventing sediment delivery to stream channels	• Statewide Narrative Criteria Road Building Waste Materials OAR 340-041-0007 • Statewide Narrative Criteria Sediment, Adverse Deposits OAR 340-041-0007 • Turbidity OAR 340-041-0036
Divert road and landing runoff water away from headwalls or unstable areas adjacent to stream channels.	Coarse and Fine Sediment: Water volume concentration resulting in headwall saturation with possible failures to waterbodies, floodplains and wetlands	• Statewide Narrative Criteria Road Building Waste Materials OAR 340-041-0007 • Statewide Narrative Criteria Sediment, Adverse Deposits OAR 340-041-0007 • Turbidity OAR 340-041-0036

Best Management Practices for Roads and Landings	Input Variables and Causal Mechanisms	Water Quality Standards and Regulations
Shape landings to spread surface water runoff to natural, well-vegetated, stable ground.	Coarse and Fine Sediment: Effective surface drainage to the forest floor, preventing sediment delivery to stream channels	• Statewide Narrative Criteria Road Building Waste Materials OAR 340-041-0007 • Statewide Narrative Criteria Sediment, Adverse Deposits OAR 340-041-0007 • Turbidity OAR 340-041-0036
Prevent diversion of water from streams into road ditches.	Coarse and Fine Sediment: Concentrated water flow from streams causing ditch erosion, and sediment delivery to another stream channel. Dewatering of a stream channel with negative effects on fishes and aquatic life.	• Antidegradation OAR 340-041-0004(1) • Biocriteria OAR 340-041-0011 • Statewide Narrative OAR 340-041-0007(1)&(13) • Turbidity OAR 340-041-0036
For roads involving very erodible soils near streams: • Construct 75 feet lead-in ditch to catchbasins • Require rock armoring of lead-in ditch for through fills greater than 6 feet in height • Design catch basins in a manner that would settle out transported sediments. Maintain these basins.	Coarse and Fine Sediment: Concentrated water flow from roads and subsequent soil movement to streams	• Antidegradation OAR 340-041-0004(1) • Biocriteria OAR 340-041-0011 • Statewide Narrative OAR 340-041-0007(1)&(13) • Turbidity OAR 340-041-0036
Cross Drains		
Locate cross drains at intervals sufficient to prevent water volume concentration and accelerated ditch erosion.	Coarse and Fine Sediment: Water volume concentration, resulting greater erosive energy, rilling and gullying road ditchlines and delivery to waterbodies, floodplains and wetlands	• Statewide Narrative Criteria Road Building Waste Materials OAR 340-041-0007 • Statewide Narrative Criteria Sediment, Adverse Deposits OAR 340-041-0007 • Turbidity OAR 340-041-0036
Increase cross drain frequency through unstable areas.	Coarse and Fine Sediment: Water volume concentration, resulting in headwall saturation with possible failures to waterbodies, floodplains and wetlands	• Statewide Narrative Criteria Road Building Waste Materials OAR 340-041-0007 • Statewide Narrative Criteria Sediment, Adverse Deposits OAR 340-041-0007 • Turbidity OAR 340-041-0036

Best Management Practices for Roads and Landings	Input Variables and Causal Mechanisms	Water Quality Standards and Regulations
Use cross drainage culverts that are a minimum of 18 inches in diameter.	Coarse and Fine Sediment: Cross drain restricted size that can plug with sediments and debris, causing water flow volume concentration in ditchlines resulting in gullying with materials delivered to waterbodies, floodplains and wetlands	• Statewide Narrative Criteria Road Building Waste Materials OAR 340-041-0007 • Statewide Narrative Criteria Sediment, Adverse Deposits OAR 340-041-0007 • Turbidity OAR 340-041-0036
Construct cross drainage culverts or drainage dips immediately upgrade of stream crossings to prevent ditch sediment from entering the stream.	Coarse and Fine Sediment: Concentrated ditch flow from storm events or snowmelt, causing erosion of the ditchline or carrying sediment sloughed from the cutbank, that if left unchecked may deliver to a stream channel	• Statewide Narrative Criteria Road Building Waste Materials OAR 340-041-0007 • Statewide Narrative Criteria Sediment, Adverse Deposits OAR 340-041-0007 • Turbidity OAR 340-041-0036
Site cross drains to exit on convex slopes and avoid discharge onto erodible and/or unstable ground, (such as headwalls, slumps, or block failure zones), or directly into stream channels. Provide a buffer or sediment basin between the cross drain outlet and waterbodies, floodplains, or wetlands.	Coarse and Fine Sediment: Water volume concentration, resulting in headwall saturation with possible failures to waterbodies, floodplains and wetlands	• Statewide Narrative Criteria Road Building Waste Materials OAR 340-041-0007 • Statewide Narrative Criteria Sediment, Adverse Deposits OAR 340-041-0007 • Turbidity OAR 340-041-0036
Armor drainage dips.	Coarse and Fine Sediment: Effective surface drainage to the forest floor, preventing water volume concentration and sediment delivery to waterbodies, floodplains and wetlands	• Statewide Narrative Criteria Road Building Waste Materials OAR 340-041-0007 • Statewide Narrative Criteria Sediment, Adverse Deposits OAR 340-041-0007 • Turbidity OAR 340-041-0036
Install downspout structures and/or energy dissipators (e.g., rock material) at cross drain outlets or drain dips where water is discharged onto loose material or erodible soils, fills, or steep slopes.	Coarse and Fine Sediment: Concentrated ditch flow from storm events or snowmelt, causing erosion of the ditchline or carrying sediment sloughed from the cutbank that if left unchecked, may deliver to a stream channel	• Statewide Narrative Criteria Road Building Waste Materials OAR 340-041-0007 • Statewide Narrative Criteria Sediment, Adverse Deposits OAR 340-041-0007 • Turbidity OAR 340-041-0036

Best Management Practices for Roads and Landings	Input Variables and Causal Mechanisms	Water Quality Standards and Regulations
Extend all downspout structures to the toe of fill onto undisturbed ground.	Coarse and Fine Sediment: Convey surface water safely off fills, preventing erosion and sediment delivery to waterbodies, floodplains and wetlands	• Statewide Narrative Criteria Road Building Waste Materials OAR 340-041-0007 • Statewide Narrative Criteria Sediment, Adverse Deposits OAR 340-041-0007 • Turbidity OAR 340-041-0036
Cut protruding “cannon” culverts at the fill surface, install downspout and/or energy dissipators on erodible fills.	Coarse and Fine Sediment: Convey surface water safely off fills, preventing erosion and sediment delivery to waterbodies, floodplains and wetlands	• Statewide Narrative Criteria Road Building Waste Materials OAR 340-041-0007 • Statewide Narrative Criteria Sediment, Adverse Deposits OAR 340-041-0007 • Turbidity OAR 340-041-0036
Place protective rock at culvert entrance.	Coarse and Fine Sediment: Prevent scour or road fills causing sediment delivery to waterbodies, floodplains and wetlands	• Statewide Narrative Criteria Road Building Waste Materials OAR 340-041-0007 • Statewide Narrative Criteria Sediment, Adverse Deposits OAR 340-041-0007 • Turbidity OAR 340-041-0036
Use slotted risers, over-sized culverts or build catch basins.	Coarse and Fine Sediment: Culvert plugging causing road fill failure and slug injections of sediments to waterbodies, floodplains and wetlands	• Statewide Narrative Criteria Road Building Waste Materials OAR 340-041-0007 • Statewide Narrative Criteria Sediment, Adverse Deposits OAR 340-041-0007 • Turbidity OAR 340-041-0036
Stream Crossings		
Install all crossings during the low flow period (generally June 15 to September 15).	Coarse and Fine Sediment: Sediment movement downstream during periods of low turbidities with possible effects on aquatic life	• Biocriteria OAR 340-041-0011 • Statewide Narrative Criteria Sediment, Adverse Deposits OAR 340-041-0007 • Turbidity OAR 340-041-0036

Best Management Practices for Roads and Landings	Input Variables and Causal Mechanisms	Water Quality Standards and Regulations
Stream Crossings: Permanent Stream Crossings		
Size culverts, bridges, and other stream crossings for the 100-year flood event (including allowance for bed load and small floatable debris) without exceeding capacity or diversion. Match culvert width with active channel width.	Coarse Sediment, Fine Sediment, nd Organic Debris: Floodwaters exceeding pipe capacity, causing overtopping of pipe and fills, with ensuing headcutting and loss of road fill.	• Statewide Narrative Criteria Road Building Waste Materials OAR 340-041-0007 • Statewide Narrative Criteria Sediment, Adverse Deposits OAR 340-041-0007 • Turbidity OAR 340-041-0036
Limit the number of new stream crossings.	Coarse and Fine Sediment: Sediment entry of road related run-off	• Statewide Narrative Criteria Road Building Waste Materials OAR 340-041-0007 • Statewide Narrative Criteria Sediment, Adverse Deposits OAR 340-041-0007 • Turbidity OAR 340-041-0036
Construct the stream crossing approach at a right angle (or as near a right angle as possible) to the stream.	Coarse and Fine Sediment: Earthwork near waterbodies, floodplains and wetlands causing sediment delivery.	• Biocriteria OAR 340-041-0011 • Statewide Narrative Criteria Road Building Waste Materials OAR 340-041-0007 • Statewide Narrative Criteria Sediment, Adverse Deposits OAR 340-041-0007 • Turbidity OAR 340-041-0036
Locate culvert placement on a well defined, unobstructed, and straight reach of stream. Avoid locations that require a stream channel to be straightened beyond the length of a culvert.	Coarse and Fine Sediment: Earthwork near waterbodies, floodplains and wetlands causing sediment delivery.	• Biocriteria OAR 340-041-0011 • Statewide Narrative Criteria Road Building Waste Materials OAR 340-041-0007 • Statewide Narrative Criteria Sediment, Adverse Deposits OAR 340-041-0007 • Turbidity OAR 340-041-0036
Do not install culverts on fill material in ephemeral or intermittent channels.	Coarse and Fine Sediment: Floodwater piping or eroding unconsolidated road fill, causing failures with sediment delivery to waterbodies, floodplains and wetlands.	• Statewide Narrative Criteria Road Building Waste Materials OAR 340-041-0007 • Statewide Narrative Criteria Sediment, Adverse Deposits OAR 340-041-0007 • Turbidity OAR 340-041-0036

Best Management Practices for Roads and Landings	Input Variables and Causal Mechanisms	Water Quality Standards and Regulations
Divert (e.g., coffer dam, pumping etc.) the stream around the work area. Maintain diversion until all instream work is completed. Pump seepage water that may escape the containment to off-stream filtration area.	Coarse and Fine Sediment: rosion at the instream construction site causing sediment movement downstream during periods of low turbidities with possible effects on aquatic life.	• Biocriteria OAR 340-041-0011 • Statewide Narrative Criteria Road Building Waste Materials OAR 340-041-0007 • Statewide Narrative Criteria Sediment, Adverse Deposits OAR 340-041-0007 • Turbidity OAR 340-041-0036
Use containment and filtering techniques (e.g., bladder barriers, silt curtains etc.) if diversion is not possible. Place sediment controls along or immediately downstream of the instream work.	Coarse and Fine Sediment: Sediment movement downstream during periods of low turbidities with possible effects on aquatic life.	• Biocriteria OAR 340-041-0011 • Statewide Narrative Criteria Road Building Waste Materials OAR 340-041-0007 • Statewide Narrative Criteria Sediment, Adverse Deposits OAR 340-041-0007 • Turbidity OAR 340-041-0036
Limit activities of mechanized equipment to streambank areas or temporary platforms when installing or removing structures.	Coarse and Fine Sediment: Erosion at the instream construction site causing sediment movement downstream	• Biocriteria OAR 340-041-0011 • Statewide Narrative Criteria Road Building Waste Materials OAR 340-041-0007 • Statewide Narrative Criteria Sediment, Adverse Deposits OAR 340-041-0007 • Turbidity OAR 340-041-0036
Countersink culvert below the streambed. Increase culvert diameters accordingly.	Coarse and Fine Sediment: Scour of streambed at culvert outlet, causing entrainment of sediment in flowing water and delivery to waterbodies, floodplains and wetlands.	• Biocriteria OAR 340-041-0011 • Statewide Narrative Criteria Road Building Waste Materials OAR 340-041-0007 • Statewide Narrative Criteria Sediment, Adverse Deposits OAR 340-041-0007 • Turbidity OAR 340-041-0036

Best Management Practices for Roads and Landings	Input Variables and Causal Mechanisms	Water Quality Standards and Regulations
Use stream crossing protection (e.g., hardened crossing, fill armoring, grade dipping, etc.) where high debris loads are expected (such as debris torrent channels) to allow overflow without loss of the fill.	Coarse Sediment, Fine Sediment, and Organic Debris: Debris flows plugging culverts or removing road fills with high delivery of sediments and materials to waterbodies, floodplains and wetlands.	• Statewide Narrative Criteria Road Building Waste Materials OAR 340-041-0007 • Statewide Narrative Criteria Sediment, Adverse Deposits OAR 340-041-0007 • Turbidity OAR 340-041-0036
Provide adequate stream bank protection using bioengineering techniques (e.g., rock and/or organic material) where bank erosion would occur.	Coarse and Fine Sediment: Stream scour of road fill, causing entrainment of sediment in flowing water and delivery to waterbodies, floodplains and wetlands.	• Biocriteria OAR 340-041-0011 • Statewide Narrative Criteria Road Building Waste Materials OAR 340-041-0007 • Statewide Narrative Criteria Sediment, Adverse Deposits OAR 340-041-0007 • Turbidity OAR 340-041-0036
Provide structural erosion control measures (e.g., rip-rap, wing walls, etc.) on erosion-prone fills, inlets, and outlets.	Coarse and Fine Sediment: Scour of streambed at culvert outlet, causing entrainment of sediment in flowing water and delivery to waterbodies, floodplains and wetlands.	• Biocriteria OAR 340-041-0011 • Statewide Narrative Criteria Road Building Waste Materials OAR 340-041-0007 • Statewide Narrative Criteria Sediment, Adverse Deposits OAR 340-041-0007 • Turbidity OAR 340-041-0036
Place energy dissipators (e.g., large rock) at the outlet of culverts on streams.	Coarse and Fine Sediment: Stream scour of road fill, causing entrainment of sediment in flowing water and delivery to waterbodies, floodplains and wetlands.	• Biocriteria OAR 340-041-0011 • Statewide Narrative Criteria Road Building Waste Materials OAR 340-041-0007 • Statewide Narrative Criteria Sediment, Adverse Deposits OAR 340-041-0007 • Turbidity OAR 340-041-0036

Best Management Practices for Roads and Landings	Input Variables and Causal Mechanisms	Water Quality Standards and Regulations
Stabilize fill material over stream crossing structures immediately after construction has been completed, normally before October 15. Exposed soils would be seeded and mulched. Temporarily suspend activity if rain saturates soils to the extent that there is potential for movement of sediment from the road to the stream. Soils must be covered or temporarily stabilized during work suspension.	Coarse and Fine Sediment: Surface erosion with sediment delivery to waterbodies, floodplains and wetlands.	• Statewide Narrative Criteria Road Building Waste Materials OAR 340-041-0007 • Statewide Narrative Criteria Sediment, Adverse Deposits OAR 340-041-0007 • Turbidity OAR 340-041-0036
Incorporate additional design criteria (e.g., rock blankets, buttressing, relief pipes higher in the fill, etc.) for deep fills to lesson the susceptibility of fill failures.	Coarse Sediment, Fine Sediment, and Organic Debris: Floodwaters exceeding pipe capacity, causing overtopping of pipe, possible piping through fills with possible collapse or overtopping, with ensuing headcutting, loss of road fill, and possible dam break flood scouring downstream reaches.	• Biocriteria OAR 340-041-0011 • Statewide Narrative Criteria Road Building Waste Materials OAR 340-041-0007 • Statewide Narrative Criteria Sediment, Adverse Deposits OAR 340-041-0007 • Turbidity OAR 340-041-0036
Use slotted risers, trash racks, or over-sized culverts to prevent culvert plugging in areas of active debris movement.	Coarse Sediment, Fine Sediment, and Debris: Mobile debris and materials plugging culverts with overtopping and failure of the road fill, and possible dam break flood, scouring downstream reaches	• Biocriteria OAR 340-041-0011 • Statewide Narrative Criteria Road Building Waste Materials OAR 340-041-0007 • Statewide Narrative Criteria Sediment, Adverse Deposits OAR 340-041-0007 • Turbidity OAR 340-041-0036
Install permanent stream crossing structures before heavy equipment moves beyond the crossing area. Where this is not feasible, install temporary crossings.	Coarse and Fine Sediment: Sediment movement downstream during periods of low turbidities with possible effects on aquatic life	• Biocriteria OAR 340-041-0011 • Statewide Narrative Criteria Road Building Waste Materials OAR 340-041-0007 • Statewide Narrative Criteria Sediment, Adverse Deposits OAR 340-041-0007 • Turbidity OAR 340-041-0036

Best Management Practices for Roads and Landings	Input Variables and Causal Mechanisms	Water Quality Standards and Regulations
Stream Crossings: Temporary Stream Crossings for Roads and Skid Trails		
Design temporary structures to keep vehicles/equipment out of the stream.	Coarse Sediment, Fine Sediment, Oil, and Toxins: Vehicles wheel tracks breaking down banks, to access stream channel bottoms, driving through stream water column, disturbing fish habitat, with possible release of oil, and asbestos from brake linings and similar toxins.	• Biocriteria OAR 340-041-0011 • Statewide Narrative Criteria Oil and Floating Solids OAR 340-041-0007 • Statewide Narrative Criteria Toxics OAR 340-041-0007 • Turbidity OAR 340-041-0036
Limit the number of new temporary crossings on a stream.	Coarse and Fine Sediment: Sediment movement downstream during periods of low turbidities with possible effects on aquatic life.	• Biocriteria OAR 340-041-0011 • Statewide Narrative Criteria Sediment, Adverse Deposits OAR 340-041-0007 • Turbidity OAR 340-041-0036
Use washed river rock as backfill material or crushed rock over geo-textile fabric, as fill over temporary culverts.	Coarse and Fine Sediment: Higher than anticipated streamflows, washing over or through temporary road crossing.	• Biocriteria OAR 340-041-0011 • Statewide Narrative Criteria Sediment, Adverse Deposits OAR 340-041-0007 • Turbidity OAR 340-041-0036
Use methods other than fill first, or use the least amount of fill possible to facilitate the temporary stream crossing structure if a non-fill structure is not possible.	Coarse and Fine Sediment: Higher than anticipated streamflows, washing over or through temporary road crossing.	• Biocriteria OAR 340-041-0011 • Statewide Narrative Criteria Sediment, Adverse Deposits OAR 340-041-0007 • Turbidity OAR 340-041-0036
No driving of mechanized equipment in the stream channel to the area that is necessary for installation and removal operations. Work from bank or temporary platforms.	Coarse Sediment, Fine Sediment, Oil, and Toxins: Mechanized equipment working within the stream channel, disturbing fish habitat, causing turbidity, and possible release of oil, and similar toxins.	• Biocriteria OAR 340-041-0011 • Statewide Narrative Criteria Oil and Floating Solids OAR 340-041-0007 • Statewide Narrative Criteria Toxics OAR 340-041-0007 • Turbidity OAR 340-041-0036
Limit the installation and removal of temporary crossing structures to only one time during the same year and within the prescribed work period where possible. Follow practices under the Closure/Decommissioning section for removing stream crossing drainage structures and reestablishing natural drainage configuration.	Coarse and Fine Sediment: Fall or winter streamflows washing over temporary road and high stream energies washing a portion or all of the crossing downstream.	• Biocriteria OAR 340-041-0011 • Statewide Narrative Criteria Sediment, Adverse Deposits OAR 340-041-0007 • Turbidity OAR 340-041-0036

Best Management Practices for Roads and Landings	Input Variables and Causal Mechanisms	Water Quality Standards and Regulations
Stream Crossings: Low-Water Ford Stream Crossings		
Use materials that would withstand 100-year flow events (e.g., concrete, well anchored concrete mats, etc.) on permanent crossings.	Coarse Sediment, Fine Sediment, and Toxins: High streamflow undermining or twisting structure, with possible channel shifts, and partial collapse or loss of structure.	• Statewide Narrative Criteria Toxics OAR 340-041-0007 • Turbidity OAR 340-041-0036
Harden approaches with non-erodible materials on permanent crossings. Provide relief drainage on approaches.	Coarse Sediment, Fine Sediment, and Toxins: Loose road surfacing, washing into the stream during storms.	Turbidity OAR 340-041-0036
Use washed rock/gravel in temporary crossings, where a non-fill structure is not possible.	Coarse and Fine Sediment: Higher than anticipated streamflows, washing over or through temporary road crossing.	• Biocriteria OAR 340-041-0011 • Statewide Narrative Criteria Sediment, Adverse Deposits OAR 340-041-0007 • Turbidity OAR 340-041-0036
Restrict access to temporary crossings.	Coarse Sediment, Fine Sediment, Oil, and Toxins: Vehicles driving through stream water column, disturbing fish habitat, with possible release of oil, and asbestos from brake linings and similar toxins.	• Biocriteria OAR 340-041-0011 • Statewide Narrative Criteria Oil and Floating Solids OAR 340-041-0007 • Statewide Narrative Criteria Toxics OAR 340-041-0007 • Turbidity OAR 340-041-0036
Use ramped low water fords in debris flow susceptible streams.	Coarse and Fine Sediment: Debris flows piling against road fills, plugging culverts and overtopping and loss of road prism, or dam break flood wave scouring downstream habitat.	Turbidity OAR 340-041-0036
Road Use and Dust Abatement		
Apply durable rock surfacing to withstand expected loads and traffic volume.	Coarse and Fine Sediment: Road rock breaking down to fines, and washing from roads to ditchlines to stream channels.	Turbidity OAR 340-041-0036
Avoid wet season (generally, November through April) hauling on unsurfaced roads.	Coarse and Fine Sediment: Road surface becoming soft and eroding and washing from roads to ditchlines to stream channels.	Turbidity OAR 340-041-0036
Apply structural treatments (i.e., adjust frequency of cross-drain spacing, sediment barriers or catch basins, gravel lifts or asphalt road surfacing at stream crossing approaches, and clean and armor ditchlines) for winter hauling.	Coarse and Fine Sediment: Road ditchlines gaining water volume concentration, transporting soil material to stream channels, or sediment sources near channels that can flow overland during storms by sheetwash or rill erosion, depositing soil material into stream channels.	Turbidity OAR 340-041-0036

Best Management Practices for Roads and Landings	Input Variables and Causal Mechanisms	Water Quality Standards and Regulations
Suspend timber hauling during wet weather when road surface degradation results in sediment delivery to waterbodies, floodplains and wetlands. Hauling could resume when ditch flow subsides or turbidity standards are met.	Coarse and Fine Sediment: Road erosion with potential transport to the channel and floodplain.	Turbidity OAR 340-041-0036
Suspend timber hauling during wet weather when road run-off delivers sediment at higher concentrations than the existing conditions in the receiving stream. Hauling could resume when ditch flow subsides, or when conditions allow turbidity standards to be met.	Coarse and Fine Sediment: Road erosion with potential transport to the channel and floodplain.	Turbidity OAR 340-041-0036
Remove snow on haul roads in a manner that will protect roads and adjacent resources. Remove or place snow berms to prevent water concentration on the roadway or on erodible side-slopes or soils.	Coarse and Fine Sediment: Road erosion with potential transport to the channel and floodplain.	Turbidity OAR 340-041-0036
Wash equipment at sites with no potential for run-off into waterbodies, floodplains, or wetlands.	Coarse and Fine Sediment: Soil erosion with potential transport to the channel and floodplain.	Turbidity OAR 340-041-0036
Use water or approved surface stabilizers/dust palliatives to reduce surfacing material loss and buildup of fine sediment that may wash off into waterbodies, floodplains, or wetlands.	Coarse and Fine Sediment: Road surfacing becoming detached and blowing or washing from roadways to ditchlines to stream channels.	Turbidity OAR 340-041-0036
Maintenance		
Avoid routine machine cleaning of ditches during the wet season (generally, November through April).	Coarse and Fine Sediment: Removing vegetation or fill material from ditches in the wet season would increase bare soils susceptible to erosion, with potential delivery to stream channels.	Turbidity OAR 340-041-0036
Avoid undercutting of cut-slopes when cleaning ditchlines. Seed and mulch bare soils.	Coarse and Fine Sediment: Removing vegetation or fill material from ditches or undercutting backslopes would increase bare soils susceptible to erosion, with potential delivery to stream channels.	Turbidity OAR 340-041-0036
Promptly remove slide material when it is obstructing road surface and ditchline drainage.	Coarse and Fine Sediment: Slide material, being eroded by ditch streamflow and routing to stream channels, especially during storms.	Turbidity OAR 340-041-0036

Best Management Practices for Roads and Landings	Input Variables and Causal Mechanisms	Water Quality Standards and Regulations
End-haul sloughed or excavated materials to a stable site outside Riparian management areas with no potential to reach waterbodies, wetlands and floodplains. Avoid wasting loose ditch or surface material over the shoulder where it can cause stream sedimentation or weaken slump prone areas.	Coarse and Fine Sediment: Wasting soil material on steep slopes, may trigger a debris avalanche that could enter a stream channel, delivering sediment and debris.	• Statewide Narrative Criteria Road Building Waste Materials OAR 340-041-0007 • Turbidity OAR 340-041-0036
Keep road inlet and outlet ditches, catch basins, and culverts free of obstructions, particularly before and during winter precipitation and spring run-off.	Coarse and Fine Sediment: Plugged culverts by sediment and debris, leading to los of road fill and movement of road sediment downstream.	Turbidity OAR 340-041-0036
Repair damaged inlets and downspouts to maintain drainage design capacity.	Coarse and Fine Sediment: Plugged culverts by sediment and debris, leading to los of road fill and movement of road sediment downstream.	Turbidity OAR 340-041-0036
Blade and shape roads to conserve existing aggregate surface material, retain the original crowned or out-sloped self-draining cross section, prevent or remove eroding berms (except those designed for slope protection) and other irregularities that retard normal surface runoff.	Coarse and Fine Sediment: Road erosion with potential transport to the channel and floodplain.	Turbidity OAR 340-041-0036
Eliminate undesirable berms that retard surface runoff.	Coarse and Fine Sediment: Road erosion with potential transport to the channel and floodplain.	Turbidity OAR 340-041-0036
Retain low-growing, herbaceous ground cover and brush on cut-and-fill slopes and ditchlines during the wet season (generally, November through April).	Coarse and Fine Sediment: Increased vegetative cover rapidly diminishes surface erosion potential, and delivery of sediment to stream channels.	Turbidity OAR 340-041-0036
Cut roadside vegetation rather than pulling it out and disturbing the soil.	Coarse and Fine Sediment: Pulling vegetation near ditchlines, creates loose soil material that may fall or wash into ditchlines and then route to stream channels.	Turbidity OAR 340-041-0036
Closure and Decommissioning		
• Decommission new roads not included in the permanent road system upon completion of use, or stormproof if needed the following season. • Decommission older, under used roads that require high maintenance where regular maintenance is unlikely to occur due to lack of resources. • Decommission to Level 1 and any other appropriate level as described below.	Coarse and Fine Sediment: Surface erosion with delivery to waterbodies, floodplains and wetlands.	• Biocriteria OAR 340-041-0011 • Statewide Narrative Criteria Sediment, Adverse Deposits OAR 340-041-0007 • Turbidity OAR 340-041-0036

Best Management Practices for Roads and Landings	Input Variables and Causal Mechanisms	Water Quality Standards and Regulations
Level 1: Gate or block roads not needed, but not recommended to be fully decommissioned.	Coarse and Fine Sediment: Wheel track formation and rilling/gullying with delivery to waterbodies, floodplains and wetlands.	• Biocriteria OAR 340-041-0011 • Statewide Narrative Criteria Sediment, Adverse Deposits OAR 340-041-0007 • Turbidity OAR 340-041-0036
Level 2: Convert existing drainage structures such as ditches and cross drain culverts to a long-term no maintenance drainage configuration such as large dips, outsloped road surface, and well drained, high-capacity waterbars.	Coarse and Fine Sediment: Sediment accumulation or debris plugging cross drains causing road erosion.	• Biocriteria OAR 340-041-0011 • Statewide Narrative Criteria Sediment, Adverse Deposits OAR 340-041-0007 • Turbidity OAR 340-041-0036
Remove stream crossing culverts and in-channel fill material during low flow (generally, June 15 to September 15) and prior to fall rains. Pull back road fill to match channel widths and establish former drainageways when removing culverts.	Coarse and Fine Sediment: Sediment accumulation or debris plugging stream culverts, causing road gully erosion or stream crossing failure. Stream channels readjusting to active channel width, entraining road fill materials.	• Biocriteria OAR 340-041-0011 • Statewide Narrative Criteria Road Building Waste Materials OAR 340-041-0007 • Statewide Narrative Criteria Sediment, Adverse Deposits OAR 340-041-0007 • Turbidity OAR 340-041-0036
Place excavated material from removed stream crossings in a stable location where it would not reenter the stream. If necessary, place sediment and erosion controls around all stockpiled material.	Coarse and Fine Sediment: Surface erosion delivering to waterbodies, floodplains and wetlands.	• Biocriteria OAR 340-041-0011 • Statewide Narrative Criteria Sediment, Adverse Deposits OAR 340-041-0007 • Turbidity OAR 340-041-0036
Reestablish stream crossings to the natural stream gradient. Reestablish stream side slopes to the natural contour.	Coarse and Fine Sediment: Stream bed nickpoints traveling upstream, scouring below the armor layer in gravel bed streams causing excessive channel erosion. Surface erosion delivering to waterbodies, floodplains and wetlands.	• Biocriteria OAR 340-041-0011 • Statewide Narrative Criteria Road Building Waste Materials OAR 340-041-0007 • Statewide Narrative Criteria Sediment, Adverse Deposits OAR 340-041-0007 • Turbidity OAR 340-041-0036

Best Management Practices for Roads and Landings	Input Variables and Causal Mechanisms	Water Quality Standards and Regulations
Seed (with native or approved seed), mulch, and plant (with native tree species) streambanks and side slopes as soon as possible after culvert removal has been completed, and before October 15.	Coarse and Fine Sediment: Surface erosion delivering to waterbodies, floodplains and wetlands.	• Biocriteria OAR 340-041-0011 • Statewide Narrative Criteria Sediment, Adverse Deposits OAR 340-041-0007 • Turbidity OAR 340-041-0036
Place sediment trapping materials (such as straw bales) at the toe of the stream adjacent side slopes.	Coarse and Fine Sediment: Surface erosion delivering to waterbodies, floodplains and wetlands.	• Biocriteria OAR 340-041-0011 • Statewide Narrative Criteria Sediment, Adverse Deposits OAR 340-041-0007 • Turbidity OAR 340-041-0036
Waterbar decommissioned roads on each side of stream crossings.	Coarse and Fine Sediment: Surface erosion delivering to waterbodies, floodplains and wetlands.	• Biocriteria OAR 340-041-0011 • Statewide Narrative Criteria Sediment, Adverse Deposits OAR 340-041-0007 • Turbidity OAR 340-041-0036
Level 3: Seed and mulch the road surface, where erosion could occur.	Coarse and Fine Sediment: Surface erosion delivering to waterbodies, floodplains and wetlands.	• Biocriteria OAR 340-041-0011 • Statewide Narrative Criteria Sediment, Adverse Deposits OAR 340-041-0007 • Turbidity OAR 340-041-0036
Level 4: Till the roadbed, landings, and construction areas.	Coarse and Fine Sediment: Water concentration eroding compacted surfaces resulting to sediment delivery to waterbodies, floodplains and wetlands.	• Biocriteria OAR 340-041-0011 • Statewide Narrative Criteria Sediment, Adverse Deposits OAR 340-041-0007 • Turbidity OAR 340-041-0036
Level 5: Pull back road fill and recontour to the natural slopes.	Coarse and Fine Sediment: Water concentration eroding compacted surfaces resulting to sediment delivery to waterbodies, floodplains and wetlands.	• Biocriteria OAR 340-041-0011 • Statewide Narrative Criteria Sediment, Adverse Deposits OAR 340-041-0007 • Turbidity OAR 340-041-0036

Best Management Practices for Roads and Landings	Input Variables and Causal Mechanisms	Water Quality Standards and Regulations
Suspend decommissioning work if rain saturates soils to the extent that there is potential for environmental damage, including movement of sediment from the road to the stream.	Coarse and Fine Sediment: Surface erosion delivering to waterbodies, floodplains and wetlands.	• Biocriteria OAR 340-041-0011 • Statewide Narrative Criteria Sediment, Adverse Deposits OAR 340-041-0007 • Turbidity OAR 340-041-0036
Stormproof open roads not scheduled for planned maintenance.	Coarse and Fine Sediment: Surface erosion with delivery to waterbodies, floodplains and wetlands.	• Biocriteria OAR 340-041-0011 • Statewide Narrative Criteria Sediment, Adverse Deposits OAR 340-041-0007 • Turbidity OAR 340-041-0036
Place woody material or other appropriate barriers to discourage off-highway vehicle use on decommissioned roads, unless specifically designated for this use.	Coarse and Fine Sediment: Surface erosion delivering to waterbodies, floodplains and wetlands.	• Biocriteria OAR 340-041-0011 • Statewide Narrative Criteria Sediment, Adverse Deposits OAR 340-041-0007 • Turbidity OAR 340-041-0036
Water Source Development and Use		
Construct water sources during low flows (generally, August through October).	Coarse Sediment, Fine Sediment, and Aquatic Habitat: Changing or removing stream habitat and associated stream turbidity.	• Biocriteria OAR 340-041-0011 • Turbidity OAR 340-041-0036
Locate road approaches to in-stream water source developments so as to limit disturbance to vegetation. Surface these approaches with rock.	Coarse Sediment, Fine Sediment, and Toxins: Road surfacing, washing into the stream during storms.	Turbidity OAR 340-041-0036
Avoid use of road fills for water impoundment dams unless specifically designed for that purpose. Existing road fill impoundments are required to pass 100-year flood events without failure.	Coarse Sediment, Fine Sediment, and Toxins: Road fill washout, leading to stream sedimentation	• Biocriteria OAR 340-041-0011 • Statewide Narrative Criteria Road Building Waste Materials OAR 340-041-0007 • Statewide Narrative Criteria Sediment, Adverse Deposits OAR 340-041-0007 • Turbidity OAR 340-041-0036
Direct overflow from off-channel water developments back into the stream as long as overflow water characteristics remain the same.	Low Flows: Decreasing low flows, potentially causing increased stream water temperatures, and decreased stream oxygen levels.	• Dissolved Oxygen OAR 340-041-0016 • Temperature OAR 340-041-0028

Best Management Practices for Roads and Landings	Input Variables and Causal Mechanisms	Water Quality Standards and Regulations
Do not construct temporary pump chances. When necessary, use temporary plastic dams to create chances and remove these dams when not actively pumping.	Low Flows: Decreasing low flows, potentially causing increased stream water temperatures, and decreased stream oxygen levels.	• Dissolved Oxygen OAR 340-041-0016 • Temperature OAR 340-041-0028
Suspend pump intakes near the deepest/highest quantity of flow of the stream. Do not place pump intakes on the substrate or edges of the stream channel.	Coarse Sediment, Fine Sediment, and Stream Habitat: Changing or removing stream habitat and associated stream turbidity.	• Biocriteria OAR 340-041-0011 • Turbidity OAR 340-041-0036

Timber Harvest Activities

See *Summary of Water Quality Standards* for additional details about the standards and regulations that are associated with the best management practices.

Table 272. Best management practices for timber harvest activities

Best Management Practices for Timber Harvest Activities	Input Variables and Causal Mechanisms	Water Quality Standards and Regulations
Cable Yarding		
Yard away from riparian management areas	• Coarse and Fine Sediment: Yarding operations can cause compaction, displacement and exposure of soils and sediment sources in zones with potential for transport and delivery of sediment to water bodies and wetlands resulting in turbidity. • Water Temperature: Yarding operations in RMA's can result in vegetation canopy loss due to removal for safety and operations. Decreases in canopy can result in losses of effective shade and exposure of stream channel to solar radiation, resulting in heating of the waterbody.	• Antidegradation OAR 340-041-0004(1) • Statewide Narrative OAR 340-041-0007(1) and(13) • Temperature OAR 340-041-0028 • Turbidity OAR 340-041-0036
Remove introduced slash into waterbodies within before the next precipitation and runoff event.	Coarse and Fine Sediment: Debris jams can form damming the stream and directing streamflow against banks, leading to bank erosion , or a dam break flood.	• Antidegradation OAR 340-041-0004(1) • Statewide Narrative OAR 340-041-0007(1) and(13) • Turbidity OAR 340-041-0036

Best Management Practices for Timber Harvest Activities	Input Variables and Causal Mechanisms	Water Quality Standards and Regulations
Design yarding corridors so as to limit canopy loss in riparian management areas and to meet shade targets. Techniques include limiting the number of such corridors, using narrow widths, and using a perpendicular orientation to the stream.	Water Temperature: Yarding corridors in RMA's can result in vegetation canopy loss due to removal for safety and yarding operations. Decreases in canopy can result in losses of effective shade and exposure of stream channel to solar radiation, resulting in heating of the waterbody. Removal of more than 80% effective shade can exceed criteria and TMDL Targets	• Antidegradation OAR 340-041-0004(1) • Statewide Narrative OAR 340-041-0007(1) and(13) • Temperature OAR 340-041-0028
Require full suspension over flowing streams, non-flowing streams with erodible bed and bank, and jurisdictional wetlands.	Coarse and Fine Sediment: Log yarding through waterbodies can cause direct introduction of sediment into water or channels resulting in accumulation of sediment and turbidity. Displacement of stream and wetland bed and banks exposing soil to erosion resulting in sedimentation and turbidity.	• Antidegradation OAR 340-041-0004(1) • Statewide Narrative OAR 340-041-0007(1) and(13) • Turbidity OAR 340-041-0036
Limit downhill logging into riparian management areas or where yarding trails can expand the stream or ditch network.	Coarse and Fine Sediment: Downhill logging into RMA's could result in converging skid paths intersecting stream channels, and less than full suspension, which could result in sediment accumulation, delivery and turbidity	• Antidegradation OAR 340-041-0004(1) • Statewide Narrative OAR 340-041-0007(1) and(13) • Turbidity OAR 340-041-0036
Widely space yarding corridors or new road crossings within riparian management areas if no practical alternative exists to treat adjacent uplands, or to avoid building more roads or landings.	Temperature and Sediment: Site specific acceptance of RMA entry can reduce overall displacement of soils and canopy losses in riparian areas, floodplains and wetlands. Cumulative increases in sediment and temperature can be reduced through tradeoffs with local site specific impacts.	• Antidegradation OAR 340-041-0004(1) • Statewide Narrative OAR 340-041-0007(1) and(13) • Temperature OAR 340-041-0028 • Turbidity OAR 340-041-0036
Where slopes exceed 60 percent along stream channels, yard with full suspension, one-end suspension using seasonal restrictions, or one-end suspension using a standing skyline with lateral yarding capacity. Yard remaining areas using one-end suspension	Coarse and Fine Sediment: Slopes greater than 65% present a high risk of soil displacement and transport downslope to RMAs due to gravitational forces. Increased displacement from lack of log suspension can cause excessive displacement, exposure of sediment sources and delivery to waterbodies and wetlands.	• Antidegradation OAR 340-041-0004(1) • Statewide Narrative OAR 340-041-0007(1) and(13) • Turbidity OAR 340-041-0036
Implement erosion control measures such as water-barring, slash placement and seeding in cable yarding corridors where the potential for erosion and delivery to waterbodies, floodplains and wetlands exists.	Coarse and Fine Sediment: Exposure of soils to erosive forces of water with potential delivery to waterbodies and wetlands.	• Antidegradation OAR 340-041-0004(1) • Statewide Narrative OAR 340-041-0007(1) and(13) • Turbidity OAR 340-041-0036

Best Management Practices for Timber Harvest Activities	Input Variables and Causal Mechanisms	Water Quality Standards and Regulations
Ground-Based Yarding		
Exclude ground-based yarding on hydric soils.	Coarse and Fine Sediment: Displacement and exposure of soils through equipment operation with potential delivery of sediment to waterbodies resulting in sedimentation and turbidity	• Antidegradation OAR 340-041-0004(1) • Statewide Narrative OAR 340-041-0007(1) and(13) • Turbidity OAR 340-041-0036
When operating within riparian management areas: • Avoid construction of new skid trails by preferentially using existing skid trails. • In previously un-entered stands, use designated skid trails to limit soil compaction to no more than 12 percent of the harvest area. • Site-specific conditions, such as shade retention or soil erodibility, may require a ground-based equipment exclusion zone (50 to 75 feet) adjacent to waterbodies, floodplains, and wetlands to provide filtration and shade retention. • Limit width and attain one end suspension. • Restrict ground-based harvest and skidding operations to periods of low soil moisture when soils have the most resistance to compaction and displacement. • Use “one-pass” harvest techniques.	• Coarse and Fine Sediment: Displacement and exposure of soils through equipment operation with potential delivery of sediment to waterbodies resulting in sedimentation and turbidity • Temperature: Loss of vegetation canopy due to removal during yarding operations. Decreased shade and exposure of stream channel to solar radiation and increased heating.	• Antidegradation OAR 340-041-0004(1) • Statewide Narrative OAR 340-041-0007(1) and(13) • Temperature OAR 340-041-002 • Turbidity OAR 340-041-0036
Limit mechanical track equipment to slopes less than 35 percent and nontrack mechanized equipment to slopes less than 20 percent.	Coarse and Fine Sediment: Displacement and exposure of soils through equipment operation with potential delivery of sediment to waterbodies resulting in sedimentation and turbidity	• Antidegradation OAR 340-041-0004(1) • Statewide Narrative OAR 340-041-0007(1) and(13) • Turbidity OAR 340-041-0036

Best Management Practices for Timber Harvest Activities	Input Variables and Causal Mechanisms	Water Quality Standards and Regulations
Designate skid trails where water from trail surface would not be channeled into unstable areas adjacent to waterbodies, floodplains, and wetlands.	Coarse and Fine Sediment: Compaction of skid trails resulting in additional surface flow to unstable areas. Increases in water to unstable areas can elevate pore pressure and weight of unstable area causing mass wasting and delivery of sediment and turbidity to waterbodies and wetlands.	• Antidegradation OAR 340-041-0004(1) • Statewide Narrative OAR 340-041-0007(1) and(13) • Turbidity OAR 340-041-0036
Directionally fall trees towards skid trails.	Coarse and Fine Sediment: Minimize compaction of skid trails resulting in loss of infiltration, surface water flow and erosion of exposed soils. Potential delivery to waterbodies and wetlands resulting in sedimentation and turbidity.	• Antidegradation OAR 340-041-0004(1) • Statewide Narrative OAR 340-041-0007(1) and(13) • Turbidity OAR 340-041-0036
Apply erosion control practices to all disturbed areas (eg., skid trails) with potential for erosion and delivery to waterbodies, floodplains, or wetlands. These practices could include tillage, water barring, seeding, mulching, and woody debris placement.”	Coarse and Fine Sediment: Exposure of soils to erosive forces of water with potential delivery to waterbodies and wetlands.	• Antidegradation OAR 340-041-0004(1) • Statewide Narrative OAR 340-041-0007(1) and(13) • Turbidity OAR 340-041-0036
Allow logging on snow when snow depth is greater than 18 inches or over frozen ground.	Coarse and Fine Sediment: Displacement, compaction, and exposure of soils through equipment operation with potential delivery of sediment to waterbodies resulting in sedimentation and turbidity.	• Antidegradation OAR 340-041-0004(1) • Biocriteria OAR 340-041-0011 • Statewide Narrative OAR 340-041-0007(1)&(13) • Turbidity OAR 340-041-0036
Block skid roads that intersect haul roads at the end of seasonal use.	Coarse and Fine Sediment: Displacement, compaction, and exposure of soils through equipment operation with potential delivery of sediment to waterbodies resulting in sedimentation and turbidity.	• Antidegradation OAR 340-041-0004(1) • Biocriteria OAR 340-041-0011 • Statewide Narrative OAR 340-041-0007(1)&(13) • Turbidity OAR 340-041-0036

Best Management Practices for Timber Harvest Activities	Input Variables and Causal Mechanisms	Water Quality Standards and Regulations
Helicopter		
Use helicopter yarding in waterbodies, floodplains, and wetlands when other BMP's will not meet water quality standards/ criteria.	• Coarse and Fine Sediment: Soil exposure due to yarding operations resulting in soil erosion with potential transport to the waterbody resulting in sedimentation and turbidity. • Temperature: Loss of vegetation canopy due to removal during yarding operations. Decreased shade and exposure of stream channel to solar radiation and increased heating.	• Antidegradation OAR 340-041-0004(1) • Statewide Narrative OAR 340-041-0007(1) and(13) • Temperature OAR 340-041-0028 • Turbidity OAR 340-041-0036
Horse		
Limit horse logging in riparian management area's to slopes less than 20 percent.	Coarse and Fine Sediment: Soil on skid trails exposed to water erosion with potential delivery to waterbodies , floodplains, and wetlands resulting in sedimentation and turbidity.	• Antidegradation OAR 340-041-0004(1) • Statewide Narrative OAR 340-041-0007(1) and(13) • Turbidity OAR 340-041-0036
Construct waterbars on horse skid trails when there is potential for soil erosion and delivery to waterbodies, floodplains, and wetlands.	Coarse and Fine Sediment: Soil on skid trails exposed to water erosion with potential delivery to waterbodies , floodplains, and wetlands resulting in sedimentation and turbidity.	• Antidegradation OAR 340-041-0004(1) • Statewide Narrative OAR 340-041-0007(1) and(13) • Turbidity OAR 340-041-0036

Silvicultural Activities

See *Summary of Water Quality Standards* for additional details about the standards and regulations that are associated with the best management practices.

Table 273. Best management practices for silvicultural activities

Best Management Practices for Silvicultural Activities	Input Variables and Causal Mechanisms	Water Quality Standards and Regulations
General		
During active silvicultural management of riparian management areas, retain dominant site potential species within primary shade zones.	Temperature: Persistent stream canopy provides consistent effective shade over time and will contribute to meeting shade targets and temperature criteria.	• Antidegradation OAR 340-041-0004(1) • Statewide Narrative OAR 340-041-0007(1) and (13) • Temperature OAR 340-041-0028
Limit crossing stream channels with motorized support vehicles (e.g., ATV's) and mechanized equipment to existing road crossings.	Coarse and Fine Sediment: Vehicle and equipment crossing streams can cause breakdown of bed and banks exposing soil to water erosion and resulting turbidity.	• Antidegradation OAR 340-041-0004(1) • Statewide Narrative OAR 340-041-0007(1) and (13) • Turbidity OAR 340-041-0036
Thinning		
Fell thinned trees away from steams when possible.	Coarse and Fine Sediment: Accumulation of slash in channels can redirect flows out of the stream channel, increasing stress on banks and resulting in streambank and floodplain erosion and increases in local turbidity	• Antidegradation OAR 340-041-0004(1) • Statewide Narrative OAR 340-041-0007(1) and (13) • Turbidity OAR 340-041-0036
Use manual techniques (includes chainsaws) for thinning within riparian management areas.	Coarse and Fine Sediment: Avoiding soil exposure from the use of ground based equipment, and the possible erosion and delivery of sediment to waterbodies and wetlands resulting in turbidity increases.	• Antidegradation OAR 340-041-0004(1) • Statewide Narrative OAR 340-041-0007(1) and (13) • Turbidity OAR 340-041-0036
Retain as much down, woody material in riparian management areas as possible.	Coarse and Fine Sediment: RMA's function as filtration barriers to fine sediment if the soil surface and organic material is retained on the soil surface.	• Antidegradation OAR 340-041-0004(1) • Statewide Narrative OAR 340-041-0007(1) and (13) • Turbidity OAR 340-041-0036
Remove excess slash from steep headwalls (e.g., gross yard). Embedded logs or other logs that contribute to channel or slope stability will not be removed.	Coarse and Fine Sediment: Accumulation of slash in unstable areas associated with channels can over weight slope surface causing translational sliding and debris torrents , delivering sediment and resulting in downstream turbidity.	• Antidegradation OAR 340-041-0004(1) • Statewide Narrative OAR 340-041-0007(1) and (13) • Turbidity OAR 340-041-0036

Best Management Practices for Silvicultural Activities	Input Variables and Causal Mechanisms	Water Quality Standards and Regulations
Scatter treatment debris on disturbed soils and water bar any yarding trails that could erode and deposit in water bodies , floodplains, and wetlands	Coarse and Fine Sediment: Erosion of exposed soil and delivery to waterbodies and wetlands resulting in turbidity increases.	• Antidegradation OAR 340-041-0004(1) • Statewide Narrative OAR 340-041-0007(1) and (13) • Turbidity OAR 340-041-0036
Fertilization		
Avoid applying fertilizer to riparian management areas, floodplains, and wetlands.	Nutrient Enrichment: Application of Nitrate to potentially nitrogen rich riparian areas, leading to leaching and delivery of nitrates through local groundwater to and water bodies.	• 0.5 mg/L toxic to rainbow trout • Biocriteria OAR 340-041-0011
Locate storage, transfer, and loading sites outside riparian management areas and away from streams and road ditches that are linked to stream channels.	Nutrient Enrichment: Spilling of fertilizer with potential delivery of nutrients to waterbodies and wetlands through leaching or direct surface water transport.	• 0.5 mg/L toxic to rainbow trout • Biocriteria OAR 340-041-0011
Apply fertilizer when climate conditions (wind and rain) minimize risk of application to water bodies, floodplains, and wetlands.	Nutrient Enrichment: Application of Nitrate to potentially nitrogen rich riparian areas, leading to leaching and delivery of nitrates through local groundwater to and water bodies.	• 0.5 mg/L toxic to rainbow trout • Biocriteria OAR 340-041-0011
Stand Conversion		
Klamath Falls: • Use mechanical treatments in aspen stands during the dry season (generally, May through September). • Where slopes along streams are less than 30%, limit mechanical equipment to 25 feet from the edge of the riparian zone. • Where slopes along streams are greater than 30%, limit mechanical equipment to 50 feet from the edge of the riparian zone. • Limit mechanical entry to within 50 feet from the edge of wetlands riparian indicators.	Coarse and Fine Sediment: Displacement and exposure of soils through equipment operation with potential delivery of sediment to waterbodies resulting in sedimentation and turbidity.	• Antidegradation OAR 340-041-0004(1) • Statewide Narrative OAR 340-041-0007(1) and (13) • Turbidity OAR 340-041-0036

Fire and Fuels Management

See *Summary of Water Quality Standards* for additional details about the standards and regulations that are associated with the best management practices.

Table 274. Best management practices for fire and fuels management

Best Management Practices for Fire and Fuels Management	Input Variables and Causal Mechanisms	Water Quality Standards and Regulations
Fuels Management		
Fuels Management: Underburn, Concentration Burn, and Broadcast Burn		
• Allow low intensity underburns to back into riparian management areas; however no ignition would occur within riparian management areas, unless prescribed for restoration purposes. • Keep concentration and broadcast burns at least 100 feet away from riparian management areas, unless prescribed for restoration purposes. • Locate ignition lines above large open meadows associated with stream channels.	Coarse Sediment, Fine Sediment, and Temperature: • Bare soil in RMA is subject to surface erosion and potential sediment delivery to adjacent waterbody. • Loss of riparian vegetation due to wildfire could reduce shade and increase water temperature.	• Antidegradation OAR 340-041-0004(1) • Biocriteria OAR 340-041-0011 • Statewide Narrative OAR 340-041-0007(1) and (13) • Temperature OAR 340-041-0028 • Turbidity OAR 340-041-0036
Avoid ignition of large woody material that is touching the high water mark of a waterbody or that may be affected by high flows.	Coarse and Fine Sediment: Large wood provides channel stabilization and energy dissipation, thus reducing channel erosion and subsequent sedimentation.	• Antidegradation OAR 340-041-0004(1) • Biocriteria OAR 340-041-0011 • Statewide Narrative OAR 340-041-0007(1) and (13) • Turbidity OAR 340-041-0036
• Avoid delivery of foam or additives to waterbodies, floodplains, or wetlands. • Store and dispose of ignition devices/materials (e.g., flares, plastic spheres, etc.) outside riparian management areas or a minimum of 100 feet from waterbodies, floodplains, and wetlands. • Maintain and refuel equipment (e.g., drip torches, chainsaws, and portable pumps) a minimum of 100 feet from waterbodies, floodplains, and wetlands.	Chemicals: Direct contamination of waterbodies.	Toxic Substances OAR 340-041-0033

Best Management Practices for Fire and Fuels Management	Input Variables and Causal Mechanisms	Water Quality Standards and Regulations
• Limit hand constructed firelines inside riparian management areas and prohibit machine constructed firelines in riparian management areas. • Construct firelines by hand on all slopes greater than 35 percent. • Use erosion control techniques such as tilling, waterbaring, or debris placement on firelines. Construct waterbars on tractor and hand firelines. • Avoid placement of any fireline where water would be directed into waterbodies, floodplains, wetlands, headwalls, or areas of instability.	Coarse and Fine Sediment: Firelines can channel water and sediment into waterbodies.	• Antidegradation OAR 340-041-0004(1) • Biocriteria OAR 340-041-0011 • Statewide Narrative OAR 340-041-0007(1) and (13) • Turbidity OAR 340-041-0036
Fuels Management: Pile and Burn		
• Prohibit mechanical piling within riparian management areas. • Prohibit tractor piling in areas that could deliver sediment to waterbodies, floodplains, wetlands.	Coarse and Fine Sediment: Ground disturbance reduces infiltration and increases surface runoff with subsequent soil movement. Erosion more likely on steeper slopes.	• Antidegradation OAR 340-041-0004(1) • Biocriteria OAR 340-041-0011 • Statewide Narrative OAR 340-041-0007(1) and (13) • Turbidity OAR 340-041-0036
Use temporary stream crossings if necessary for equipment to access the opposite side. Follow Temporary Stream Crossing practices under Roads section.	Coarse and Fine Sediment: Equipment can damage streambeds and banks causing turbidity and sedimentation.	• Antidegradation OAR 340-041-0004(1) • Biocriteria OAR 340-041-0011 • Statewide Narrative OAR 340-041-0007(1) and (13) • Turbidity OAR 340-041-0036
Locate hand piles outside riparian management areas for fish-bearing or perennial streams, and springs/ seeps/wetlands, unless prescribed for restoration purposes.	Coarse Sediment, Fine Sediment, and Temperature: • Bare soil is subject to surface erosion. • Loss of riparian vegetation due to fire could reduce shade and increase water temperature.	• Antidegradation OAR 340-041-0004(1) • Biocriteria OAR 340-041-0011 • Statewide Narrative OAR 340-041-0007(1) and (13) • Temperature OAR 340-041-0028 • Turbidity OAR 340-041-0036

Best Management Practices for Fire and Fuels Management	Input Variables and Causal Mechanisms	Water Quality Standards and Regulations
Locate hand piles outside of riparian management areas for intermittent streams or above the first slope break, whichever is greater, unless prescribed for restoration purposes.	Bare soil is subject to surface erosion.	• Antidegradation OAR 340-041-0004(1) • Biocriteria OAR 340-041-0011 • Statewide Narrative OAR 340-041-0007(1) and (13) • Turbidity OAR 340-041-0036
Fuels Management: Mechanical and Manual Fuel Treatments		
• No mechanical fuel reduction equipment within 75 feet of streams and other waterbodies, unless prescribed to meet specific land management objectives. • Limit mechanical fuel reduction equipment to slopes less than 35 percent. Restrict non-track mechanized equipment to slopes less than 20 percent.	Ground-based equipment reduces infiltration and increases surface runoff with subsequent soil movement.	• Antidegradation OAR 340-041-0004(1) • Biocriteria OAR 340-041-0011 • Statewide Narrative OAR 340-041-0007(1) and (13) • Turbidity OAR 340-041-0036
Use temporary stream crossings if necessary to access the opposite side with any equipment or vehicles (including ATVs). Follow Temporary Stream Crossing practices under Roads section.	Coarse and Fine Sediment: Stream crossings subject to streambank damage and erosion.	• Antidegradation OAR 340-041-0004(1) • Biocriteria OAR 340-041-0011 • Statewide Narrative OAR 340-041-0007(1) and (13) • Turbidity OAR 340-041-0036
Place residual slash on disturbed areas and seed upon completion when appropriate.	Coarse and Fine Sediment: Bare soil areas are subject to erosion and subsequent sediment delivery to waterbody.	• Antidegradation OAR 340-041-0004(1) • Biocriteria OAR 340-041-0011 • Statewide Narrative OAR 340-041-0007(1) and (13) • Turbidity OAR 340-041-0036
Maintain and refuel equipment (e.g., drip torches, chainsaws, and portable pumps) at least 100 feet from waterbodies, floodplains, and wetlands.	Petroleum Products: Direct contamination of waterbodies.	Toxic Substances OAR 340-041-0033
Wildfire		
Wildfire: Suppression		

Best Management Practices for Fire and Fuels Management	Input Variables and Causal Mechanisms	Water Quality Standards and Regulations
• Limit hand constructed firelines and prohibit machine constructed firelines inside riparian management areas. • Where hand constructed firelines are necessary in riparian management areas, angle the approach rather than have it perpendicular to the riparian management area. • Exclude ground-based equipment within riparian management areas. Limit use of heavy equipment adjacent to riparian management areas and on slopes greater than 35 percent.	Coarse and Fine Sediment: Ground-based equipment reduces infiltration and increases surface runoff with subsequent soil movement. Soil disturbance causes soil erosion and potential for soil movement to waterbody.	• Antidegradation OAR 340-041-0004(1) • Biocriteria OAR 340-041-0011 • Statewide Narrative OAR 340-041-0007(1) and (13) • Turbidity OAR 340-041-0036
• Prevent cutting of logs or woody material if any portion of that material extends into the stream channel. • Fall snags in the riparian management area towards the stream channel when felling is necessary for safety or fire suppression activities.	Coarse and Fine Sediment: Large wood stabilizes channels and prevents channel erosion.	• Antidegradation OAR 340-041-0004(1) • Biocriteria OAR 340-041-0011 • Statewide Narrative OAR 340-041-0007(1) and (13) • Turbidity OAR 340-041-0036
Do not locate incident bases, camps (including spike/remote camps), helibases, staging areas, constructed helispots, and other centers for incident activities in riparian management areas or within 200 feet of any waterbody, floodplain, or wetland.	Coarse Sediment, Fine Sediment, Temperature, and Petroleum Products: Riparian disturbance from equipment and people could increase sediment. Removal of riparian vegetation could cause water temperature increases. Accidental spillage of fuel and other chemicals could enter waterways.	• Antidegradation OAR 340-041-0004(1) • Biocriteria OAR 340-041-0011 • Statewide Narrative OAR 340-041-0007(1) • Temperature OAR 340-041-0028 • Toxic Substances OAR 340-041-0033 • Turbidity OAR 340-041-0036
Locate and maintain portable sanitation facilities at incident bases, camps (including spike/remote camps), helibases, staging areas, constructed helispots, and other centers for incident activities in accordance with state and local regulations.	Bacteria: Contamination from human waste.	Bacteria OAR 340-041-0009
• Keep chemical retardant, foam, or additives out of waterbodies, floodplains, or wetlands. • Do not use chemical retardants within the riparian management area. • Apply aerial retardant adjacent to riparian management areas by making parallel passes.	Chemical Retardants: Contamination of waterbodies from chemical retardant.	• Antidegradation OAR 340-041-0004(1) • Biocriteria OAR 340-041-0011 • Statewide Narrative OAR 340-041-0007(1) • Toxic Substances OAR 340-041-0033

Best Management Practices for Fire and Fuels Management	Input Variables and Causal Mechanisms	Water Quality Standards and Regulations
Wildfire: Rehabilitation		
Implement emergency fire rehabilitation treatments to accomplish erosion control as quickly as possible and before the wet season. Examples include: • Use native or other ecologically appropriate vegetation for short-term cover development and long-term recovery. • Mulch with straw or other suitable material. • Use straw wattles. • Install log erosion barriers. • Spread slash on bare soils. • Place channel stabilization structures. • Place sediment retention structures in channel. • Place trash racks above road drainage structures. • Install drainage structures, such as water bars or drainage dips, on firelines, fire roads, and other cleared areas according to guidelines in *Table 5* (Waterbar spacing by gradient and erosion class). • Repair damaged road drainage facilities. • Block or decommission roads and trails.	Coarse and Fine Sediment: Bare soil areas are subject to erosion and subsequent sediment delivery to waterbody.	• Antidegradation OAR 340-041-0004(1) • Biocriteria OAR 340-041-0011 • Statewide Narrative OAR 340-041-0007(1) and (13) • Turbidity OAR 340-041-0036

Best Management Practices for Fire and Fuels Management	Input Variables and Causal Mechanisms	Water Quality Standards and Regulations
Wildfire: Fuel/Retardant Transport		
If more than 42 gallons of fuel or combined quantity of petroleum product and chemical substances would be transported to a project site, the following precautions would be implemented. 1. Plan a safe route and transfer sites that could contain the transported volume. 2. Plan an active dispatch system that can relay the information to appropriate resources. 3. Ensure a spill containment kit that can adsorb and contain 55 gallons of petroleum product and chemical substances is readily available. 4. Provide for immediate notification in the event of a spill. Have a radio equipped vehicle lead the chemical or fuel truck to the project site. 5. Assemble a spill notification list that includes the district hazardous materials coordinator, DEQ, and spill clean-up contractors. 6. Construct a water user contact list with address and phone numbers. 7. When operating within Source Water Watersheds, pre-estimate travel times through the watershed to predict downstream arrival times. 8. Be prepared to sample water and carry sample containers.	Petroleum and Chemical Substances: Spillage into waterbodies with chemical contamination of waterbodies.	• Antidegradation OAR 340-041-0004(1) • Biocriteria OAR 340-041-0011 • Statewide Narrative OAR 340-041-0007(1) and (13) • Toxic Substances OAR 340-041-0033

Table 275. Waterbar spacing by gradient and erosion class

Gradient (%)	Waterbar Spacing (feet)[1] Per Erosion Class[2]		
	High Class	Moderate Class	Low Class
2 to 5%	200 ft.	300 ft.	400 ft.
6 to 10%	150 ft.	200 ft.	300 ft.
11 to 15%	100 ft.	150 ft.	200 ft.
16 to 20%	75 ft.	100 ft.	150 ft.
21 to 35%	50 ft.	75 ft.	100 ft.
36+%	50 ft.	50 ft.	50 ft.

[1]Spacing is determined by slope distance and is the maximum allowed for the grade.

[2]The erosion classes include the following rock types:

- **High:** granite, sandstone, andesite porphyry, glacial or alluvial deposits, soft matrix conglomerate, volcanic ash, and pyroclastics
- **Moderate**: basalt, andesite, quartzite, hard matrix conglomerate, and rhyolite
- **Low:** metasediments, metavolcanics, and hard shale

Surface Source Water for Drinking Water

See *Summary of Water Quality Standards* for additional details about the standards and regulations that are associated with the best management practices.

Table 276. Best management practices for surface source water for drinking water

Best Management Practices for Surface Source Water for Drinking Water	Input Variables and Causal Mechanisms	Water Quality Standards and Regulations
Sanitary facilities would be planned, located, designed, constructed, operated, inspected, and maintained to minimize possibilities of water contamination.	Bacteria: Fecal Coliform enrichment of local groundwater and surface water with delivery to downstream drinking water diversion.	• Antidegradation OAR 340-041-0004(1) • Bacteria OAR 340-041-0009 • Statewide Narrative OAR 340-041-0007(1) and (13)
Locate contractor camps outside Oregon Department of Environmental Quality sensitive zones in surface source water watersheds. If this is not possible, require self-contained sanitary facilities.	Bacteria: Fecal Coliform enrichment of local groundwater and surface water with delivery to downstream drinking water diversion.	• Antidegradation OAR 340-041-0004(1) • Bacteria OAR 340-041-0009 • Statewide Narrative OAR 340-041-0007(1) and (13)
Require self-contained sanitary facilities in surface source water watersheds, when long-term camping (greater than 14 days) is involved with contract implementation.	Bacteria: Fecal Coliform enrichment of local groundwater and surface water with delivery to downstream drinking water diversion.	• Antidegradation OAR 340-041-0004(1) • Bacteria OAR 340-041-0009 • Statewide Narrative OAR 340-041-0007(1) and (13)
Provide self-contained sanitary facilities when there is high recreational use (almost continuous occupancy) within Oregon Department of Environmental Quality sensitive zones or along streams above domestic water diversions of record.	Bacteria: Fecal Coliform enrichment of local groundwater and surface water with delivery to downstream drinking water diversion.	• Antidegradation OAR 340-041-0004(1) • Statewide Narrative OAR 340-041-0007(1) and(13) • Bacteria OAR 340-041-0009
Locate pack, riding, restoration, and logging stock facilities 200 feet away from watercourses upstream of source drinking diversions.	Bacteria: Fecal Coliform enrichment of local groundwater and surface water with delivery to downstream drinking water diversion.	• Antidegradation OAR 340-041-0004(1) • Bacteria OAR 340-041-0009 • Statewide Narrative OAR 340-041-0007(1) and (13)

Best Management Practices for Surface Source Water for Drinking Water	Input Variables and Causal Mechanisms	Water Quality Standards and Regulations
Do not allow surface occupancy within 200 feet of a recorded domestic or public drinking water diversion.	Bacteria: Fecal Coliform enrichment of local groundwater and surface water with delivery to downstream drinking water diversion.	• Antidegradation OAR 340-041-0004(1) • Bacteria OAR 340-041-0009 • Statewide Narrative OAR 340-041-0007(1) and (13) • Toxic Substances OAR 340-041-0033
Do not apply sewage sludge as a soil amendment in surface source water watersheds, above Domestic Water diversions of record, or within riparian management areas.	Toxic Pollutants: Leaching and surface water movement can transport toxics and bacteria downstream to water supply diversions. Some domestic supplies have no ability to detect or treat this pollution.	• Antidegradation OAR 340-041-0004(1) • Bacteria OAR 340-041-0009 • Statewide Narrative OAR 340-041-0007(1) and (13) • Toxic Substances OAR 340-041-0033
Do not load, transfer, or store chemical, fuel, or fertilizer in sensitive zones in surface source water watersheds.	Toxic Pollutants, Oil, Gas, and Nutrients: Leaks, spills, and improper handling of pesticides, herbicides and petroleum products can leach or be transported by surface water to drinking water diversion points.	• Antidegradation OAR 340-041-0004(1) • Statewide Narrative OAR 340-041-0007(1) and(13) • Toxic Substances OAR 340-041-0033
Conduct equipment maintenance outside site-specific sensitive zones in surface source water watersheds.	Toxic Pollutants, Oil, and Gas: Leaks, spills, and improper handling petroleum products can leach or be transported by surface water to drinking water diversion points.	• Antidegradation OAR 340-041-0004(1) • Statewide Narrative OAR 340-041-0007(1) and (13) • Toxic Substances OAR 340-041-0033
Use non-oil-based dust suppressants in surface source water watersheds.	Toxic Pollutants, Oil, and Gas: Leaks, spills, and improper application of oil based dust control products can introduce petroleum products to surface water and to drinking water diversion points.	• Antidegradation OAR 340-041-0004(1) • Statewide Narrative OAR 340-041-0007(1) and (13) • Toxic Substances OAR 340-041-0033
Do not allow mineral lease surface occupancy within sensitive zones in surface source water watersheds.	Toxic Pollutants, Oil, and Gas: Leachate from mineral operations or equipment use may contain chemicals and wastes which is transported and delivered to drinking water diversion points.	• Antidegradation OAR 340-041-0004(1) • Statewide Narrative OAR 340-041-0007(1) and (13) • Toxic Substances OAR 340-041-0033

Best Management Practices for Surface Source Water for Drinking Water	Input Variables and Causal Mechanisms	Water Quality Standards and Regulations
Use fire retardant and surfactants as a last resort in fire suppression activities in surface source water watersheds.	Toxic Pollutants: Direct application of fire retardant and surfactants to waterbodies above drinking water intakes can cause delivery of Nitrate reaching concentrations as high as 33 mg/L, well above the primary water quality standard of 1 mg/L. The main chemical of concern in streams 24 hours after a retardant drop is un-ionized ammonia (NH3) is the principal toxic component to aquatic species.	• Antidegradation OAR 340-041-0004(1) • Statewide Narrative OAR 340-041-0007(1) and (13) • Toxic Substances OAR 340-041-0033

Recreation

See *Summary of Water Quality Standards* for additional details about the standards and regulations that are associated with the best management practices.

Table 277. Best management practices for recreation

Best Management Practices for Recreation	Input Variables and Causal Mechanisms	Water Quality Standards and Regulations
All Recreation Facilities		
Implement erosion control measures on all recreation sites to stabilize exposed soils.	Coarse and Fine Sediment: Minimize sediment delivery to wetlands, floodplains, and waterbodies.	Turbidity OAR 340-041-0036
Locate new recreational facilities, developed and dispersed sites, outside of the water influence area or 100 feet from wetlands, floodplains, or waterbodies, whichever is greater. Low impact uses, such as hiking trails, picnic sites, or water dependant facilities (e.g., boat ramps or docks), are excluded.	Coarse and Fine Sediment: Minimize sediment delivery resulting from surface erosion.	• Bacteria OAR 340-041-0009 • Temperature OAR 340-041-0028 • Turbidity OAR 340-041-0036
Developed Recreation Sites		
Sealed vault toilets will be used at all developed recreational facilities, unless a sewage system and drainfield is approved by the Department of Environmental Quality.	Bacteria: Bacterial pollution from improperly constructed sanitation facilities could be injurious to the health of humans and aquatic organisms.	Bacteria OAR 340-041-0009
Construct and maintain refuse disposal sites to avoid water contamination.	Bacteria: Bacteria could enter surface and groundwater if garbage is not disposed of properly.	Bacteria OAR 340-041-0009

Best Management Practices for Recreation	Input Variables and Causal Mechanisms	Water Quality Standards and Regulations
When conducting recreation site maintenance, do not cut logs or coarse woody debris if any portion of that material extends in the active stream channel.	Coarse and Fine Sediment: Sediment storage, streambank stability, and reduction of turbidity.	• Antidegradation OAR 340-041-004(1) • Biocriteria OAR 340-041-0011 • Statewide Narrative OAR 340-041-0007(1) and (13) • Turbidity OAR 340-041-0036
Water Dependent Facilities		
Construct boat ramps and approaches with hardened surfaces.	Coarse and Fine Sediment: Impacts to streambanks, turbidity	Turbidity OAR 340-041-0036
Off-Highway Vehicle (OHV) Trails		
Avoid construction of trails within RMAs.	Coarse and Fine Sediment: Surface erosion from trail tread to streams, floodplains, or wetlands.	Turbidity OAR 340-041-0036
Use existing hardened stream crossings to the extent possible when constructing trails through RMAs.	Coarse and Fine Sediment: Old roads converted to trails with rock surfacing at stream crossings reduce sedimentation for OHV trails.	Turbidity OAR 340-041-0036
When constructing or maintaining trails within Riparian Management Areas, do not cut logs or coarse woody debris if any portion of that material extends into the active stream channel.	Coarse and Fine Sediment: Sediment storage, streambank stability, and reduction of turbidity.	• Antidegradation OAR 340-041-004(1) • Biocriteria OAR 340-041-0011 • Statewide Narrative OAR 340-041-0007(1) and (13) • Turbidity OAR 340-041-0036
Prohibit vehicle and off-highway vehicle use in streams, ponds, wetlands, and other waters.	Coarse Sediment, Fine Sediment, and Toxic Pollutants: Direct delivery of sediment and/or petroleum based fluids from vehicles is unnecessary degradation of waters of the State.	• Toxic substances OAR 430-041-0033 • Turbidity OAR 340-041-0036
Stream crossings would be designed to accommodate active channel width, bed load, and fish passage without exceeding capacity or diversion for the 100-year flood event.	Coarse and Fine Sediment: Floodwaters exceeding crossing capacity, causing overtopping of fills, with ensuing headcutting and loss of trail fill.	• Statewide Narrative Criteria Sediment, Adverse Deposits OAR 340-041-0007 • Turbidity OAR 340-041-0036
Construct or maintain trails prior to the wet season.	Coarse and Fine Sediment: Sediment from trail related run-off.	Turbidity OAR 340-041-0036
Locate staging areas outside riparian management areas. Design or upgrade staging areas to prevent sediment/pollutant delivery to wetlands, floodplains, and waterbodies (e.g., rocking or hardening)	Coarse Sediment, Fine Sediment, and Toxic Pollutants: Stop sediment or petroleum products or from reaching streams.	• Toxic substances OAR 430-041-0033 • Turbidity OAR 340-041-0036

Best Management Practices for Recreation	Input Variables and Causal Mechanisms	Water Quality Standards and Regulations
Harden trail approaches to stream crossings using materials such as geotextile fabric and crushed rock aggregate.	Coarse and Fine Sediment: Sediment from trail related run-off.	Turbidity OAR 340-041-0036
Drain dips will be installed on approaches to stream crossings and reinforced with rock for longevity. Drain dips would be placed within 100 feet of a stream. Large wood would be placed on both sides of the tread to keep riders on the trail and to contain any sediment movement.	Coarse and Fine Sediment: Sediment from trail related run-off.	Turbidity OAR 340-041-0036
Do not use pressure treated wood in construction of bridges over streams where materials are in contact with the stream or may leach into the soil or water.	Toxic Pollutants: Leaching of chemicals from treated wood into adjacent streams.	Toxic substances OAR 430-041-0033
During construction, perennial stream crossings may require a temporary flow diversion structure through the work area. (See Roads Section for Stream Crossing BMPs)	Coarse and Fine Sediment: Exposed soils may be vulnerable to erosion and sediment deposition into streams.	Turbidity OAR 340-041-0036
Prevent vehicle access to nearby wetlands by using suitable barriers.	Coarse and Fine Sediment: Defining trail route may prevent development of new trails into fragile areas susceptible to compaction and sediment transport to water resources.	Turbidity OAR 340-041-0036
Where trails intersect road ditches, provide hardened crossings. Divert water from the trail to keep from reaching wetlands, floodplains, and waterbodies.	Coarse and Fine Sediment - Exposed soils may be vulnerable to erosion, resulting in deposition to road ditches that could flow into nearby streams.	Turbidity OAR 340-041-0036
If trail width is deemed excessive for designated use (such as old roads converted to trails) one side of the trail will be tilled, covered with brush, and seeded or planted.	Coarse and Fine Sediment: Wider trails more prone to erosion and sediment delivery to waterbodies.	Turbidity OAR 340-041-0036
Repair rills and gullies using appropriately sized equipment or by hand.	Coarse and Fine Sediment: Unless tread erosion is maintained regularly, erosion escalates and can route sediment to waterbodies nearby.	Turbidity OAR 340-041-0036
Waterbars, drain dips, and lead off ditches will be constructed or repaired as needed. These features may need rock reinforcement to promote longevity. Drain dips or lead-off features are the preferred design.	Coarse and Fine Sediment: Drainage features can route run-off to stable vegetated land and avoid impacts on water quality.	Turbidity OAR 340-041-0036
Drain dips or lead off ditches will be constructed on steeper gradient trails and approaches to stream crossings.	Coarse and Fine Sediment: Drainage features protect steep trails from chronic erosion as well as leading off surface water before it could reach waterbodies.	Turbidity OAR 340-041-0036

Best Management Practices for Recreation	Input Variables and Causal Mechanisms	Water Quality Standards and Regulations
Trails (Hiking)		
When constructing or maintaining trails within riparian management areas, do not cut logs or coarse woody debris if any portion of that material extends into the active stream channel. Use alternative passage options, such as earthen ramps, small notch steps, or slight trail realignments, to facilitate maintenance of intact logs.	Coarse and Fine Sediment: Sediment storage, streambank stability, and reduction of turbidity.	• Antidegradation OAR 340-041-004(1) • Biocriteria OAR 340-041-0011 • Statewide Narrative OAR 340-041-0007(1) and (13) • Turbidity OAR 340-041-0036
Trail Closure		
Remove existing stream crossings or bridges. (See Road Decom. BMPs)	Coarse and Fine Sediment: Unmaintained crossings can fail and deliver sediment to streams.	Turbidity OAR 340-041-0036
Position fill or waste material in a location that would avoid direct or indirect sediment discharges to streams or wetlands.	Coarse and Fine Sediment: Until vegetation is established, or erosion control measures are undertaken, waste material is vulnerable to erosion.	Turbidity OAR 340-041-0036
Restored stream banks would be planted with native vegetation, straw mulched, and planted with water tolerant species where appropriate.	Coarse and Fine Sediment: Exposed soils are vulnerable to erosion in storm events and/or periods of high stream flows.	Turbidity OAR 340-041-0036
Barricade and brush in closed trails with nearby vegetation.	Coarse and Fine Sediment: Unrestricted access to unmaintained or abandoned trails can result in rill and gully erosion and sediment delivery to waterbodies.	Turbidity OAR 340-041-0036
Dispersed Recreation		
Site camps for permitted group overnight camping would be greater than 100 feet from surface water.	Coarse and Fine Sediment: Soil disturbance close to streams can result in sedimentation. Lack of developed and maintained sanitation facilities poses a risk of fecal coliform contamination.	• Bacteria OAR 340-041-0009 • Turbidity OAR 340-041-0036

Grazing

See *Summary of Water Quality Standards* for additional details about the standards and regulations that are associated with the best management practices.

Table 278. Best management practices for grazing

Best Management Practices for Grazing	Input Variables and Causal Mechanisms	Water Quality Standards and Regulations
Fence water developments, including springs and seeps, unless other methods are available. Pipe overflow away from the developed source area.	Coarse Sediment, Fine Sediment, Bacteria, Dissolved Oxygen, Temperature, and Biocriteria: Concentrated livestock use near/ within spring, seep areas resulting in overgrazing and subsequent loss of riparian vegetation, soil erosion, loss of shade and increases in summer stream water temperature, reduction in summer dissolved oxygen, delivery of bacteria and nutrients, with potential effects upon aquatic communities.	• Antidegradation OAR 340-04l-0004 • Bacteria OAR 340-041-0009 • Biocriteria OAR 340-041-0011 • Dissolved Oxygen OAR 340-041-0016 • Temperature OAR 340-041-0028 • Turbidity OAR 340-041-0036
Do not locate salting areas within ¼ mile of permanent water sources or riparian management areas.	Coarse Sediment, Fine Sediment, Bacteria, Dissolved Oxygen, Temperature, and Biocriteria: Concentrated livestock use near/ within spring, seep areas resulting in overgrazing and subsequent loss of riparian vegetation, soil erosion, loss of shade and increases in summer stream water temperature, reduction in summer dissolved oxygen, delivery of bacteria and nutrients, with potential effects upon aquatic communities	• Antidegradation OAR 340-04l-0004 • Bacteria OAR 340-041-0009 • Biocriteria OAR 340-041-0011 • Dissolved Oxygen OAR 340-041-0016 • Temperature OAR 340-041-0028 • Turbidity OAR 340-041-0036
• Locate new livestock handling or management facilities (corrals, pens, or holding pastures) outside riparian management areas or 200 eet from waterbodies and on level ground where drainage would not enter surface waters. • If existing livestock handling facilities inside riparian management areas, do not meet water quality through use of BMPs, relocate or remove such facilities away from riparian management areas.	Coarse Sediment, Fine Sediment, Bacteria, Dissolved Oxygen, Temperature, and Biocriteria: Concentrated livestock use near/ within spring, seep areas resulting in overgrazing and subsequent loss of riparian vegetation, soil erosion, loss of shade and increases in summer stream water temperature, reduction in summer dissolved oxygen, delivery of bacteria and nutrients, with potential effects upon aquatic communities	• Antidegradation OAR 340-04l-0004 • Bacteria OAR 340-041-0009 • Biocriteria OAR 340-041-0011 • Dissolved Oxygen OAR 340-041-0016 • Temperature OAR 340-041-0028 • Turbidity OAR 340-041-0036

Best Management Practices for Grazing	Input Variables and Causal Mechanisms	Water Quality Standards and Regulations
Apply specific grazing strategies for riparian wetland areas, including timing, intensity, or exclusion for maintenance of proper functioning condition. Use one or more of the following features: • Inclusion of the waterbodies, floodplains, and wetlands within a separate pasture. • Fence or herd livestock out of waterbodies, floodplains, and wetlands for as long as necessary to allow vegetation to recover. • Control the timing of grazing to keep livestock off streambanks when they are most vulnerable to damage and to coincide with the physiological needs of target plant species. • Add more rest to the grazing cycle to increase plant vigor, allow streambanks to revegetate, or encourage more desirable plant species composition. • Limit grazing intensity to a level that will maintain desired species composition and vigor. • Permanently exclude livestock from those waterbodies, floodplains, and wetlands areas that are at high risk and have poor recovery potential, and when there is no practical way to protect them while grazing adjacent uplands.	Coarse Sediment, Fine Sediment, Bacteria, Dissolved Oxygen, Temperature, and Biocriteria: Concentrated livestock use near/ within spring, seep areas resulting in overgrazing and subsequent loss of riparian vegetation, soil erosion, loss of shade and increases in summer stream water temperature, reduction in summer dissolved oxygen, delivery of bacteria and nutrients, with potential effects upon aquatic communities	• Antidegradation OAR 340-04l-0004 • Bacteria OAR 340-041-0009 • Biocriteria OAR 340-041-0011 • Dissolved Oxygen OAR 340-041-0016 • Temperature OAR 340-041-0028 • Turbidity OAR 340-041-0036
Recover degraded waterbodies through adjustments to forage utilization levels, improved livestock distribution, and management through fencing, vegetation treatments, water source developments, or changes in season of use or livestock numbers.	Coarse Sediment, Fine Sediment, Bacteria, Dissolved Oxygen, Temperature, and Biocriteria: Concentrated livestock use near/ within spring, seep areas resulting in overgrazing and subsequent loss of riparian vegetation, soil erosion, loss of shade and increases in summer stream water temperature, reduction in summer dissolved oxygen, delivery of bacteria and nutrients, with potential effects upon aquatic communities	• Antidegradation OAR 340-04l-0004 • Bacteria OAR 340-041-0009 • Biocriteria OAR 340-041-0011 • Dissolved Oxygen OAR 340-041-0016 • Temperature OAR 340-041-0028 • Turbidity OAR 340-041-0036

Minerals Exploration and Development

See *Summary of Water Quality Standards* for additional details about the standards and regulations that are associated with the best management practices.

Table 279. Best management practices for minerals exploration and development

Best Management Practices for Minerals Exploration and Development	Input Variables and Causal Mechanisms	Water Quality Standards and Regulations
All Minerals		
Locate, design, operate, and maintain settling ponds to contain sediment discharges.	Coarse and Fine Sediment: Sediment could be transported to nearby streams from improperly designed or overflowing settling ponds.	Turbidity OAR 340-041-0036
Use existing roads, skid trails, and stream crossings.	Coarse and Fine Sediment: Potential sedimentation is reduced by minimizing new soil disturbance near streams.	Turbidity OAR 340-041-0036
Storm proof all natural surface roads and trails when an operation halts for the wet season. See Roads and Landings section for guidelines.	Coarse and Fine Sediment: Bare soil is subject to surface erosion and potential sediment delivery to adjacent waterbody.	Turbidity OAR 340-041-0036
Locate and maintain sanitation facilities where overflow or discharges would not enter surface water. Where possible, locate these facilities outside of riparian management areas.	Bacteria: Bacterial pollution from improperly constructed sanitation facilities could be injurious to the health of humans and aquatic organisms.	Bacteria OAR 340-041-0009
Locate structures and support facilities, including new roads, at least 200 feet from water bodies, floodplains, and wetlands.	Coarse Sediment, Fine Sediment, and Temperature: Developed sites can channel water and sediment into nearby waterbodies. Loss of riparian vegetation due to development could reduce shade and increase water temperature.	• Temperature OAR 340-041-0028 • Turbidity OAR 340-041-0036
Design, locate, and construct stream crossings in conformance with practices described in Roads and Landings section.	Coarse and Fine Sediment: Earthwork near streams can expose erodible soils and result in sedimentation to streams.	Turbidity OAR 340-041-0036
If roads are used during wet seasons with potential for sediment delivery to stream channels, rock aggregate would be used to surface those roads.	Coarse and Fine Sediment: Use of native surfaced roads during wet weather could result in unnecessary and undue degradation of water quality in nearby streams.	Turbidity OAR 340-041-0036
Prior to fall rains, reclaim all roads and trails constructed for exploratory purposes that are unnecessary for the mineral access.	Coarse and Fine Sediment: Bare soil is subject to surface erosion and potential sediment delivery to adjacent waterbody.	Turbidity OAR 340-041-0036
Retain an undisturbed riparian buffer strip between mineral operations and water bodies, floodplains, and wetlands.	Coarse Sediment, Fine Sediment, and Temperature: Protect integrity of streambanks, provide for water temperature control and for filtration of sediment from surface runoff	• Temperature OAR 340-041-0028 • Turbidity OAR 340-041-0036

Best Management Practices for Minerals Exploration and Development	Input Variables and Causal Mechanisms	Water Quality Standards and Regulations
Stockpile available topsoil for use during reclamation of the site. Stockpiled topsoil would be stabilized to prevent erosion and contamination of other resources in the area.	Coarse and Fine Sediment: Bare soil is subject to surface erosion and potential sediment delivery to adjacent waterbodies.	Turbidity OAR 340-041-0036
On access roads to mineral sites where no future entry is planned, reclaim these access roads. This may include tilling, water barring, blocking, recontouring, fertilization, planting, mulching, and seeding.	Coarse and Fine Sediment: Soil erosion of exposed surfaces with potential transport to the channel, floodplain, or wetlands.	Turbidity OAR 340-041-0036
Reclaim depleted or closed mineral sites by stabilizing and contouring the mining area. Replace topsoil and mulch, seed, and plant.	Coarse and Fine Sediment: Bare soil is subject to surface erosion and potential sediment delivery to adjacent waterbodies.	Turbidity OAR 340-041-0036
Locate exploratory drill sites next to or on existing roads. Install erosion control structures to limit sediment transport off-site.	Coarse and Fine Sediment: Minimize soil disturbance to reduce potential for erosion and sediment delivery to streams.	Turbidity OAR 340-041-0036
Protect exposed soils from erosion by seeding, mulching, etc when constructing wells.	Coarse and Fine Sediment: Bare soil is subject to surface erosion and potential sediment delivery to adjacent waterbodies.	Turbidity OAR 340-041-0036
Locatable Minerals		
Comply with seasonal restrictions on suction dredging identified in Oregon Guidelines for Timing of In-Water Work to Protect Fish and Wildlife Resources when discharging to Oregon's surface waters.	Coarse and Fine Sediment: Suction dredging can deposit fine sediment in gravels which is deleterious to fish and aquatic life. It can also be injurious to public health and recreation.	• Biocriteria OAR 340-041-0011 • Turbidity OAR 340-041-0036
Design new projects to contain waste products and prevent leaching contaminants from entering surface and ground water.	Toxic Substances: Mine generated waste and runoff can negatively impact surface or groundwater quality and impair aquatic habitat.	• Biocriteria OAR 340-041-0011 • Toxic substances OAR 430-041-0033
Do not locate toxic mine waste (e.g., waste rock, spent ore, or tailings) in riparian management areas.	Toxic Substances: Mine generated waste and runoff can negatively impact surface or groundwater quality and impair aquatic habitat.	Toxic substances OAR 430-041-0033
Reclaim mine waste after operations to ensure chemical and physical stability according to DOGAMI requirements.	Toxic Substances: Mine generated waste and runoff can negatively impact surface or groundwater quality and impair aquatic habitat.	• Toxic substances OAR 430-041-0033 • Turbidity OAR 340-041-0036
Stabilize exposed soils by seeding and mulching and provide for non-erosive drainage from disturbed areas that were constructed or renovated for mining activities.	Coarse and Fine Sediment: Bare soil is subject to surface erosion and potential sediment delivery to adjacent waterbodies.	Turbidity OAR 340-041-0036
When operating during the wet season, stabilize disturbed areas that will not be mined for at least 30 days.	Coarse and Fine Sediment: Bare soil is subject to surface erosion and potential sediment delivery to adjacent waterbodies.	Turbidity OAR 340-041-0036

Best Management Practices for Minerals Exploration and Development	Input Variables and Causal Mechanisms	Water Quality Standards and Regulations
Prohibit surface occupancy within 200 feet of streams or other waterbodies.	Coarse Sediment, Fine Sediment, Temperature, and Bacteria: Developed sites can channel water and sediment into nearby waterbodies. Loss of riparian vegetation due to development could reduce shade and increase water temperature. Bacterial pollution could be injurious to the health of humans and aquatic organisms.	• Bacteria OAR 340-041-0009 • Temperature OAR 340-041-0028 • Turbidity OAR 340-041-0036
Salable Minerals		
Locate stockpile sites on stable ground where the material would not move into waterbodies, floodplains, and wetlands.	Coarse and Fine Sediment: Placement of soil and rock stockpiles on unstable landforms can result in landslides with drainage of sediment-laden water to streams.	Turbidity OAR 340-041-0036
Locate, design, and construct salable mineral sites to minimize sedimentation to streams. Close roads, excavations and crusher pads in accordance with Roads and Landings section when the salable mineral site is depleted.	Coarse and Fine Sediment: Bare soil is subject to surface erosion and potential sediment delivery to adjacent waterbodies.	Turbidity OAR 340-041-0036
Do not develop or expand quarries within the riparian management area or within 200 feet of waterbodies, floodplains, and wetlands, whichever is greater.	Coarse Sediment, Fine Sediment, and Temperature: Developed sites can channel water and sediment into nearby waterbodies. Loss of riparian vegetation due to development could reduce shade and increase water temperature. Sedimentation in streams from road related runoff can impair aquatic habitat.	• Biocriteria OAR 340-041-0011 • Temperature OAR 340-041-0028 • Turbidity OAR 340-041-0036
Use culverts and rip-rap for crusher pad drainage when necessary.	Coarse and Fine Sediment: Effective drainage of surface runoff prevents sediment delivery to streams.	Turbidity OAR 340-041-0036
Use erosion-reduction practices, such as seeding, mulching, and woody debris placement, to limit erosion and transport of sediment to streams from quarries or other common variety mineral sites. Provide drainage from stockpiles and salable mineral sites that is dispersed over stable vegetated areas rather than directly into stream channels.	Coarse and Fine Sediment: Soil erosion of exposed surfaces with potential transport to the channel, floodplain, or wetlands.	Turbidity OAR 340-041-0036

Best Management Practices for Minerals Exploration and Development	Input Variables and Causal Mechanisms	Water Quality Standards and Regulations
Limit collection of decorative rock to outside of riparian management areas and floodplains.	Coarse and Fine Sediment: Removing rock from the RMA or floodplain affects channel structure and results in a reduction in energy dissipation capability, potentially decreasing bank and floodplain stability during flood events, releasing stored fine sediment, and increasing the proportion of fine sediments in streams (removing the rocks, leaving the fines). Also, removal of large rocks within the RMA may necessitate the use of ground-based equipment that would cause soil disturbance and the potential for sediment delivery.	Turbidity OAR 340-041-0036
Leasable Minerals		
Stabilize roads, drill sites, and excavation areas to a free draining and non eroding condition from disturbed areas that are constructed or renovated for leasable mineral activities (e.g., roads, drill sites, and excavation areas).	Coarse and Fine Sediment: Bare soil is subject to surface erosion and potential sediment delivery to adjacent waterbodies.	Turbidity OAR 340-041-0036
When operating during the wet season, stabilize disturbed areas that will remain inactive for at least 30 days.	Coarse and Fine Sediment: Bare soil is subject to surface erosion and potential sediment delivery to adjacent waterbodies.	Turbidity OAR 340-041-0036
Line all mud pits that contain drilling fluid to prevent leaking.	Coarse and Fine Sediment: Drilling fluid can leak from unlined pits to surface and groundwater resources.	• Toxic substances OAR 430-041-0033 • Turbidity OAR 340-041-0036
Limit drill site construction and access through riparian management areas to established roadways unless the operator submits a plan that demonstrates that impacts to water quality from the proposed action can be adequately mitigated.	Coarse and Fine Sediment: Protect integrity of streambanks, provide for water temperature control and for filtration of sediment from surface runoff. Drilling and equipment fluids can negatively impact surface or groundwater quality and impair aquatic habitat.	• Temperature OAR 340-041-0028 • Toxic substances OAR 430-041-0033 • Turbidity OAR 340-041-0036

Spill Prevention and Abatement

See *Summary of Water Quality Standards* for additional details about the standards and regulations that are associated with the best management practices.

Table 280. Best management practices for spill prevention and abatement

Best Management Practices for Spill Prevention and Abatement	Input Variables and Causal Mechanisms	Water Quality Standards and Regulations
Heavy Equipment Use		
• Require inspection and cleaning as necessary of heavy equipment prior to moving onto the project site in order to remove oil and grease, noxious weeds, and excessive soil. • Ensure that hydraulic fluid and fuel lines on heavy-mechanized equipment are in proper working condition. • Maintain and refuel equipment a minimum of 100 feet away from streams and other waterbodies. • In the event of a spill or release, all reasonable and safe actions to contain the material will be taken. Specific actions are dependent on the nature of the material spilled. • Use spill containment booms or as required by DEQ. Have booms and other absorbent containment materials on site and ready to deploy. • Immediately remove waste or spilled hazardous materials (including but not limited to diesel, oil, hydraulic fluid) and contaminated soils near any stream or other waterbody, and dispose of it/them in accordance with the applicable regulatory standard. Notify OERS of any spill over the material RQ, and any spill not totally cleaned up after 24 hours • Store equipment containing toxic fluids away from streams or other waterbodies.	Toxic Substances: Contaminants from equipment leaking into waterbodies.	• Antidegradation OAR 340-041-0004(1) • Biocriteria OAR 340-041-0011 • Statewide Narrative OAR 340-041-0007(1) and (13) • Toxic Substances OAR 340-041-0033

Best Management Practices for Spill Prevention and Abatement	Input Variables and Causal Mechanisms	Water Quality Standards and Regulations
Fuel and Chemical Transport		
If more than 42 gallons of fuel or combined quantity of petroleum product and chemical substances would be transported to a project site, the following precautions will be implemented. 1. Plan a safe route and material transfer sites so that all spilled material will be contained easily at that designated location. 2. Plan an active dispatch system that can relay the information to appropriate resources. 3. Ensure a spill containment kit that can adsorb and contain 55 gallons of petroleum product and chemical substances is readily available. 4. Provide for immediate notification to OERS in the event of a spill. Have a radio-equipped vehicle lead the chemical or fuel truck to the project site. 5. Assemble a spill notification list that includes the district hazardous materials coordinator, DEQ, and spill clean-up contractors. 6. Construct a downstream water user contact list with addresses and phone numbers. 7. When operating within Source Water watersheds, pre-estimate water flow travel times through the watershed to predict downstream arrival times. 8. Be prepared to sample water and carry sample containers. 9. Be prepared to assist OSP and ODFW assess wildlife impacts of any material spilled.	Toxic Substances: Chemical contamination of waterbodies.	• Antidegradation OAR 340-041-0004(1) • Biocriteria OAR 340-041-0011 • Statewide Narrative OAR 340-041-0007(1) and (13) • Toxic Substances OAR 340-041-0033
Spill Abatement		
Spill Prevention, Control, and Countermeasure Plan (SPCC): All operators shall develop a modified SPCC plan prior to initiating project work if there is a potential risk of chemical or petroleum spills near water bodies. The SPCC plan will include the appropriate containers to be used and design of the material transfer locations. No interim fuel depot or storage location other than a manned transport vehicle.	Toxic Substances: Chemical or petroleum product routing to water bodies.	[40 CFR 112] 42 U.S. Gallons for reportable quantities not involving waterways, a visible sheen where waterways are involved

Best Management Practices for Spill Prevention and Abatement	Input Variables and Causal Mechanisms	Water Quality Standards and Regulations
Spill Containment Kit (SCK): All operators shall have a SCK as described in the SPCC plan on-site during any operation with potential for run-off to adjacent water bodies. The SCK will be appropriate in size and type for the oil or hazardous material carried by the operator.	Toxic Substances: Chemical or petroleum product routing to water bodies.	OAR-340-142-[0030]
Operators shall be responsible for the clean-up, removal, and proper disposal of contaminated materials from the site.	Toxic Substances: Chemical or petroleum product routing to water bodies.	• OAR-340-102-[inclusive] • OAR-340-122-[inclusive]

Restoration

See *Summary of Water Quality Standards* for additional details about the standards and regulations that are associated with the best management practices.

Table 281. Best management practices for restoration

Best Management Practices for Restoration	Input Variables and Causal Mechanisms	Water Quality Standards and Regulations
Confine work in the stream channels to the low flow period.	Coarse and Fine Sediment: Concentrated turbidity and sedimentation potential due to channel disturbance during low flow conditions.	• Accumulation of bottom deposits OAR-340-041-0007 • Turbidity OAR-340-041-0036
In stream channels that are sensitive to disturbance (e.g., meadow streams), do not drive heavy equipment in flowing channels and floodplains.	Coarse and Fine Sediment: Disturbance of stream channel and streambanks resulting in erosion, sedimentation, turbidity, and loss of channel stability.	• Accumulation of bottom deposits OAR-340-041-0007 • Turbidity OAR-340-041-0036
In well armored channels that are resistant to damage (e.g., bedrock, small boulder, or cobble dominated), consider conducting the majority of heavy-equipment work from within the channel to minimize damage to sensitive riparian areas.	Coarse Sediment, Fine Sediment, and Temperature: Disturbance of floodplain and streambanks resulting in erosion, sedimentation, turbidity, and loss of stream shade.	• Turbidity OAR-340-041-0036 • Water Temperature OAR-340-041-0028
Design access routes for individual work sites to reduce exposure of bare soil and extensive streambank shaping.	Coarse and Fine Sediment: Soil erosion with potential transport to the channel and floodplain.	Turbidity OAR-340-041-0036
Confine heavy-equipment use in the streambed to the area necessary by working from the bank or a temporary structure for installation of structure to avoid flowing water.	Coarse and Fine Sediment: Excess disturbance of streambed and banks resulting in erosion, sedimentation and turbidity.	Turbidity OAR-340-041-0036
Limit the number and length of equipment access points through riparian management areas.	Coarse Sediment, Fine Sediment, and Temperature: Disturbance of floodplain and streambanks resulting in erosion, sedimentation, turbidity, and loss of stream shade.	• Turbidity • OAR-340-041-0036 • Water Temperature OAR-340-041-0028

Best Management Practices for Restoration	Input Variables and Causal Mechanisms	Water Quality Standards and Regulations
Limit the amount of streambank excavation to the minimum necessary to ensure stability of enhancement structures. Provide isolation from flowing water during excavation. Place excavated material above the flood prone area and cover or place a berm to avoid its reentry into the stream during high flow events.	Coarse and Fine Sediment: Sedimentation during high flow events resulting in erosion, sedimentation and turbidity.	• Accumulation of bottom deposits OAR-340-041-0007 • Turbidity OAR-340-041-0036
Obtain logs for habitat restoration structures from outside the riparian management area or at least 100 feet from the stream channel.	Temperature: Removal of stream shade and future source of large woody material, loss of root stability on stream banks.	Water Temperature OAR-340-041-0028
Inspect all mechanized equipment daily for leaks and clean as necessary to help ensure that toxic materials, such as fuel and hydraulic fluid, do not enter the stream.	Oil, Gas, and Chemical Fluids: Direct entry of oil and gas into waterbody	Statewide Narrative Criteria Oil and Floating Solids OAR 340-041-0007
Equipment will not be stored in stream channels when not in use.	Oil, Gas, and Chemical Fluids: Direct entry of oil and gas into waterbody	Statewide Narrative Criteria Oil and Floating Solids OAR 340-041-0007
When using heavy equipment in or adjacent to stream channels during restoration activities, develop and implement an approved spill containment plan that includes having a spill containment kit on-site and at previously identified containment locations.	Oil, Gas, and Chemical Fluids: Direct entry of oil and gas into waterbody	Statewide Narrative Criteria Oil and Floating Solids OAR 340-041-0007
Refuel equipment, including chainsaws and other hand power tools, at least 100 feet from water bodies (or as far as possible from the water body where local site conditions do not allow a 150-foot setback) to prevent direct delivery of contaminants into a water body.	Oil, Gas, and Chemical Fluids: Direct entry of oil and gas into waterbody	Statewide Narrative Criteria Oil and Floating Solids OAR 340-041-0007
Use waterbars, barricades, seeding, and mulching to stabilize bare soil areas along project access routes prior to the wet season.	Coarse and Fine Sediment: Excessive turbidity and sedimentation to downstream areas due to erosion of disturbed soils.	Turbidity OAR-340-041-0036
Rehabilitate and stabilize disturbed areas where soil will support seed growth by seeding and planting with native seed mixes or plants, or using erosion control matting.	Coarse and Fine Sediment: Excessive turbidity and sedimentation to downstream areas due to erosion of disturbed soils.	Turbidity OAR-340-041-0036
When replacing culverts, install grade control structures (e.g., boulder vortex weirs or boulder step weirs).	Coarse and Fine Sediment: Excessive turbidity and sedimentation to downstream areas due to erosion of upstream sand/gravel/cobble deposits.	• Accumulation of bottom deposits OAR-340-041-0007 • Turbidity OAR-340-041-0036

Best Management Practices for Restoration	Input Variables and Causal Mechanisms	Water Quality Standards and Regulations
Rehabilitate headcuts and gullies.	Coarse and Fine Sediment: Excessive turbidity and sedimentation to downstream areas due to erosion of upstream sand/gravel/cobble deposits.	• Accumulation of bottom deposits OAR-340-041-0007 • Turbidity OAR-340-041-0036
Install turbidity control structures (e.g., isolation, diversioin, or silt curtains) immediately downstream of in-stream restoration work areas. Remove these structures following completion of turbidity generating activities.	Coarse and Fine Sediment: Excessive turbidity to downstream areas generated during instream structure placement.	Turbidity OAR-340-041-0036
Klamath Falls: During restoration projects involving juniper control or prescribed burns, design projects so that adequate soil cover remains (either by leaving cut trees in place for many years or by lopping and scattering branches); and adequate herbaceous seed source or seed bed is available (either naturally or through seeding), and ensure that subsequent management of the site addresses other limiting factors caused by management (e.g., livestock use or recreation).	Coarse and Fine Sediment: Soil erosion with potential transport to the channel and floodplain.	Turbidity OAR-340-041-0036

Summary of Oregon Water Quality Standards

This section summarizes the Oregon standards and regulations for water quality that are associated with the best management practices.

Statewide Narrative Criteria

The following are the Oregon administrative rules (OARs) for the statewide narrative criteria for water quality by name, number, and descriptive excerpt.

- **Antidegradation (OAR 340-04l-0004)**
  "The purpose of the Antidegradation Policy is to guide decisions that affect water quality such that unnecessary further degradation from new or increased point and nonpoint sources of pollution is prevented, and to protect, maintain, and enhance existing surface water quality to ensure the full protection of all existing beneficial uses."

  Note: The antidegradation policy applies to all 303(d) listed waterbodies when a project could further degrade the water quality.

- **Statewide Narrative Criteria Biological Criteria (OAR 340-041-0007)**
  "**(**11) The development of fungi or other growths having a deleterious effect on stream bottoms, fish or other aquatic life, or that are injurious to health, recreation, or industry may not be allowed."

- **Statewide Narrative Criteria Oil and Floating Solids (OAR 340-041-0007)**
  "(14) Objectionable discoloration, scum, oily sheens, or floating solids, or coating of aquatic life with oil films may not be allowed."

- **Statewide Narrative Criteria Road Building Waste Materials (OAR 340-041-0007)**
  "(9) Road building and maintenance activities must be conducted in a manner so as to keep waste materials out of public waters and minimize erosion of cut banks, fills, and road surfaces."

- **Statewide Narrative Criteria Sediment, Adverse Deposits (OAR 340-041-0007)**
  "(13) The formation of appreciable bottom or sludge deposits or the formation of any organic or inorganic deposits deleterious to fish or other aquatic life or injurious to public health, recreation, or industry may not be allowed."

- **Statewide Narrative Criteria Summary (OAR 340-041-0007)**
  "(1) Notwithstanding the water quality standards contained in this Division, the highest and best practicable treatment and/or control of wastes, activities, and flows must in every case be provided so as to maintain dissolved oxygen and overall water quality at the highest possible levels and water temperatures, coliform bacteria concentrations, dissolved chemical substances, toxic materials, radioactivity, turbidities, color, odor, and other deleterious factors at the lowest possible levels."

Oregon Water Quality

For information about Oregon's water quality standards and a complete list of Oregon's administrative rules (OARs) for water quality, see http://www.deq.state.or.us/regulations/rules.htm. and http://www.deq.state.or.us/wq/standards/stanards.htm.

- **Statewide Narrative Criteria Toxics (OAR 340-041-0007)**
  "(12) The creation of tastes or odors or toxic or other conditions that are deleterious to fish or other aquatic life or affect the potability of drinking water or the palatability of fish or shellfish may not be allowed."

Statewide Numeric Criteria

The following are the Oregon administrative rules (OARs) for the statewide numeric criteria for water quality by name, number, and descriptive excerpt.

- **Bacteria (OAR 340-041-0009)**
  "(1) Numeric Criteria: Organisms of the coliform group commonly associated with fecal sources (MPN) or equivalent membrane filtration using a representative number of samples) may not exceed the criteria described in paragraphs (a) and (b) of this paragraph:
  (a) Freshwaters and Estuarine Waters Other than Shellfish Growing Waters:
  (A) A 30-day log mean of 126 *E. coli* organisms per 100 milliliters, based on a minimum of five (5) samples;
  (B) No single sample may exceed 406 *E. coli* organisms per 100 milliliters."

- **Biocriteria** (**OAR 340-041-0011**)
  "Waters of the State must be of sufficient quality to support aquatic species without detrimental changes in the resident biological communities."

- **Dissolved Oxygen (OAR 340-041-0016)**
  "Dissolved oxygen (DO): No wastes may be discharged and no activities must be conducted that either alone or in combination with other wastes or activities will cause violation of the following standards: The changes adopted by the Commission on January 11, 1996, become effective July 1, 1996. Until that time, the requirements of this rule that were in effect on January 10, 1996, apply:
  (1) For waterbodies identified as active spawning areas in the places and

times indicated on the following Tables and Figures set out in OAR 340-041-0101 to 340-041-0340: Tables 101B, 121B, 180B, 201B and 260B, and Figures 130B, 151B, 160B, 170B, 220B, 230B, 271B, 286B, 300B, 310B, 320B, and 340B, (as well as any active spawning area used by resident trout species), the Rules of this Division as last modified by the EQC 05/20/2004 following criteria apply during the applicable spawning through fry emergence periods set forth in the tables and figures:
(a) The dissolved oxygen may not be less than 11.0 mg/l. However, if the minimum intergravel dissolved oxygen, measured as a spatial median, is 8.0 mg/l or greater, then the DO criterion is 9.0 mg/l;
(b) Where conditions of barometric pressure, altitude, and temperature preclude attainment of the 11.0 mg/l or 9.0 mg/l criteria, dissolved oxygen levels must not be less than 95 percent of saturation;
(c) The spatial median intergravel dissolved oxygen concentration must not fall below 8.0 mg/l.
(2) For waterbodies identified by the Department as providing cold-water aquatic life, the dissolved oxygen may not be less than 8.0 mg/l as an absolute minimum. Where conditions of barometric pressure, altitude, and temperature preclude attainment of the 8.0 mg/l, dissolved oxygen may not be less than 90 percent of saturation. At the discretion of the Department, when the Department determines that adequate information exists, the dissolved oxygen may not fall below 8.0 mg/l as a 30-day mean minimum, 6.5 mg/l as a seven-day minimum mean, and may not fall below 6.0 mg/l as an absolute minimum (Table 21);
(3) For waterbodies identified by the Department as providing cool-water aquatic life, the dissolved oxygen may not be less than 6.5 mg/l as an absolute minimum. At the discretion of the Department, when the Department determines that adequate information exists, the dissolved oxygen may not fall below 6.5 mg/l as a 30-day mean minimum, 5.0 mg/l as a seven-day minimum mean, and may not fall below 4.0 mg/l as an absolute minimum (Table 21);
(4) For waterbodies identified by the Department as providing warm-water aquatic life, the dissolved oxygen may not be less than 5.5 mg/l as an absolute minimum. At the discretion of the Department, when the Department determines that adequate information exists, the dissolved oxygen may not fall below 5.5 mg/l as a 30-day mean minimum, and may not fall below 4.0 mg/l as an absolute minimum (Table 21);
(5) For estuarine water, the dissolved oxygen concentrations may not be less than 6.5 mg/l (for coastal waterbodies)."

- **Temperature (OAR 340-041-0028)**
  "A. The seven-day-average maximum temperature of a stream identified as having salmon and steelhead spawning use may not exceed 55.4 degrees Fahrenheit. B. The seven-day-average maximum temperature of a stream identified as having core cold water habitat use may not exceed 60.8 degrees Fahrenheit. C. The seven-day-average maximum temperature of a stream identified as having salmon and trout rearing and migration use may not exceed 64.4 degrees Fahrenheit. D. The seven-day-average maximum temperature of a stream identified as having a migration corridor use may not exceed 68.0 degrees Fahrenheit."
- **Turbidity (OAR 340-041-0036)**
  "No more than a ten percent cumulative increase in natural stream turbidities may be allowed, as measured relative to a control point immediately upstream of the turbidity causing activity."

Appendix J. Recreation

This appendix provides supplemental material for the recreational topics discussed in this draft environmental impact statement.

In this appendix:

Interim Off-highway Vehicle Management Guidelines 1191

Planning Frameworks for Special Management Areas 1208

Interim Off-highway Vehicle Management Guidelines

This section provides interim off-highway vehicle (OHV) management guidelines that would be implemented until subsequent transportation management plans are completed. These interim guidelines have been developed at the district level, for OHV emphasis areas, and for the Heceta Dunes ACEC on the Eugene District. These guidelines are presented in the order of Salem, Eugene, Roseburg, Coos Bay, Medford (the five western Oregon BLM districts), and Klamath Falls (one of the resource areas of the Lakeview District).

Maps associated with these interim OHV management guidelines are available at BLM district offices. These maps show OHV area designations, a preliminary road and trail network, and BLM lands that have secured legal public access. See Chapter 2 for a listing of individual closed areas and OHV emphasis areas by district.

BLM road maintenance levels that pertain to limitations on types of OHV use are described below.

Level 1 – This level is assigned to roads where minimum maintenance is required to protect adjacent lands and resource values. Emphasis is given to maintaining drainage and runoff patterns as needed to protect adjacent lands. Grading, brushing, or slide removal is not performed unless roadbed drainage is being adversely affected, causing erosion. Closure and traffic restrictive devices are maintained as needed.

Level 2 – This level is assigned to roads that are passable by high clearance vehicles. Drainage structures are to be inspected within a 3-year period and maintained as needed. Grading is conducted as necessary to correct drainage problems. Brushing is conducted as needed to allow access. These are typically low standard, low volume, single lane, natural and aggregate surfaced, and are functionally classified as a resource road.

Level 3 – This level is assigned to roads where management objectives require the road to be open seasonally or year-round for commercial, recreational, or administrative access. Typically, these roads are natural or aggregate surfaced, but may include low use bituminous surfaced road. These roads have a defined cross section with drainage structures (e.g., rolling dips, culverts, or ditches). These roads may be negotiated by passenger cars traveling at prudent speeds. User comfort and convenience are not considered a high priority. Drainage structures are to be inspected at least annually and maintained as needed. Grading is conducted to provide a reasonable level of riding comfort at prudent speeds for the road conditions. Brushing is conducted as needed to improve sight distance.

Level 4 – This level is assigned to roads where management objectives require the road to be open all year (except may be closed or have limited access due to snow conditions) and which connect major administrative features (recreational sites, local road systems, administrative sites, etc.) to County, State, or Federal roads. Typically these roads are single or double lane, aggregate, or bituminous surface, with a higher volume of commercial and recreational traffic than administrative traffic.

Salem District

OHV Designations:

Limited to designated roads and trails: 291,969 acres

Limited to designated roads: 85,165 acres

Closed: 26,208 acres

Description:

Includes all BLM lands located within the Salem District. See additional interim guidelines for the Upper Nestucca OHV Emphasis Area.

Limited Area Management Guidelines:

- Limited OHV areas are managed in accordance with all applicable federal and state off-highway vehicle regulations.
- Motor vehicle use will be limited to administrative, commercial, and passenger vehicle traffic where not specifically signed or gated.
- Until road and trail designations are complete, all motorized vehicles will be limited to the interim road and trail network as mapped unless closed or restricted under a previous planning effort or due to special circumstances as defined below.
- Routes may be closed or their use limited under seasonal or administrative restrictions. These restrictions may include, but are not limited to, fire danger, wet conditions, special requirements for wildlife species, protection of cultural resources, or for public safety.
- Vehicles may pull off roads or trails to park or allow others to pass, up to 25 feet from centerline of roads or up to 15 feet from centerline of trails.
- Limitations apply to all Class I (ATVs), Class II (4WDs) and Class III (motorcycles) vehicles and to all activity types (recreational, commercial, etc.) unless authorized by the BLM for administrative purposes.

Closed Area Management Guidelines:

- All motorized vehicles are prohibited from entering closed OHV areas unless authorized by the BLM for administrative purposes.

Process for on-going public collaboration/outreach:

- The principle venue for public collaboration is through public outreach and scoping during future travel management planning efforts, special projects, and local partnership.

- Press releases will be sent out as needed informing the public of OHV opportunities and restrictions. Signs will be posted where appropriate.
- Upon completion of the transportation management plan, maps and brochures shall be available to the public at the main office illustrating designations, describing specific restrictions, and defining opportunities.

Process for selecting a final road and trail network:

Route designations have been completed for the Upper Nestucca OHV Emphasis Area. Final route designations for the rest of the district will be accomplished in a comprehensive, interdisciplinary travel and transportation management plan scheduled to be complete no later than five years after completion of the RMP revision.

BLM's geo-database will provide information for identifying roads and trails for both motorized and non-motorized activities. On-the-ground inventories will be conducted if a reasonable determination can not be made using remote-sensing techniques. Proposed designations will be analyzed through public scoping and a NEPA analysis. Amendments to the designated system will be considered during the transportation management planning process.

Road and trail construction and maintenance standards:

Construction and maintenance will be done in accordance with the standards in BLM Manual H-9114-1 and other professional sources.

Upper Nestucca OHV Emphasis Area

Acres: 9,579

OHV Designation:

Limited to designated roads and trails

Niche: Located 20 miles northwest of McMinnville, Oregon, this area provides Class I (ATVs) and Class III (motorcycles) OHV riding experience along a designated road and trail network.

Management Guidelines:

- Designated trails and maintained roadways are limited to Class I and Class III motor vehicle use within the boundaries of the OHV emphasis area.

- All Class I and Class III vehicles must be equipped with approved spark arresters, an Oregon ATV sticker for the appropriate vehicle class, and must meet posted noise requirements.
- Class II vehicle use is only authorized on Level 3 and Level 4 roadways.
- Motorized use on the trail system may be restricted during summer months due to fire hazard conditions.
- Areas and trails may be permanently or temporarily closed for administrative use, extreme wet conditions, construction/reconstruction requirements, or other environmental concerns.

Process for on-going public collaboration/outreach:

The principle venue for public collaboration on the trail system is through local partnership with the Applegate Rough Riders Motorcycle Club. A trail map is available to the public at the Salem District Office and Tillamook Field Office. The trail system is marked on the ground with regulatory and directional signage.

Process for selecting a final road and trail network:

Route designations have been completed through the Upper Nestucca Motorcycle Trail System Environmental Assessment (EA OR 086-97-05). Adaptive management is used to adjust the system for timber management, user needs, and resource protection.

Road and trail construction and maintenance standards:

Construction and maintenance are completed in accordance with the design features identified in the Monitoring and Maintenance Plan for the Upper Nestucca OHV Trail System. Trail maintenance will be a priority within this OHV emphasis area to ensure a quality riding experience for trail users and to conserve natural resource values.

Eugene District

OHV Designations:

Limited to designated roads and trails: 308,595 acres

Closed: 5,187 acres

Description:

Includes all BLM lands located within the Eugene District. See additional interim guidelines for the Shotgun Creek OHV Emphasis Area and the Heceta Dunes Area of Critical Environmental Concern.

Limited Area Management Guidelines:

- Limited OHV areas are managed in accordance with all applicable federal and state off-highway vehicle regulations.
- Motor vehicle use will be limited to administrative, commercial, and passenger vehicle traffic where not specifically signed or gated.
- Until road and trail designations are complete, all motorized vehicles will be limited to the interim road and trail network as mapped unless closed or restricted under a previous planning effort or due to special circumstances as defined below.
- Routes may be closed or limited under seasonal or administrative restrictions. These restrictions may include, but are not limited to, fire danger, wet conditions, special requirements for wildlife species, to protect cultural resources, or for public safety.
- Vehicles may pull off roads or trails to park or allow others to pass, up to 25 feet from centerline of roads or up to 15 feet from centerline of trails.
- Limitations apply to all Class I (ATVs), Class II (4WDs) and Class III (motorcycles) vehicles and to all activity types (recreational, commercial, etc.) unless authorized by the BLM for administrative purposes.

Closed Area Management Guidelines:

- All motorized vehicles are prohibited from entering closed OHV areas unless authorized by the BLM for administrative purposes.

Process for on-going public collaboration/outreach:

- The principle venue for public collaboration is through public outreach and scoping during future travel management planning efforts, special projects, and local partnership.
- Press releases will be sent out as needed informing the public of OHV opportunities and restrictions. Signs will be posted where appropriate.
- Upon completion of the transportation management plan, maps and brochures shall be available to the public at the main office illustrating designations, describing specific restrictions, and defining opportunities.

Process for selecting a final road and trail network:

Route designations have been completed for the Upper Lake Creek Special Recreation Management Area and the Shotgun Creek OHV Emphasis Area. Final route designations for the rest of the district will be accomplished in a comprehensive, interdisciplinary travel and transportation management plan scheduled to be complete no later than five years after completion of the RMP revision.

BLM's geo-database will provide information for identifying roads and trails for both motorized and non-motorized activities. On-the-ground inventories will be conducted if a reasonable determination can not be made using remote-sensing techniques. Proposed designations will be analyzed through public scoping and a NEPA analysis. Amendments to the designated system will be considered during the transportation management planning process.

Road and trail construction and maintenance standards:

Construction and maintenance will be done in accordance with the standards in BLM Manual H-9114-1 and other professional sources.

Shotgun Creek OHV Emphasis Area

Acres: 8,090

OHV Designation:

Limited to designated roads and trails

Niche: Offers a multiple-use, single-track trail riding experience for motorcycle riders, ATV riders, and four-wheel drive enthusiasts.

Management Guidelines:

- The trail system is available to Class I (ATVs), Class II (4WDs) and Class III (motorcycles) motorized vehicles with Oregon ATV permits.
- Routes open to OHV use will be signed and mapped.
- Routes available for OHV use may change periodically due to timber harvest activity or trail rehabilitation.

Process for on-going public collaboration/outreach:

The principle venue for public collaboration on the trail system is through local partnership relationships with the Emerald Trail Riders Association, the Junction

City Jeepers, and other user groups. A trail map is available to the public at the Eugene District Office and will be updated as trail routes change. The trail system is marked on the ground with regulatory and directional signs.

Process for selecting a final road and trail network:

Route designations were completed through two Shotgun OHV Trail System Environmental Assessments (EA OR 090-00-04 and EA OR 090-06-04). Adaptive management will be used to adjust the system for approved timber harvesting, user needs, and resource protection. These modifications will be accomplished in collaboration with trail partners and users.

Road and trail construction and maintenance standards:

Trail maintenance will be a priority within this OHV emphasis area to ensure quality riding experiences for trail users and to conserve natural resource values.

Heceta Dunes Area of Critical Environmental Concern

Acres: 200

OHV Designation:

Open: 77 acres

Closed: 133 acres

Niche: Offers an open sand dune riding experience for OHV riders within a portion of the ACEC.

Management Guidelines:

- OHV use is limited to an open sand dune areas and connector routes between open dunes, as mapped. All other portions of the ACEC are closed to OHV use.
- Supplemental rules regulating other activities, such as camping, may be established in coordination with the USFS.

Process for on-going public collaboration/outreach:

Signs will be installed and maps made available to the public that clearly delineate the open OHV area. BLM shall coordinate outreach efforts with the U.S. Forest Service.

Process for selecting a final road and trail network:

The area open to OHV use will be delineated to avoid rare plant habitats and private land. The "open" area delineation will be coordinated with the adjacent open area on U.S. Forest Service lands.

Roseburg District

OHV Designations:

Limited to designated roads and trails: 415,658 acres

Closed: 10,643 acres

Description:

Includes all BLM lands located within the Roseburg District. See additional interim guidelines for the Hubbard Creek OHV Emphasis Area.

Limited Area Management Guidelines:

- Limited OHV areas are managed in accordance with all applicable federal and state off-highway vehicle regulations.
- Motor vehicle use will be limited to administrative, commercial, and passenger vehicle traffic where not specifically signed or gated.
- Until road and trail designations are complete, all motorized vehicles will be limited to the interim road and trail network as mapped unless closed or restricted under a previous planning effort or due to special circumstances as defined below.
- Routes may be closed or limited under seasonal or administrative restrictions. These restrictions may include, but are not limited to, fire danger, wet conditions, special requirements for wildlife species, to protect cultural resources, or for public safety.
- Vehicles may pull off roads or trails to park or allow others to pass, up to 25 feet from centerline of roads or up to 15 feet from centerline of trails.
- Limitations apply to all Class I (ATVs), Class II (4WDs) and Class III (motorcycles) vehicle use and to all activity types (recreational, commercial, etc.) unless authorized by the BLM for administrative purposes.

Closed Area Management Guidelines:

- All motorized vehicles are prohibited from entering closed OHV areas unless authorized by the BLM for administrative purposes.

Process for on-going public collaboration/outreach:

- The principle venue for public collaboration is through public outreach and scoping during future travel management planning efforts, special projects, and local partnership.
- Press releases will be sent out as needed informing the public of OHV opportunities and restrictions. Signs will be posted where appropriate.
- Upon completion of the transportation management plan, maps and brochures shall be available to the public at the Roseburg District office illustrating designations, describing specific restrictions, and defining opportunities.

Process for selecting a final road and trail network:

Final route designations for the district will be accomplished in a comprehensive, interdisciplinary travel and transportation management plan scheduled to be complete no later than five years after completion of the RMP revision.

BLM's geo-database will provide information for identifying roads and trails for both motorized and non-motorized activities. On-the-ground inventories will be conducted if a reasonable determination can not be made using remote-sensing techniques. Proposed designations will be analyzed through public scoping and a NEPA analysis. Amendments to the designated system will be considered during the transportation management planning process.

Road and trail construction and maintenance standards:

Construction and maintenance will be done in accordance with the standards in BLM Manual H-9114-1 and other professional sources.

Hubbard Creek OHV Emphasis Area

Acres: 12,041

OHV Designation:

Limited to designated roads and trails

Niche: Offers a multiple-use trail riding experience for motorcycles, ATVs, and 4X4 vehicles.

Management Guidelines:

- Paved roads are limited to licensed, street-legal vehicles only.
- Level 1and 2 routes are open to Class I (ATVs), Class II (4X4s) and Class III (motorcycles) vehicles according to width. Trails under 50 inches wide are restricted to Class I and Class III vehicles.
- ATVs and motorcycles must have Oregon ATV permits.
- Non-motorized travel (horseback riding, hiking, and mountain biking) is allowed on all access routes, but is not encouraged due to potential conflicts and safety hazards.
- Motorized use on the trail system may be restricted during the summer due to fire hazard conditions, as determined by Douglas Forest Protective Association.

Process for on-going public collaboration/outreach:

The principle venue for public collaboration on the trail system is through partnerships with the local motorcycle and 4X4 associations.

Process for selecting a final road and trail network:

No route designations were made in the previous planning effort since it was designated as limited to existing roads and trails. After completion the RMP revision, a road and trail inventory and designation process for the area will be developed.

Road and trail construction and maintenance standards:

Trail maintenance will be a priority within this OHV emphasis area to ensure a quality riding experience for trail users, to minimize user conflicts, promote safety for users, and conserve resource values.

Coos Bay District

OHV Designations:

Limited to designated roads and trails: 318,674 acres

Closed: 3,489 acres

Description:

Includes all BLM lands located within the Coos Bay District. See additional interim guidelines for the Blue Ridge OHV Emphasis Area.

Limited Area Management Guidelines:

- Limited OHV areas are managed in accordance with all applicable federal and state off-highway vehicle regulations.
- Motor vehicle use will be limited to administrative, commercial, and passenger vehicle traffic where not specifically signed or gated.
- Until road and trail designations are complete, all motorized vehicles will be limited to the interim road and trail network as mapped unless closed or restricted under a previous planning effort or due to special circumstances as defined below.
- Routes may be closed or limited under seasonal or administrative restrictions. These restrictions may include, but are not limited to, fire danger, wet conditions, special requirements for wildlife species, to protect cultural resources, or for public safety.
- Vehicles may pull off roads or trails to park or allow others to pass, up to 25 feet from centerline of roads or up to 15 feet from centerline of trails.
- Limitations apply to all Class I (ATVs), Class II (4WDs) and Class III (motorcycles) vehicle use and to all activity types (recreational, commercial, etc.) unless authorized by the BLM for administrative purposes.

Closed Area Management Guidelines:

- All motorized vehicles are prohibited from entering closed OHV areas unless authorized by the BLM for administrative purposes.

Process for on-going public collaboration/outreach:

- The principle venue for public collaboration is through public outreach and scoping during future travel management planning efforts, special projects, and local partnership.
- Press releases will be sent out as needed informing the public of OHV opportunities and restrictions. Signs will be posted where appropriate.
- Upon completion of the transportation management plan, maps and brochures shall be available to the public at the Coos Bay District office illustrating designations, describing specific restrictions, and defining opportunities.

Process for selecting a final road and trail network:

Route designations have been completed for the New River ACEC and the Blue Ridge OHV Emphasis Area. Final route designations for the rest of the district will be accomplished in a comprehensive, interdisciplinary travel and transportation management plan scheduled to be complete no later than five years after completion of the RMP revision.

BLM's geo-database will provide information for identifying roads and trails for both motorized and non-motorized activities. On-the-ground inventories will be conducted if a reasonable determination can not be made using remote-sensing techniques. Proposed designations will be analyzed through public scoping and a NEPA analysis. Amendments to the designated system will be considered during the transportation management planning process.

Road and trail construction and maintenance standards:

Construction and maintenance will be done in accordance with the standards in BLM Manual H-9114-1 and other professional sources.

Blue Ridge OHV Emphasis Area

Acres: 1,609

OHV Designation:

Limited to designated roads and trails

Niche: Offers a multiple-use, single-track trail riding experience for hikers, equestrians, mountain bikers, and motorcycle riders.

Management Guidelines

- Level 3 and 4 BLM roads are limited to street-legal vehicles only.
- The single-track trail system is available to Class III (motorcycles) vehicles with Oregon ATV permits and all non-motorized modes of travel.
- Motorized, mechanized, and equestrian use is prohibited between December and April to prevent excessive damage to the trail tread when soil moisture conditions are high. Motorized use on the trail system may be restricted during summer months due to fire hazard conditions.

Process for on-going public collaboration/outreach:

The principle venue for public collaboration on the trail system is through local partnership relationships with the South Coast Trail Riders, Oregon Equestrian Trails, and the Coos Regional Trail Partnership. A printed trail map is available to the public at the Coos Bay District office and on the Coos Regional Trail Partnership webpage. The trail system is marked on the ground with regulatory and directional signage.

Process for selecting a final road and trail network:

Route designations were completed through the Blue Ridge Multiple Use Trail System environmental assessment (EA OR-125-98-18). Adaptive management will be used to adjust the system for commercial timber production demands, user needs and resource protection. These modifications will be accomplished in collaboration with trail partners and users and through amendments to the Blue Ridge Trail system plan and EA.

Road and trail construction and maintenance standards:

Construction and maintenance shall be done in accordance with the design features identified in the EA and standards in BLM Manual H-9114-1 and other professional sources. Trail maintenance will be a priority within this OHV emphasis area to ensure a quality riding experience for trail users and to conserve natural resource values.

Medford District

OHV Designations:

Limited to designated roads and trails: 825,188 acres

Closed: 42,298 acres

Description:

Includes all BLM lands located within the Medford District. See additional interim guidelines for that apply to all OHV emphasis areas within the district.

Limited Area Management Guidelines:

- Limited OHV areas are managed in accordance with all applicable federal and state off-highway vehicle regulations.
- Motor vehicle use will be limited to administrative, commercial, and to passenger vehicle traffic where not specifically signed or gated.
- Until road and trail designations are complete, all motorized vehicles will be limited to the interim road and trail network as mapped unless closed or restricted under a previous planning effort or due to special circumstances as defined below.
- Routes may be closed or limited under seasonal or administrative restrictions. These restrictions may include, but are not limited to, fire danger, wet conditions, special requirements for wildlife species, to protect cultural resources, or for public safety.

- Vehicles may pull off roads or trails to park or allow others to pass, up to 25 feet from centerline of roads or up to 15 feet from centerline of trails.
- Limitations apply to all Class I (ATVs), Class II (4WDs) and Class III (motorcycles) vehicle use and to all activity types (recreational, commercial, etc.) unless authorized by the BLM for administrative purposes.

Closed Area Management Guidelines:

- All motorized vehicles are prohibited from entering closed OHV areas unless authorized by the BLM for administrative purposes.

Process for on-going public collaboration/outreach:

- The principle venue for public collaboration is through public outreach and scoping during future travel management planning efforts, special projects, and local partnership.
- Press releases will be sent out as needed informing the public of OHV opportunities and restrictions. Signs will be posted where appropriate.
- Upon completion of the transportation management plan, maps and brochures shall be available to the public at the main office illustrating designations, describing specific restrictions, and defining opportunities.

Process for selecting a final road and trail network:

Final route designations for the district will be accomplished in a comprehensive, interdisciplinary travel and transportation management plan scheduled to be complete no later than five years after completion of the RMP revision.

BLM's geo-database will provide information for identifying roads and trails for both motorized and non-motorized activities. On-the-ground inventories will be conducted if a reasonable determination can not be made using remote-sensing techniques. Proposed designations will be analyzed through public scoping and a NEPA analysis. Amendments to the designated system will be considered during the transportation management planning process.

Road and trail construction and maintenance standards:

Construction and maintenance will be done in accordance with the standards in BLM Manual H-9114-1 and other professional sources.

Medford District OHV Emphasis Areas

The following interim management guidelines would apply to OHV emphasis areas on the Medford District if designated in the RMP revision.

Anderson Butte: 11,742 acres

Coyote Creek: 14,597 acres

East Howard: 6,812 acres

Elderberry Flats: 3,393 acres

Elliot Creek: 3,931 acres

Ferris Gulch: 2,222 acres

Illinois Valley: 4,681 acres

Lake Creek: 8,561 acres

Quartz Creek: 6,867 acres

Salt Creek: 4,692 acres

Spencer Creek: 7,468 acres

Timber Mountain/ Johns Peak: 16,375 acres

Worthington Road/Obenchain: 9,410 acres

Niche: These OHV emphasis areas offer a multiple-use trail riding experience for users of Class I (ATVs), Class II (4WDs) and Class III (motorcycles) vehicles. The transportation system of these areas also supports commercial and administrative access.

Management Guidelines:

- Paved roads are limited to licensed, street-legal vehicles only.
- Level 1 and 2 routes are open to Class I (ATVs), Class II (4WDs) and Class III (motorcycles) vehicles. Trails less than 50 inches wide are restricted to ATVs and motorcycles.
- ATVs and motorcycles must have valid Oregon ATV permits.
- Non-motorized travel is allowed on all access routes (e.g. horseback riding, hiking, and mountain biking) but is not encouraged due to potential conflicts and safety hazards.
- Motorized use on the road and trail system may be restricted during the summer due to fire hazard conditions.

Process for on-going public collaboration/outreach:

The principle venue for public collaboration within these emphasis areas is through local partnership relationships with local motorcycle and 4X4 associations.

Process for selecting a final road and trail network:

Criteria shall be established for future route designations**.** No route designations were made in the previous RMP planning effort.

Road and trail construction and maintenance standards:

Trail maintenance would be a priority within these OHV emphasis areas to ensure a quality riding experience for trail users, to minimize user conflicts, promote safety for users, and conserve natural resource values.

Klamath Falls Resource Area

OHV Designations:

Limited to designated roads and trails: 213,747 acres

Closed: 10,970 acres

Description:

Includes all BLM lands located within the Klamath Falls Resource Area.

Limited Area Management Guidelines:

- Limited OHV areas are managed in accordance with all applicable federal and state off-highway vehicle regulations.
- Motor vehicle use will be limited to administrative, commercial, and passenger vehicle traffic where not specifically signed or gated.
- Until road and trail designations are complete, all motorized vehicles will be limited to the interim road and trail network as mapped unless closed or restricted under a previous planning effort or due to special circumstances as defined below.
- Routes may be closed or limited under seasonal or administrative restrictions. These restrictions may include, but are not limited to, fire danger, wet conditions, special requirements for wildlife species, to protect cultural resources, or for public safety.

- Vehicles may pull off roads or trails to park or allow others to pass, up to 25 feet from centerline of roads or up to 15 feet from centerline of trails.
- Limitations apply to all Class I (ATVs), Class II (4WDs) and Class III (motorcycles) vehicles and to all activity types (recreational, commercial, etc.) unless authorized by the BLM for administrative purposes.

Seasonal restrictions:

- The Eastside seasonal OHV closure is in effect from November 1 to April 15. Applies to all BLM lands located within deer winter range cooperative wildlife areas, including the majority of Stukel and Bryant Mountain and portions of the Gerber block as mapped.
- The Pokegema wildlife area seasonal OHV closure is in effect from November 20 to April 1.
- For designated snowmobile trails, wheeled vehicles are prohibited once grooming of trails begins for winter season.
- OHV use may be limited in other areas on a seasonal basis due to special conditions such as temporary fire restrictions, special wildlife requirements, etc.

Closed Area Management Guidelines:

- All motorized vehicles are prohibited from entering closed OHV areas unless authorized by the BLM for administrative purposes.

Process for on-going public collaboration/outreach:

- The principle venue for public collaboration is through public outreach and scoping during future travel management planning efforts, special projects, and local partnership.
- Press releases will be sent out as needed informing the public of OHV opportunities and restrictions. Signs will be posted where appropriate.
- Upon completion of the transportation management plan, maps and brochures shall be available to the public at the main office illustrating designations, describing specific restrictions, and defining opportunities.
- BLM will continue to participate with other land managers in the cooperative management of the Pokegema wildlife area and deer winter range areas.

Process for selecting a final road and trail network:

Route designations have been completed for the New River ACEC and the Blue Ridge OHV Emphasis Area. Final route designations for the rest of the district will be accomplished in a comprehensive, interdisciplinary travel and

transportation management plan scheduled to be complete no later than five years after completion of the RMP revision.

BLM's geo-database will provide information for identifying roads and trails for both motorized and non-motorized activities. On-the-ground inventories will be conducted if a reasonable determination can not be made using remote-sensing techniques. Proposed designations will be analyzed through public scoping and a NEPA analysis. Amendments to the designated system will be considered during the transportation management planning process.

Road and trail construction and maintenance standards:

Construction and maintenance will be done in accordance with the standards in BLM Manual H-9114-1 and other professional sources.

Planning Frameworks for Special Management Areas

This section presents district-specific management guidelines for management areas that would be carried forward under all three action alternatives. For a complete list of special recreation management areas, see the Tables section in Chapter 2. The management guidelines are presented in the order of Salem, Eugene, Roseburg, Coos Bay, Medford (the five western Oregon BLM districts), and Klamath Falls (one of the resource areas of the Lakeview District).

Salem District

Alsea Falls SRMA

Primary Market Strategy: Community

Niche: Overnight camping, picnicking, hiking and mountain biking, horse-back riding, and leisurely driving opportunities in a coastal mountain setting.

Management Objectives: Manage the area to provide overnight camping, hiking, mountain biking, and equestrian opportunities in a coastal mountain setting.

Targeted Outcomes:

Activities: Camping, hiking, picnicking, viewing natural landscapes, mountain biking, equestrian trail riding, and resting at a stop along a national backcountry byway

Experiences: Sense of achievement by developing personal skills and abilities; savoring the total sensory experience of a natural landscape; enjoying the closeness of family; relishing group affiliation and togetherness; bringing back pleasant memories; enjoying getting some needed physical exercise or rest; and escaping from personal-social, physical, or family pressures for awhile

Benefits: Improved mental health and health maintenance; restored body from fatigue, improved capacity for outdoor physical activity, improved fitness and health; greater family bonding, opportunity for a more well-rounded childhood development, enhanced lifestyle; and greater retention of distinctive natural landscape features

Prescribed Setting Character:

Physical: Primarily front country and middle country landscaping varies from un-modified forest to highly modified timber actions throughout the SRMA and along the byway

Social: Accommodates 16 families with up to 100 people in the campground and 22 families and up to 150 people in the picnic area when at full capacity. Encounters are highly expected during the high-use season. A group size of up to 10 in the rest of Alsea Falls Area SRMA with a less likelihood of encounters

Administrative: Brochures are available. Agency presence lessens as remoteness increases, mostly non-motorized recreation in and around the recreation site. The remaining SRMA is limited to mapped designated roads and trails. Resident summer staff and camp hosts during the open season. Site is closed during the low-use season of October through April, while allowing walk-in day use access during that time. Rules are clearly posted throughout the park.

Activity Planning Framework:

Management: Continue to provide for a developed camping and day use experience and associated facilities with an emphasis on maintaining a front and middle country recreation setting in the SRMA.

Marketing: Use information and interpretation to lessen visitor conflicts and resource impacts in the recreation area and SRMA.

Monitoring: Monitor visitor satisfaction.

Administrative: Apply administrative actions as needed to maintain safe and enjoyable recreation experience and to conserve and restore the natural setting.

Fishermen's Bend

Primary Market Strategy: Community

Niche: Offers a wide variety of safe and high-quality family and group facilities and outdoor recreational opportunities in a forested setting along the scenic North Santiam River, within 30 miles of larger rural communities and densely populated urban communities.

Management Objectives: To provide highly developed, clean, safe, enjoyable, and accessible facilities and outdoor recreation opportunities in a forested setting. To provide outdoor nature study programs and activities for children and adults.

Targeted Outcomes:

Activities: Individual and group camping and picnicking, non-motorized boating, fishing, nature study, water-play, biking, walking, and athletic field sports

Experiences: Enjoying closeness of family and friends and group affiliation and togetherness, enjoying easy access to natural landscapes, participating in outdoor events, getting some needed physical exercise, getting some needed physical rest, and releasing or reducing built-up mental tensions

Benefits: Improved mental health and health maintenance, stronger ties with family and friends, greater appreciation for parks and how managers care for them, and positive economic contribution to nearby rural communities

Prescribed Setting Character:

Physical: The overall physical setting is rural with a relatively natural appearing mature conifer forest setting along the scenic North Santiam River. The level of development and visitor amenities is high with paved roads, developed campsites (water, sewer and electrical hook-ups), cabins, flush restrooms with showers, accessible trails, and a boat ramp. Large group camping and picnic facilities are present with athletic fields, playgrounds, and basketball courts. Nature study facilities include a nature center and interpretive nature trail.

Social: High density with family, friends, and group interactions

Administrative: Park staff presence high with seasonal staff and volunteer hosts staying onsite and conducting frequent fee compliant checks and maintaining park facilities and cleanliness. Rules are clearly posted throughout site. Nature study programs and activities for both children and adults are provided on a weekly basis.

Activity Planning Framework:

Management: Continue to manage the park's facilities for a high level of facility maintenance, safety, cleanliness, and accessibility. To the extent possible, maintain the park's desirable mature forest and native vegetation. Expand site use for environmental educational activities, especially in the shoulder season.

Marketing: Work with interested groups to provide visitor information both on and off site.

Monitoring: Continue recreation staff/law enforcement patrols, resource monitoring, and seek input from visitors.

Administrative: To provide high-quality visitor service and to ensure compliance with park rules and resource protection, continue to use efficient mix of seasonal and volunteer staff to provide onsite management presence. To participate in partnerships that help meet management objectives.

Little North Santiam River

Primary Market Strategy: Community

Niche: Offers a wide variety of safe and high-quality outdoor recreational opportunities in a forested setting along the scenic Little North Santiam River, within 40 miles of larger rural communities and densely populated urban communities. Rugged and remote backcounty experiences are available in the Elkhorn Creek Wild and Scenic River (WSR).

Management Objectives: To provide a wide range of outdoor recreation opportunities and protect Elkhorn Creek WSR. To provide facilities, river access and administrative control that support resource protection, visitor safety, health, and enjoyment. To provide recreation visitor with education, information and interpretation designed to encourage stewardship and minimize user impacts and conflicts.

Targeted Outcomes:

Activities: Swimming, camping, picnicking, fishing, hiking, hunting, and recreational mining

Experiences: Enjoying closeness of family and friends and group affiliation and togetherness; enjoying easy access to natural landscapes, participating in outdoor events and getting some needed physical exercise; getting some needed physical rest and reducing built-up mental tensions; and enjoying more strenuous exercise and escaping crowds

Benefits: Improved mental health and health maintenance, stronger ties with family and friends, greater appreciation for parks and how managers care for them, personal growth and development with greater self-reliance associated with improved outdoor skills, and positive economic contribution to nearby rural communities

Prescribed Setting Character:

Physical: Modifications such as paved roads, utilities, houses, a golf course, and forest management are frequently observable along county roads and the Little North Santiam River. BLM lands along Elkhorn Creek WSR are much more rugged and remote with little to no observable modifications.

Social: Moderate to high levels of visitor interaction occurs in most of the SRMA with very low to no encounters expected along in the Elkhorn Creek WSR.

Administrative: Park staff presence high with seasonal staff and volunteer hosts staying onsite and conducting frequent fee compliant checks and maintaining park facilities and cleanliness. Rules are clearly posted in sites and areas. Much less agency presence and signage for Elkhorn Creek WSR.

Activity Planning Framework:

Management: Continue to manage park's facilities for a high level of facility maintenance, safety, cleanliness, and accessibility. To the extent possible, maintain desirable mature forest and native vegetation at parks.

Marketing: Work with interested groups to provide visitor information both on and off site.

Monitoring: Continue recreation staff/law enforcement patrols, resource monitoring, and seek input from visitors.

Administrative: Provide high-quality visitor service and to ensure compliance with park rules and resource protection, continue to use efficient mix of seasonal and volunteer staff to provide onsite management presence. Participate in partnerships that help meet management objectives.

Molalla River/Table Rock

Primary Market Strategy: Community

Niche: Offers a wide variety of settings and recreation activities within 10 miles of a large rural community and 60 miles of large urban populations. Uplands provide year round non-motorized trail opportunities and the Molalla River is popular for summer fishing, swimming, and rafting. Table Rock Wilderness (TRW) offers more remote opportunities with scenic overlooks, mountain meadows and forested non-motorized trails.

Management Objectives: To provide the facilities and visitors services needed for resource protection and a wide spectrum of outdoor recreational and nature study opportunities in a variety of natural settings from rural to primitive and social settings from highly interactive to more remote. To provide a variety of visitor information media and support to special events that promote "Leave No Trace" use practices, public land stewardship, and partnerships.

Targeted Outcomes:

Activities: Hiking, biking, equestrian use, camping, picnicking, swimming, fishing, boating, hunting, and natural resource education

Experiences: Enjoying closeness of family and friends and group affiliation and togetherness, enjoying having access to hands-on outdoor natural resource educational facilities and activities, and getting some needed physical rest and reducing built-up mental tensions and escaping everyday responsibilities for awhile in both developed and remote areas

Benefits: Improved mental health and health maintenance, stronger ties with family and friends; personal growth and development with greater self-reliance associated with improved outdoor skills, and positive economic contribution to nearby rural communities

Prescribed Setting Character:

Physical: The entire area is characterized by a forested setting of various ages. The Molalla River is more developed where timber management, roads, designated campsites, vaulted restrooms, and signs are frequently observable. Aquila Vista Environmental Education Site has trails, shelters, and a vaulted restroom for use in outdoor natural resource educational programs by schools and other groups. The uplands along the Molalla River are less developed with gravel roads and single-track trails and minimal signage and TRW more primitive with trailhead parking, signs, and single-track trails.

Social: Encounters with others along the Molalla River is more frequent and intensive than in the uplands along the trail system with the most remote area being within the wilderness.

Administrative: Regular patrols and visitor contact are made by agency recreation staff and law enforcement along the Molalla River with lower levels of agency presence in the uplands.

Activity Planning Framework:

Management: Continue to provide agency presence and facility management for resource protection and a variety of recreation opportunities. Consider new facility and program development as needed.

Marketing: Work with interested groups to provide visitor information both on and off site.

Monitoring: Continue recreation staff/law enforcement patrols, resource monitoring, and seek input from visitors.

Administrative: Complete a SRMA plan to help identify future facility and program needs. To participate in partnerships that help meet management objectives.

Nestucca River

Primary Market Strategy: Community

Niche: Developed overnight camping, water-based day use recreation, and scenic driving opportunities

Management Objectives: With increasing public use of the Nestucca River corridor, it is necessary to manage the recreation resource to not only accommodate increased use but to protect or enhance recreation, watershed, and wildlife values present.

Targeted Outcomes:

Activities: Camping, picnicking, swimming, fishing, and scenic driving

Experiences: Relaxation, family and group bonding, escape from personal and social pressures, and opportunity to enjoy the sights and sounds nature has to offer

Benefits: Personal – better mental health and health maintenance, and restored sense of self; Psycho-physiological – enhanced feeling of freedom and refinement; Household and Community – greater family bonding, opportunity for more well-rounded childhood development, learning and

passing on of outdoor skills, and fulfilling the desire of simple living; and
Economic – positive contribution to regional economic stability

Prescribed Setting Character:

Physical: Four semi-developed campgrounds. Three with paved roads and parking surfaces and one walk-in site. The campgrounds border the Nestucca River, which is a free-flowing State Scenic Waterway through the Oregon Coast Range. The Nestucca Back Country Byway parallels the river winding through steep canyon walls of the coast range. It is located within a mature forest dominated primarily by Douglas fir.

Social: Medium visitor density. The campgrounds are approximately 5 acres in size each and range between 5 and 11 sites per campground. The larger campgrounds at full capacity can accommodate 11 families.

Administrative: Self-service fee booth at information kiosk. Regularly patrolled during summer months by law enforcement and other agency staff. Rules are clearly posted at fee station/information kiosk.

Activity Planning Framework:

Management: Continue to provide for a semi-developed camping experience and associated facilities with an emphasis on maintaining a front country recreational setting.

Marketing: Use visitor information to disperse recreation use throughout the recreation season to reduce crowding during peak-use periods and enhance the overall visitor experience. Use information and interpretation to lessen visitor conflicts and resource impacts in the recreation area. Inform visitor how user fees are being used in the operation of the recreation area. Solicit feedback from users and user groups on how they would like to see their fees used in the future.

Monitoring: Monitor visitor satisfaction.

Administrative: Apply administrative actions as needed to maintain a safe and enjoyable recreation experience and to conserve and restore the natural environment (i.e., visitor services, law enforcement presence, restoration, permitting, and fees).

Sandy River/Mt. Hood Corridor

Primary Market Strategy: Destination

Niche: Only 40 miles from the Portland metropolitan area, this SRMA offers a scenic corridor with a unique mix of both high-quality developed recreation and interpretive facilities and river greenway open space. Key features include the Sandy and Salmon Wild and Scenic Rivers (WSR), Wildwood Recreation Site, and the Barlow National Historic Trail.

Management Objectives: At developed sites provide clean, safe, enjoyable, and accessible facilities and outdoor recreational opportunities in a forested setting, and in undeveloped areas provide less developed open space for a variety of outdoor recreation and nature study opportunities. To provide recreation visitor with education, information, and interpretation designed to encourage stewardship and minimize user impacts and conflicts.

Targeted Outcomes:

Activities: Hiking, swimming, biking, fishing, non-motorized boating, individual, nature study, picnicking, scenic driving, historic study, and hunting

Experiences: Enjoying closeness of family and friends and group affiliation and togetherness, enjoying easy access to natural landscapes and getting some needed to strenuous physical exercise, enjoying having access to hands-on outdoor natural resource educational facilities and activities, and getting some needed physical rest and reducing built-up mental tensions

Benefits: Improved mental health and health maintenance, stronger ties with family and friends, positive economic contribution to nearby rural communities

Prescribed Setting Character:

Physical: Modifications such as paved roads, utilities, houses, businesses, and some forest management are readily observable along U.S. Highway 26. Wildwood Recreation Site is a highly developed park located along the Salmon WSR in a forested setting that features an interpretive watershed and fisheries trail with a unique in-stream fish viewing window, an interpretive wetlands boardwalk, flush restrooms, and group facilities. The Sandy River and uplands offer less developed areas.

Social: Wildwood has more frequent and intensive interaction with some groups, while less developed areas along the Sandy River have less intensive interaction and may include low to moderate encounters with other visitors.

Administrative: Park staff presence high with seasonal staff and volunteer hosts staying onsite and conducting frequent fee compliant checks and maintaining park facilities and cleanliness. Rules are clearly posted in sites and areas.

Activity Planning Framework:

Management: Manage park facilities for a high level of facility maintenance, safety, cleanliness, and accessibility. To the extent possible, maintaining park's desirable mature forest and native vegetation. Continue to support environmental education activities. As needed, address management issues on less developed areas.

Marketing: Work with interested groups to provide visitor information both on and off site.

Monitoring: Continue recreation staff/law enforcement patrols and work with volunteers to meet resource monitoring needs and seek input from visitors.

Administrative: Complete an SRMA plan to help identify future facility and program needs. Participate in partnerships that help meet management objectives.

Yaquina Head Outstanding Natural Area

Primary Market Strategy: Destination

Niche: Access to a unique coastal headland setting with historic lighthouse and ocean front settings for traditional recreation uses, resource appreciation, education, and interpretation

Management Objectives: Promote the conservation and development of the area's scenic, natural, and cultural resource values; protect the area's wildlife habitat; and make use of the area for education, scientific study, and public recreation activities.

Targeted Outcomes:

Activities: Access to the ocean for bird watching, whale and harbor seal watching, nature study, tide pooling, visiting an historic lighthouse, hiking, interpretive programs, and environmental education

Experiences: Learning about and enjoying nature, enjoying the closeness of family, relishing group affiliation and togetherness, enjoying having easy access to natural landscapes, exercise and physical fitness, escaping everyday responsibilities for awhile, learning more about wildlife and the marine environment, and learning more about northwest coastal maritime history

Benefits: Improved mental health and health maintenance; personal development and growth; supporting a more outdoor-oriented lifestyle; improved opportunity to view wildlife; improved fitness and health; greater family bonding, more well-rounded child development, enhanced lifestyle, access to low cost recreation opportunities; positive contributions to local economic stability; and maintenance of distinctive recreation setting character, greater community ownership of recreation and natural, cultural and heritage resources, and greater protection of wildlife habitats

Prescribed Setting Character:

Physical: Developed recreation and interpretive site with paved roads and parking lot surfaces, a large interpretive center on a marine coastal headland. Landscape varies from ocean front beach and tide pool environment to unmodified coastal forest to urban park-like settings. The overall physical setting character is rural.

Social: High visitor density – approximately 340,000 visitors annually

Administrative: Controlled access entrance station. Patrolled daily by agency staff. Rules and regulations are clearly posted throughout the park. High presence of regulatory and interpretive signs. High degree of visitor control.

Activity Planning Framework:

Management: Continue to provide for a high-quality day use interpretive experience and maintain the associated facilities with an emphasis on maintaining a rural recreation setting.

Marketing: Use interpretation to increase visitor awareness of coastal marine wildlife habitat and maritime history, disperse use throughout the season to reduce crowding at peak periods to enhance the overall visitor experience and lessen visitor conflicts and resource impacts.

Monitoring: Monitor visitor satisfaction on a periodic basis to determine the appropriateness of management activities, signage, fees, etc.

Administrative: Apply administrative actions as needed to maintain a safe and enjoyable recreation experience and to conserve and restore the natural and historical setting.

Yellowstone

Primary Market Strategy: Community

Niche: Features the scenic Quartzville Creek Wild and Scenic River (WSR), which is easily accessed by the paved Quartzville National Back Country Byway (BCB) Road. A unique feature includes large stands of old-growth forest.

Management Objectives: To provide a wide range of outdoor recreation opportunities and protect Quartzville Creek WSR. To provide facilities, river access and administrative control that support resource protection, visitor safety, health, and enjoyment. To provide recreation visitor with education, information, and interpretation designed to encourage stewardship and minimize user impacts and conflicts.

Targeted Outcomes:

Activities: Hiking, biking, camping, picnicking, swimming, fishing, boating, hunting, scenic driving, recreational mining, and mining history

Experiences: Enjoying closeness of family and friends and group affiliation and togetherness and enjoying easy access to natural landscapes, enjoying having access to hands-on outdoor natural resource educational facilities and activities, getting some needed physical rest and reducing built-up mental tensions, and enjoying more strenuous exercise and exercise and escaping crowds

Benefits: Improved mental health and health maintenance, stronger ties with family and friends, personal growth and development with greater self-reliance associated with improved outdoor skills, and positive economic contribution to nearby rural communities

Prescribed Setting Character:

Physical: The entire area is characterized by a forested setting of various ages, but with old-growth forest dominating BLM lands. Lands along Quartzville Creek Wild and Scenic River are more developed, including three developed recreation sites and other modifications such as paved roads, designated river campsites, and visitor signs. The uplands in the northern part of the SRMA are less developed with gravel roads and very little evidence of human activities except past timber management activities.

Social: The social setting along Quartzville Creek has more frequent and intensive interaction with some group interaction, while the uplands have less intensive use and lower encounters.

Administrative: Regular patrols and visitor contact are made by agency recreation staff and law enforcement along the Quartzville Creek with low levels of agency presence in uplands.

Activity Planning Framework:

Management: Continue to manage recreation sites for a high level of facility maintenance, and sites and the corridor for visitor safety, cleanliness, and resource protection. To the extent possible, maintain desirable mature forest and native vegetation at parks.

Marketing: Work with interested groups to provide visitor information both on and off site.

Monitoring: Continue patrolling with recreation and law enforcement staff, continue monitoring resources, and continue seeking input from visitors.

Administrative: To provide high-quality visitor service and to ensure compliance with park and corridor rules and resource protection, continue to use efficient mix of seasonal and volunteer staff to provide park and corridor management presence. To participate in partnerships that help meet management objectives.

Eugene District

Lower Lake Creek

Primary Market Strategy: Destination

Niche: Opportunities for swimming and water play in a natural setting; hiking, mountain biking

Management Objectives: Improve visitor safety and decrease health hazards; enhance visitors' recreation experience and appreciation of natural resources.

Targeted Outcomes:

Activities:

- Water play, hiking, mountain biking, primitive camping

Experiences:

- Enjoy socializing with friends and families in a scenic area
- Physical activity (hiking and mountain biking) in a scenic area

Benefits:

- Relaxation, physical exertion; interaction with family and friends

Prescribed Setting Character:

Physical: Adjacent to a state highway; rustic amenities away from developed parking lot

Social: High levels of visitation; no possibility for solitude. Crowding expected on high-use weekends.

Administrative: Regulations posted; regular visitor services and law enforcement presence.

Activity Planning Framework:

Management: Continue to provide for improved visitor safety and health as described in the Lower Lake Creek RAMP (1997).

Marketing: Use information and interpretation to increase visitor awareness of safety and health issues in the SRMA.

Monitoring: Monitor visitor satisfaction.

Administrative: Apply administrative actions as needed to maintain a safe and enjoyable experience.

McKenzie River

Primary Market Strategy: Destination

Niche: Opportunities for nonmotorized boating, fishing, environmental education.

Management Objectives: Provide river-oriented recreation opportunities in coordination with other recreation providers along the river corridor.

Targeted Outcomes:

Activities: Fishing, boating, scenic viewing, resource interpretation

Experiences: Water-based physical activity in a roaded natural setting

Benefits: Outdoor skills development, exercise, relaxation, enjoyment of forested surroundings

Prescribed Setting Character:

Physical: Mostly natural appearing environment as viewed from sensitive roads and trails. Some obvious onsite controls of visitors. Access and travel is conventional motorized vehicles (e.g., sedans, RVs, etc.) and watercraft (primarily non-motorized).

Social: Visitor encounters common, but some chance for privacy

Administrative: Regular BLM staff patrols during high-use season (May-September). Interagency maintenance agreement continued to address routine maintenance needs of some developed sites.

Activity Planning Framework:

Management: Manage for continued water-based recreation activities. Incorporate interpretive/educational opportunities to strengthen visitor understanding and appreciation of the natural environment. Maintain river access opportunities.

Marketing: Continue to work with other agencies and private partners to promote responsible recreational use of the river corridor.

Monitoring: Monitor for visitor compliance, capacity and satisfaction. Draw upon university resources for periodic surveying.

Administrative: Provide visitor services and law enforcement presence.

Row River Trail

Primary Market Strategy: Destination

Niche: Opportunities for bicycle riding on paved trail, horseback riding

Management Objectives:

- Provide a broad spectrum of resource-dependent recreation opportunities to meet the needs and demands of public land visitors.
- Foster interagency efforts to improve service to the visiting public.
- Maintain high-quality recreation facilities to meet public needs and enhance the image of the agency.
- Improve public understanding and support of the Bureau by effectively communicating the agency's multiple use management programs to the recreation visitor.

Targeted Outcomes:

Activities: Bicycle riding, walking, horseback riding

Experiences: Physical activity in a rural setting

Benefits: Exercise, appreciation of natural surroundings, feelings of accomplishment

Prescribed Setting Character:

Physical: Rural—adjacent to heavily traveled paved county road

Social: Rural—small group size, but encounters with others are commonplace; traffic noise prevalent

Administrative: Rural—A substantial amount of information is provided along the trail; BLM presence daily during the high-use season.

Activity Planning Framework:

Management: Continue to provide hard-surface non-motorized riding opportunities; provide trailheads with parking lots and basic amenities. Provide interpretive signage along the trail.

Marketing: Include on printed and web-based media generated by BLM; work with partners to promote the trail.

Monitoring: Monitor for visitor compliance and satisfaction

Administrative: Provide visitor services and law enforcement presence. Maintain OHV closure on trail.

Shotgun Creek

Primary Market Strategy: Destination

Niche: Opportunities for organized group events, swimming, picnicking, and hiking.

Management Objectives:

- Provide resource-based, nonmotorized recreation activities.
- Promote organized group gatherings.
- Maintain facilities that offer convenience to visitors.
- Minimize visitor conflicts between groups.

Targeted Outcomes:

Activities: Group events, picnicking, hiking, competitive sport activities

Experiences: Physical activity, comport in a developed setting

Benefits: Exercise, companionship, appreciation of natural surroundings

Prescribed Setting Character:

Physical: Natural forested setting containing facilities/amenities typical of those found in urban recreation sites, including opportunities for competitive sporting events

Social: Small to large group accommodations offered. Opportunity to observe/affiliate with others.

Administrative: BLM staff and volunteer presence daily. Low cost/low maintenance fee collection procedures established.

Activity Planning Framework:

Management: Provide group event and nonmotorized trail opportunities

Marketing: Distribute print and internet-based media, partner with independent newspaper media to promote recreation site.

Monitoring: Monitor for visitor compliance and safety.

Administrative: Provide high level of visitor services from May-October; collect recreation use fees from May-October; maintain OHV closure; administer group shelter rental program.

Upper Lake Creek

Primary Market Strategy: Destination

Niche: Regionally important opportunities for fishing, horseback riding, camping, and nonmotorized boating

Management Objectives:

Roaded natural): Protect natural and scenic qualities of the SRMA around Hult Reservoir while allowing for rustic recreation facility development.

Semi-primitive motorized: Maintain existing semi-primitive setting, natural appearing environment, and allow for development of multiple use nonmotorized trails.

Targeted Outcomes:

Activities:

- Roaded natural: Fishing, camping, boating (lake), hiking, horseback riding
- Semi-primitive motorized: Hiking, horseback riding, OHV use on designated roads.

Experiences:

- Enjoyment of natural settings and scenic values Benefits:
- Offer comfort in an outdoor setting
- Improved health and safety of visitors
- Enhanced appreciation of natural settings

Prescribed Setting Character:

Physical: RN – adjacent to all-weather paved road, small dam, bridge, and fish ladder readily apparent. SPM – roads available for motorized vehicle use are generally graveled surface, relatively high density of roads.

Social: RN – relatively small group size, but mostly within sight and sound of others; high traffic level on paved road. SPM – small group size, less likely to encounter others.

Administrative: RN – rules posted; BLM presence on most summer weekends. SPM: occasional regulatory signage; some BLM presence.

Activity Planning Framework:

Management: Provide for rustic day use and overnight facilities as described in the Upper Lake Creek RMP (2005).

Marketing: Provide visitor use and experience opportunity information through a variety of media including web-based, brochures and onsite information.

Monitoring: Monitor visitor satisfaction.

Administrative: Apply administrative actions as needed to maintain a safe and enjoyable recreation experience and to conserve and restore the natural setting (e.g., visitor services, law enforcement, volunteer organizations for trail maintenance)

Roseburg District

Cow Creek

Primary Market Strategy: Destination

Niche: Back Country Byway; semi-developed day-use and river access; potential for overnight camping..

Management Objectives:

- Provide a broad spectrum of resource dependent recreation opportunities to meet the needs and demands of visitors as prescribed in the Cow Creek Rec. Area Management Plan.
- Withdraw developed sites from mineral entry. Monitor and deter vandalism.
- Operate in accord with adjacent landowners and manage backcountry byway.
- Develop camping opportunities within the scenic corridor, including the Island Recreation Site..

Targeted Outcomes:

Activities: Driving for pleasure, watchable wildlife, historical interpretation, camping, picnicking, recreational gold panning, other river activities, biking, and hiking.

Experiences: Group and family affiliations, escape from social pressure, physical exercise, developing outdoor skills, exploration and enjoying outdoor resources and viewsheds.

Benefits: Personal – Increased physical fitness, obtaining greater self confidence, savoring the senses of the natural environment, enjoying participation in desired activities in preferred outdoor setting, experiencing a greater sense of independence and exploration.

Psychological – Better mental health, reducing built up tensions, feeling of personal freedom and exhilaration, enjoying a risk taking adventure, improved outdoor skills.

Economic – Increased local tourism revenue, reduced health maintenance costs.

Environmental – Increased commitment to maintain quality natural, greater local community support to manage natural resources to be enjoyed by prosperity.

Prescribed Setting Character:

Physical: Varies from small developed recreation sites to natural areas of river and rolling forested hills. Landscaping varies from forest to managed park like environments. The overall physical setting character is rural.

Social: The social setting varies on three areas of the SRMA: 1) Cow Creek Back Country Byway – Moderate visitor density; 2) Cow Creek River – Low visitor density; 3) Developed recreation sites – Moderate visitor density during use season.

All settings are within a narrow corridor, but due to length, crowding seems diminished.

Administrative: The SRMA is mainly accessed from the south and north ends of the byway, however, other access points are available.

Activity Planning Framework:

Management: Provide for quality recreation settings and facilities to support a wide variety of recreation opportunities for preferred benefit outcomes. Strengthen partnerships with local and other federal agencies. Utilize volunteers. Maintain a middle country to rural recreation setting.

Marketing: Disseminate brochures, post information on the internet, and post news releases.

Monitoring: Conduct patrols to sites within the area. Collect visitor use statistics and user preferences. Perform safety inventories annually.

Administrative: Determine and apply administrative actions as needed to promote quality recreation experiences, protect the character of settings, minimize user conflicts, promote safety of visitors and protect the natural resources. Issue Special Recreation Permits.

North Umpqua

Primary Market Strategy: Destination

Niche: Developed overnight and day-use recreation; non-motorized river recreation, undeveloped non-motorized use area, and a paved access corridor.

Management Objectives:

- Enhance recreation opportunities through management plans, including: North Bank Ranch, North Umpqua Wild and Scenic River, and North Umpqua National Scenic Byway.
- Provide recreational opportunities compatible with the management of Columbia White Tail deer within the North Bank Habitat Management Area.
- Maintain high-quality recreation facilities to meet public needs and provide for quality recreation experiences in preferred settings. Withdraw developed sites from mineral entry.
- Coordinate volunteer host program and recreation partnerships with Umpqua National Forest.

Targeted Outcomes:

Activities: Camping, picnicking, hiking, wildlife viewing, rafting, kayaking, swimming, fishing, hunting, driving for pleasure, group gatherings, collecting forest products.

Experiences: Individual, family and group affiliations, escape from personal social pressure, achievement and challenge from adventure, physical exercise, enjoying outdoor resources.

Benefits: Personal – Increased physical fitness, learning outdoor skills, testing endurance, obtaining self confidence, experiencing a greater sense of independence and exploration.

Psychological – Better mental health, personal satisfaction achieved in outdoor quests, releasing or reducing built up tensions or stress, feeling of personal freedom and exhilaration.

Economic – Increased local tourism revenue, increased work productivity after experiences.

Environmental – Increased commitment to maintain quality natural settings for future recreation activities and opportunities, greater community support to manage natural resources.

Prescribed Setting Character:

Physical: Varies from developed recreation sites to natural areas of forested to semi-forested hills. The overall physical setting character is rural.

Social: 1) North Umpqua River – Low visitor density on W&SR section, high use in bait fishing area of Swiftwater; 2) North Umpqua Trail – Low visitor density; 3) North Umpqua Scenic Byway – High visitor density during summer use season; 4) Developed Recreation Sites – High visitor density during camping season; 5) North Bank Ranch – Low density.

Administrative: The entire area is accessed through specific areas where visitors can be monitored. Regular patrols and field presence are common. Rules are posted at sites. Brochures are available. Volunteer hosts reside seasonally or year round at seven sites.

Activity Planning Framework:

Management: Provide for quality recreation settings and facilities to support a wide variety of recreation opportunities. Strengthen partnerships. Utilize volunteers. Maintain rural setting.

Marketing: Disseminate brochures, post information on the internet, post news releases. Implement tourism actions from management plans of the byway and Wild and Scenic River.

Monitoring: Conduct regular field patrols. Collect visitor use statistics and preferences. Conduct safety inventories. Document river activities in the annual North Umpqua Wild & Scenic River Monitoring Report.

Administrative: Apply administrative actions to promote quality recreation, protect settings, minimize user conflicts, promote visitor safety, and protect natural resources. Partner with the Umpqua National Forest on management of the North Umpqua Wild and Scenic River and National Scenic Byway.

Umpqua

Primary Market Strategy: Community

Niche: Developed overnight and day-use recreation sites along river corridor

Management Objectives:

- Manage recreation use to protect natural resources, provide visitor safety, and minimize user conflicts. Withdraw developed sites from mineral entry.
- Maintain high-quality recreation facilities to meet public needs and provide for quality recreation experiences in a preferred setting.
- Cultivate quality volunteer hosts who provide service to users of recreation sites and river.

Targeted Outcomes:

Activities: Camping, picnicking, wildlife viewing, water play/swimming, fishing, driving for pleasure, viewing scenery, organized group gathering and socializing, off-highway vehicles.

Experiences: Individual, family and group affiliations, developing outdoor skills.

Benefits: Personal – Increased physical fitness, learning outdoor skills, testing endurance, obtaining self confidence, enjoying desired activities in preferred outdoor setting.

Psychological – Better mental health, personal satisfaction achieved in outdoor quests, releasing or reducing built up tensions or stress, feeling of personal freedom and exhilaration.

Economic – Increased local tourism revenue, reduced health maintenance costs.

Environmental – Increased commitment to maintain quality natural settings, greater local community support to manage natural resources.

Prescribed Setting Character:

Physical: Varies from highly developed recreation sites to forested areas. Landscaping includes managed park like environments. The overall physical setting character is rural.

Social: The social setting varies on three areas of the SRMA: 1) The Umpqua River – Low visitor density; 2) Developed recreation sites – High visitor density during camping season.

Administrative: Parts of the SRMA are accessed through areas where visitors can be monitored. Regular patrols are common. Rules are posted at sites and brochures are available. Volunteer hosts reside year-round at two recreation sites.

Activity Planning Framework:

Management: Provide for quality recreation settings and facilities to support a wide variety of recreation opportunities. Utilize volunteers. Maintain a rural recreation setting.

Marketing: Provide brochures, post information on the internet, and post news releases about recreation opportunities, rules, and special events.

Monitoring: Conduct patrols to use sites and collect use statistics and preferences. Perform safety inventories annually. Monitor volunteer efforts.

Administrative: Apply administrative actions as needed to promote quality recreation experiences, protect the character of settings, minimize user conflicts, promote safety of visitors and protect the natural resources. Issue Special Recreation Permits as needed.

Coos Bay District

Coos Bay Shorelands

Primary Market Strategy: Community

Niche: Access for ocean, coastal, and bay-front dependant recreation activities.

Management Objectives:

- Promote awareness of and appreciation for the many resource values and recreational opportunities, and support a minimum impact land use ethic through educational programs such as Leave No Trace and Tread Lightly.
- Manage the area to provide for a range of recreational opportunities that contribute to meeting recreation demand while protecting natural, cultural, and scenic resources.

- Provide and maintain visitor facilities, services, signage, and programs that are appropriate for the area's recreational opportunity setting that serves to protect the sensitive resources.

Targeted Outcomes:

Activities: Access to the ocean and bay for clamming, fishing, crabbing, boating, surfing, and wind sports. Four-wheel drive and off-highway vehicle touring, hunting, hiking, horseback-riding, mushroom hunting, bird watching, dispersed camping.

Experiences: Developing outdoor skills; experiencing a greater sense of independence, exploring, closeness of family, and group affiliation; easy access to natural landscapes; exercise and physical fitness; and an ability to utilize natural resources for personal enjoyment.

Benefits: Psychological – better mental health, personal development and growth, supporting an outdoor-oriented lifestyle, and greater freedom from urban living; Household and Community – greater family bonding, more well-rounded children, enhanced lifestyle, easy access to low-cost recreation opportunities; Economic – positive contributions to local economic stability, maintenance of community's distinctive recreation-tourism market, increased desirability as a place to live or retire; Environmental – maintenance of distinctive recreation setting character, greater community ownership of recreation and natural resources, greater protection of wildlife and plant habitats from growth and development.

Prescribed Setting Character:

Physical: Rural to front/middle country setting comprised of sand dune, wetlands, meadows, shore pine uplands, and bay/ocean front beaches. BLM's developed site includes a boat ramp, a parking lot, restrooms, interpretive kiosk, dock, and volunteer host site.

Social: Visitor encounters can be high during peak use periods at the boat ramp. Encounters diminish along the sand roads and are rare along the non-motorized trail system.

Administrative: Primarily in the form of fences, gates and posted regulatory signs. Patrolled frequently by BLM staff and county and BLM law enforcement officers.

Activity Planning Framework:

Management: Provide a range of opportunities that contribute to meeting recreation demand while protecting resources. Provide and maintain

visitor facilities, services, signage, and programs that are appropriate for the area's setting and serve to protect sensitive resources.

Marketing: Use information and education to lessen potential conflicts between visitors and manage impacts to natural, cultural and scenic resources.

Monitoring: Monitor visitor satisfaction and recreation-related resource impacts.

Administrative: Apply administrative actions to maintain a quality recreation experience.

Dean Creek Elk Viewing Area

Primary Market Strategy: Community

Niche: Unparalleled opportunities to view a Roosevelt elk herd in a day-use wildlife observation and interpretive site.

Management Objectives:

- Provide safe opportunities for the public to view and study elk, other wildlife and their habitats at Dean Creek.
- Provide high-quality forage for the elk as a means of maintaining herd health and supporting public viewing opportunities.
- Provide facilities and programs that support visitor safety; wildlife viewing; and interpretive, educational and passive recreational uses, all of which are compatible with the elk and other wildlife that inhabit Dean Creek.
- Manage visitor use to avoid unacceptable conflicts with, or damage to, wildlife and their habitats. Manage visitor use so elk and other wildlife retain their wild instincts and actions, by providing them freedom to roam the entire area without human intervention.

Targeted Outcomes:

Activities: Wildlife viewing, photography, interpretive and educational programs.

Experiences: Learning more about wildlife and wetlands, enjoy the experience of viewing an elk herd and natural landscapes, and physical rest

Benefits: Psychological – personal appreciation and satisfaction – closer relationship with the natural world, improved opportunity to view wildlife close-up; Economic – positive contributions to regional economic stability, increased local tourism revenue, maintenance of community's distinctive recreation-tourism character; Environmental – retention of rural landscape features, maintenance and enhancement of habitat for elk and other wildlife.

Prescribed Setting Character:

Physical: Developed wildlife viewing and interpretive site with paved road and parking lots, a large covered interpretive wayside and restrooms. Landscape is rural pastureland and tidally affected wetlands and forested islands on the banks of the Umpqua River.

Social: Visitors are confined to specified routes and viewing areas at Dean Creek, creating a setting with a high density of visitors, especially during peak use periods.

Administrative: Most of the property is closed to all public entry, except for the designated viewing areas. The area is regularly patrolled by law enforcement, BLM staff and volunteers. Fences and gates, posted rules, and no trespassing signs are common.

Activity Planning Framework:

Management: Continue to provide for a high-quality wildlife viewing and interpretive experience and maintain facilities with an emphasis on the rural recreation setting.

Marketing: Use information and interpretation to increase visitor awareness of wildlife habitat and wetland management. Work closely with the gateway community of Reedsport and other partners in the region in marketing and outreach.

Monitoring: Monitor visitor satisfaction and resource conditions based on stated objectives.

Administrative: Apply administrative actions to maintain a safe and enjoyable wildlife viewing experience while protecting the elk herd from harassment.

Loon Lake/East Shore

Primary Market Strategy: Destination

Niche: Developed overnight camping and access to water-based day use recreation.

Management Objective: Provide a clean, safe, enjoyable experience for visitors.

Targeted Outcomes:

Activities: Camping, picnicking, beach activities, access to power boating and interpretive programs.

Experiences: Family and group affiliation, physical rest, and to escape from personal-social pressures.

Benefits: Personal – Better mental health and health maintenance; Psycho-physiological - restored body from fatigue; Household and Community – greater family bonding, opportunity for more well-rounded childhood development; learning and passing on of outdoor skills, reduced social isolation; Economic – positive contribution to regional economic stability.

Prescribed Setting Character:

Physical: Developed recreation site with paved road and parking lot surfaces within a mature Douglas fir forest on the shore of a natural lake. Landscaping varies from unmodified forest to urban-like park settings. The overall physical setting character is rural.

Social: High visitor density – accommodates over 850 people within the developed 35 acre campground and day use area when at full capacity.

Administrative: Controlled access entrance station. Regularly patrolled by law enforcement and other agency staff. Resident staff during the summer recreation season. Rules are clearly posted throughout the park.

Activity Planning Framework:

Management: Continue to provide for a developed camping and day use experience and associated facilities with an emphasis on maintaining a rural recreation setting.

Marketing: Use visitor information and the reservation system to disperse use and reduce crowding during peak periods to enhance the overall visitor experience at Loon Lake. Use information and interpretation

to lessen visitor conflicts and resource impacts in the recreation area. Inform visitors how their fees are being used in the operation of the recreation area and solicit feedback from them on how they would like to see their fees used in the future.

Monitoring: Monitor visitor satisfaction and the natural setting values within the area.

Administrative: Apply administrative actions as needed to maintain a safe and enjoyable recreation experience and to conserve and restore the natural setting at Loon Lake (i.e., permits and fees, visitor services, law enforcement, restoration/renovation).

New River

Primary Market Strategy: Community

Niche: Opportunities to explore undeveloped coastal uplands, river and ocean-front settings for traditional recreation uses, resource appreciation, and educational and interpretive programs.

Management Objectives:

- Accommodate low-impact recreational use at New River while providing a variety of experience opportunities to help meet existing and anticipated demands.
- Promote awareness and appreciation for New River's many resource values, especially those significant to its Area of Critical Environmental Concern designation.
- Provide adequate supervision, visitor facilities, services, signage, and programs to protect resources and support planned visitor use activities and levels.
- Provide reasonable access with minimal impact on resources and visitor experiences.

Targeted Outcomes:

Activities: Access to the ocean and river for fishing, waterfowl hunting, and kayaking, hiking, bird watching, photography, nature study, interpretive programs and environmental education.

Experiences: Learning about and enjoy nature; developing outdoor skills; experiencing independence, enjoying the closeness of family, group affiliation, exercise; escape pressures.

Benefits: Psychological – personal development and growth, supporting an outdoor-oriented lifestyle, improved opportunity to view wildlife,

greater freedom from urban living; Household and Community – greater family bonding, more well-rounded children, enhanced lifestyle, access to low cost recreation opportunities; Economic –contributions to local economic stability, maintenance of community's distinctive recreation-tourism market niche, increased desirability as a place to live, increased property values for adjacent land owners; Environmental – maintenance of distinctive recreation setting, greater community ownership of recreation and natural resources, greater protection of habitats from development.

Prescribed Setting Character:

Physical: Primarily a rural to front/middle country setting that includes diverse coastal habitats, sand dunes and ocean-front beaches. Facilities at Storm Ranch include a learning center, parking lots, restrooms, interpretive kiosk, picnic tables and a host site.

Social: Visitor encounters are highest (10-20 contacts) during peak use periods at Storm Ranch and Floras Lake. Encounters diminish significantly on the trail network and river.

Administrative: Primarily in the form of gates and posted regulatory signs. Area is closed to the public at night. Patrolled frequently by BLM staff and law enforcement. Interpretive and environmental education programs are used to increase awareness and to lessen impacts.

Activity Planning Framework:

Management: Provide opportunities that contribute to meeting recreation demand while protecting resources. Provide and maintain visitor facilities, services, signage, and programs.

Marketing: Use information and education to lessen potential visitor conflicts and resource impacts. Exercise discretion in promoting the recreation opportunities to minimize crowding.

Monitoring: Monitor visitor satisfaction and recreation-related resource impacts.

Administrative Apply administrative actions to maintain a quality recreation experience compatible with the appropriate setting and to protect sensitive resources.

Sixes River

Primary Market Strategy: Destination

Niche: Developed camping, water based day-use activities, and recreational gold mining.

Management Objectives:

- Provide the facilities, services and administrative designations needed to manage the activities associated with recreational use.
- Manage the existing recreation sites consistent with Roaded Natural to Roaded Modified management classes. Continue to provide for a range of recreation opportunities in the area, including individual to large-sized group camping and picnicking experiences within the Edson Creek Recreation Site.

Targeted Outcomes:

Activities: Camping, picnicking, fishing, social gatherings, swimming, non-motorized boating, recreational gold panning and sluicing.

Experiences: Family and group affiliation; physical rest; escape from personal-social pressures; ability to collect and utilize natural resources for personal enjoyment (e.g., fishing and recreational mining).

Benefits: Personal - better mental health and health maintenance, greater self reliance, stronger ties with family and friends; Psycho-physiological - restored body from fatigue; Household and Community - greater family bonding, opportunity for more well-rounded childhood development, learning and passing on of outdoor skills, reduced social isolation; Economic - positive contribution to regional economic stability.

Prescribed Setting Character:

Physical: Developed recreation sites along the banks of the Sixes River, varying from an unmodified alder and Douglas fir forest to a rural park setting.

Social: High visitor density in the developed campgrounds when operating at peak capacity. During the off-season visitor contacts can be less than 10 per day.

Administrative: Regularly patrolled by law enforcement and other agency staff. Both campgrounds are fee areas and rules are clearly posted throughout the recreation area.

Activity Planning Framework:

Management: Continue to provide for a developed camping and day use experience and associated facilities with an emphasis on maintaining a rural recreation setting.

Marketing: Use information and interpretation to lessen visitor conflicts and resource impacts in the recreation area. Inform visitors how fees are being used in the operation of the recreation area and solicit feedback from them on how they would like to see their fees used in the future.

Monitoring: Monitor visitor satisfaction and recreation-related resource impacts based on the SRMA objectives.

Administrative: Apply administrative actions to maintain a safe and enjoyable recreation experience and to conserve and restore the natural setting of the Sixes River (e.g., permits and fees, visitor services, law enforcement, restoration/renovation).

Tioga

Primary Market Strategy: Undeveloped

Niche: Undeveloped Coast Range setting for traditional forest-based recreation activities.

Management Objectives: An SRMA management plan has not been developed to establish management objectives for this area.

Targeted Outcomes:

Activities: Driving for pleasure, big game hunting, fishing, mushroom gathering, camping in developed campgrounds, primitive dispersed camping, hiking, mountain biking/bicycling.

Experiences: Developing skills and abilities; experiencing a greater independence, exploring, enjoying nature, utilize resources for personal enjoyment, physical fitness; escape pressures.

Benefits: Psychological – better mental health, personal development and growth, greater self reliance, improved outdoor skills and self confidence, stronger ties with family, friends, and the natural world, a more outdoor-oriented lifestyle, enhanced sense of personal freedom; Psycho-physiological – improved physical fitness and health, restored body from fatigue;

Household and Community – greater family bonding, reduced social isolation, passing on outdoor skills and values, more well-rounded children, enhanced lifestyle; Economic – access to low cost outdoor recreation experiences, positive contribution to local economic stability, maintenance of the region's distinctive recreation market niche and character

Prescribed Setting Character:

Physical: Developed recreation sites include: Park Creek Campground, Burnt Mountain Recreation Site, and the Doerner Fir Trail. The area contains tracts of substantially unmodified forest landscapes in the Cherry Creek Research Natural Area and Wilderness Instant Study Area, the Tioga Creek Area of Critical Environmental Concern and the China Wall Area of Critical Environmental Concern.

Social: Social encounters are very low except the Park Creek Campground during the peak of summer and fall hunting season. Visitors may encounter log trucks on the roadways and other activities commonly associated with commercial forestry practices on public and private land.

Administrative: Very few administrative controls except for gates and some regulatory signs. Infrequent patrol by law enforcement and other BLM employees involved in visitor services.

Activity Planning Framework:

Management: Provide a developed camping experience at Park Creek and associated facilities with an emphasis on maintaining a front country recreation setting. Maintain existing trails and evaluate the conversion of closed roads for additional hiking, mountain biking, equestrian, and ohh-highway vehicle opportunities. Develop new trails to connect with existing opportunities in the area.

Marketing: Use information and interpretation to lessen visitor conflicts and resource impacts with an emphasis on low impact recreation practices. Provide information to visitors about forest management practices, stream restoration and wildlife habitat management efforts.

Monitoring: Monitor visitor satisfaction and recreation-related resource impacts.

Administrative: Apply administrative actions to maintain a safe and enjoyable recreation experience within the Park Creek Campground and to conserve the middle country and backcountry settings of the area. Keep administrative controls to the minimum necessary to meet objectives in order to preserve the primitive setting valued by visitors.

Medford District

Hyatt Lake-Howard Prairie Lake

Primary Market Strategy: Destination

Niche: Sub-alpine plateau featuring two lakes adjacent to the Cascade/ Siskiyou National Monument.

Management Objectives: Address Special Recreation Management Area issues and prioritize projects in watershed analyses or separate recreation area management plans as appropriate. Prepare project plans as needed. Provide for water-based recreation opportunities, winter sports, hiking, camping, equestrian use, fishing, and sightseeing.

Targeted Outcomes:

Activities: Camping, fishing, swimming, hiking, winter sports, equestrian use, wildlife observation, and nature interpretation.

Experiences: Escape personal or social pressures. Relaxation in a forested mountain setting. Enjoy the company of family and friends, the use of recreation equipment, and exercising.

Benefits: Restored mind from unwanted stress; improved mental well being; improved skills for outdoor enjoyment; stronger ties to family and friends.

Prescribed Setting Character:

Physical: Sub-alpine forested plateau featuring two lakes with excellent fisheries, boating opportunities, hiking opportunities, and scenic vistas. The area is of a semi-developed rural character and is accessible by county roads, state highways, and BLM roads.

Social: Moderate to high visitor density during peak use periods. Off-season periods offer opportunities for solitude, especially in undeveloped areas suitable for dispersed recreation. Campgrounds are generally full on weekends with much interaction between camping groups and BLM personnel.

Administrative: Most campgrounds have controlled access entrance stations with no reservations. County, state, and BLM law enforcement patrol periodically. Campground hosts provide visitor services.

Land ownership is mixed between county, state, private, and BLM.

Activity Planning Framework:

Management: Provide the widest array of recreation opportunities available in a forest, lake, mountain, and trail environment. Provide for winter sports opportunities. Emphasize camping and water based recreation.

Marketing: This SRMA markets itself and is a perennial favorite destination for the local population of the Rogue Basin and Klamath Basin. BLM and Jackson County distribute brochures and literature describing the attractions of the area.

Monitoring: During peak use periods, agency staff perform daily monitoring in high-use density areas, providing visitor services and noting and mitigating any resource damage. Periodic customer satisfaction surveys are conducted.

Administrative: On BLM lands, provide visitor information to ensure proper use of public lands, employ law enforcement measures as appropriate, and cooperate with county and private landowners to preserve and maintain the natural character of the area.

Pacific Crest National Scenic Trail

Primary Market Strategy: National strategy for long-distance hikers, local strategy for short-distance hikers and equestrian users

Niche: This 40-mile portion of the trail offers high elevation hiking and outstanding opportunities for solitude and primitive camping along the Cascade-Siskiyou Mountains.

Management Objectives: Protect and preserve the physical, aesthetic, social and biological environments characteristic within the trail corridor. Provide interpretive information at all access points. Maintain trail conditions as prescribed by BLM standards. Cooperate with trail groups, other agencies, and private landowners in the overall management of the trail.

Targeted Outcomes:

Activities: Long distance and day hiking, equestrian use, photography, wildlife observation, sightseeing, camping, hunting, and cross-country jogging.

Experiences: Solitude and self reliance. Escape stress and pressure of the outside world. Enjoy physical exercise, challenge, and adventure of long distance wilderness hiking.

Benefits: Development of improved physical endurance. A restored mind from unwanted stress. Enhanced awareness of nature and natural processes.

Prescribed Setting Character:

Physical: The trail corridor is generally within a short distance of the ridge crest and proceeds below timberline through coniferous forest stands, abbreviated by occasional meadows. Water sources are generally uncommon. Frequent encounters with grazing livestock.

Social: Encounters with other hikers and equestrian riders are nominal away from trailheads.

Administrative: The trail passes through federal, state, county, and private lands. BLM's dominant management role is apparent to hikers as all signage is BLM produced. Law enforcement presence is negligible with the exception of very infrequent patrols.

Activity Planning Framework:

Management: Continue to monitor use patterns to detect trends and predict changes. Practice adaptive management techniques to react to changing conditions and user needs.

Marketing: Information provided at trailheads, road crossings, or at agency offices provides the user with a description of features along the trail, adjacent recreation opportunities, and information on the differing types of uses a hiker may encounter. Maintain an updated agency webpage covering trail conditions, attractions, available resources and their location. Cooperate with trail groups, managing agencies, and landowners to promote proper use.

Monitoring: Use passive electronic trail counters for visitor use information. Provide comment and message journals at trailheads. Through the trail website, encourage and request users to contact BLM and offer assessments as to trail conditions or other observations. When possible, utilize BLM staff, or volunteers to conduct foot patrols.

Administrative: Assume a proactive role in trail management, obviating any problems or conditions before any degradation of the recreation resource occurs. Use appropriate signage to alert hikers of land ownership, jurisdictional boundaries, use regulations, and emergency services.

Rogue National Wild and Scenic River

Primary Market Strategy:
Employ a nationally based destination marketing strategy

Niche: The Rogue River is renowned for its broad array of outstandingly remarkable values: superior fisheries, outstanding scenery, challenging white water, and historical significance all combine to make the Rogue stand out as a nationally significant component of the National Wild and Scenic Rivers System.

Management Objectives: Manage the designated portion of the Rogue River to protect its outstandingly remarkable values.

Targeted Outcomes:

Activities: Motorized and non-motorized white water boating, camping, fishing, swimming, hiking, photography, wildlife observation, and tributary exploration.

Experiences: Family and group affiliation, physical rest, escape from personal and social pressures, experience a risk activity, develop outdoor skills, develop nautical skills, appreciate natural wonders, and enjoyment of a relatively natural and undisturbed environment.

Benefits: Better mental health, restored mind from unwanted stress, greater self reliance, improve skills for outdoor enjoyment, and enhanced awareness and understanding of nature.

Prescribed Setting Character:

Physical: Within the designated "Wild" section of the river, visitors experience a primitive and relatively undeveloped coastal confluence river corridor with challenging rapids requiring advanced boating skills. Within the designated "Recreation" section, visitors experience a semi-developed shoreline with adjacent roads and dwellings, flatter terrain, and slow water.

Social: Within the designated "Wild" river classification, visitors encounter mostly non-motorized boating groups and shore-side campers. Encounters with others are sporadic with long time periods between contacts. Within the designated "Recreation" section, motorized tour boats are common and the dominant conveyance for visitors.

Administrative: BLM, state, and county jurisdictions overlap along the entire river stretch. BLM has the dominant role in administrative presence. Regular river maintenance and permit compliance trips are performed by BLM staff. County marine deputies provide the majority of law enforcement services. BLM manages 47 miles of the river's 84-mile long designated length. The 33-mile "Wild" section is under a limited entry permit system, allowing approximately 120 people per day to proceed down river from Grave Creek to Watson Creek. Private party permits are obtained through a lottery conducted yearly. Commercial parties are allocated approximately half of these spaces based on historic use levels.

Activity Planning Framework:

Management: Manage the entire designated BLM portion according to management plans.

Marketing: The Rogue enjoys a national reputation for its outstanding qualities. An active website is maintained to educate potential visitors regarding the opportunities.

Monitoring: Visitor numbers, types of uses, physical, social and biological resource conditions are monitored according to the prescriptive measures outlined in the river's management plans.

Administrative: Adaptive management is applied as necessary to ensure that the river's outstandingly remarkable values are either maintained or enhanced.

Klamath Falls Resource Area

Gerber

Primary Market Strategy: Community

Niche: Provide opportunities for roaded natural and semi-primitive recreation experiences.

Management Objectives: Manage Gerber Recreation site with camping units to accommodate overnight, day use and mobility impaired visitors; Frog camp day use area; and boat ramps. Manage several nearby semi-developed camp sites to provide primitive camping and day use. Manage and maintain the Gerber Watchable Wildlife Area Tour. In addition, develop or enhance watchable wildlife and other interpretive sites to showcase resource management. Manage area for roaded natural and semi-primitive recreation opportunities.

Targeted Outcomes:

Activities: Camping, fishing, wildlife viewing, hunting, OHV driving

Experiences: Opportunities for solitude, achievement/stimulation, enjoying nature

Benefits: Greater self-reliance, improved outdoor skills, greater sense of adventure, physical fitness

Prescribed Setting Character:

Physical: Provide roaded natural and semi-primitive recreation experiences.

Social: Low (6 to 10 parties per day) to moderate (10 to 50 parties per day) recreation use levels (moderate near developed sites and roads, and low to moderate in other areas).

Administrative: Onsite regimentation and controls present, but are subtle. Camp hosts provided at Gerber Recreation site (fee site).

Activity Planning Framework:

Management: Facilities include developed and semi-developed campgrounds, day use areas, boat ramps, hiking trail, Watchable Wildlife and Klamath Basin Birding Trail viewing site. Seasonal road closure in Gerber Block from November 1 to April 15.

Marketing: New brochure has been developed. Area is identified on Klamath Basin Birding Trail map.

Possible enhancement measures include additional interpretive panels and sign.

Monitoring: Area is OHV limited to existing roads, with additional seasonal road closures in place. Miller Creek ACEC, Gerber Reservoir, Willow Valley Reservoir and several streams are closed to OHV use. Limited onsite administration (except at Gerber Recreation site where camp hosts are provided)

Administrative: Limited onsite administration, primarily at Gerber Recreation site and during regular patrols and law enforcement.

Hamaker Mountain

Primary Market Strategy: Community

Niche: Roaded natural recreation opportunities, including mountain biking, hiking, OHV, competitive hill climbs and winter sports within the Klamath Falls urban area.

Management Objectives: Manage SRMA for Roaded Natural recreation opportunities. Design timber management and other activities to enhance future trail and site development with an emphasis on winter sports and mountain biking. Examples of timber management activities that would enhance recreation would include the development of cleared trails suitable for downhill or cross country skiing. Trails would be replanted with vegetation to benefit wildlife and would be unavailable for future timber harvest. The identification and resolving of specific recreation management issues and prioritization of projects (developed parking areas, designated trails, etc.) will occur during watershed analysis (completed) or recreation area planning. Establish a BLM patrol during winter months to provide visitor assistance on Hamaker Mountain. Coordinate with Federal Aviation Administration (FAA) on access road plowing, maintenance, improvements. Winter recreation opportunities limited if road is not regularly plowed by FAA.

Targeted Outcomes:

Activities: Winter sports, mountain biking, hiking, OHV trail riding, competitive events

Experiences: Exercise, Escape physical pressure, enjoying nature

Benefits: Greater self-reliance, improved outdoor skills, greater sense of adventure, physical fitness. Close to urban area recreation opportunities.

Prescribed Setting Character:

Physical: Roaded natural opportunities.

Social: About equal opportunities for affiliation with other user groups and for isolation from sights and sounds of man. Concentrations of users are low to moderate.

Administrative: Onsite controls and restrictions offer a sense of security. Rustic facilities provided.

Activity Planning Framework:

Management: No facilities currently provided. New facilities to include trailheads, designated OHV routes, developed trails, group use areas and winter sports trails and parking areas. Seasonal fire restrictions limit OHV use. Opportunity to tie-in with Klamath Sportsman's Park.

Marketing: New brochure to be developed once facilities are developed and needed easements are in place. Opportunities for concession for permitted travel/shuttle service.

Monitoring: Ongoing monitoring to be conducted during spring through fall months to monitor use, facility conditions and reduce user conflicts. Monitoring of winter use when snow is adequate for recreation activities.

Administrative: OHV use limited to existing roads (existing condition). OHV use is to be limited to designated trails once OHV inventory is completed. Limited onsite administration, primarily patrols and law enforcement. ATV allocation committee grants to be pursued for facility development and law enforcement.

Pacific Crest National Scenic Trail

Primary Market Strategy: Destination.

Niche: This 0.5-mile portion of the trail offers high elevation hiking and outstanding opportunities for solitude and primitive camping along the Cascade-Siskiyou Mountains.

Management Objectives: Protect and preserve the physical, aesthetic, social and biological environments characteristic within the trail corridor. Provide interpretive information at all access points. Maintain trail conditions as prescribed by BLM standards. Cooperate with trail groups, other agencies, and private landowners in the overall management of the trail.

Targeted Outcomes:

Activities: Long distance and day hiking, equestrian use, photography, wildlife observation, sightseeing, camping, hunting, and cross-country jogging.

Experiences: Solitude and self reliance. Escape stress and pressure of the outside world. Enjoy physical exercise, challenge, and adventure of long distance wilderness hiking.

Benefits: Development of improved physical endurance. A restored mind from unwanted stress. Enhanced awareness of nature and natural processes.

Prescribed Setting Character:

Physical: The trail corridor is generally within a short distance of the ridge crest and proceeds below timberline through coniferous forest stands, abbreviated by occasional meadows. Water sources are generally uncommon. Frequent encounters with grazing livestock.

Social: Encounters with other hikers and equestrian riders are nominal away from trailheads.

Administrative: The trail passes through federal, state, county, and private lands. BLM's dominant management role is apparent to hikers as all signage is BLM produced. Law enforcement presence is negligible with the exception of very infrequent patrols.

Activity Planning Framework:

Management: Maintenance for the Klamath Falls Resource Area section of the trail is coordinated by the Medford District BLM. Monitor use patterns to detect trends and predict changes. Practice adaptive management to react to changing conditions and user needs.

Marketing: Information provided at trailheads, road crossings, or at agency offices provides the user with a description of features along the trail, adjacent recreation opportunities, and information on the differing types of uses a hiker may encounter. Maintain an updated agency webpage covering trail conditions, attractions, available resources and their location. Cooperate with trail groups, managing agencies, and landowners to promote proper use.

Monitoring: Use passive electronic trail counters for visitor use information. Provide comment and message journals at trailheads. Through the trail website, encourage and request users to contact BLM and offer assessments as to trail conditions or other observations. When possible, utilize BLM staff, or volunteers to conduct foot patrols.

Administrative: Assume a proactive role in trail management, obviating any problems or conditions before any degradation of the recreation resource occurs. Use appropriate signage to alert hikers of land ownership, jurisdictional boundaries, use regulations, and emergency services.

Stukel Mountain

Primary Market Strategy: Community

Niche: Semi-primitive motorized and non-motorized trail opportunities within the Klamath Falls urban area. Includes proposed hiking, horseback, mountain biking, and OHV trail opportunities; and hang gliding launch area.

Management Objectives: Manage SRMA for semi-primitive motorized and non-motorized recreation opportunities. The identification and resolving of specific recreation management issues and prioritization of projects (designated off-highway vehicle trails, ease of public access, developed recreation sites, etc.) will occur during watershed analysis or recreation area planning. Improve main road access. Consider development of hang gliding and other facilities for day use and overnight camping. Improve legal access through easements.

Targeted Outcomes:

Activities: Hiking, mountain biking, horseback riding, OHV tour routes

Experiences: Exercise, Escape physical pressure, enjoying nature

Benefits: Greater self-reliance, improved outdoor skills, greater sense of adventure, physical fitness

Prescribed Setting Character:

Physical: Semi-primitive motorized and non-motorized opportunities

Social: Concentrations of users is low except on weekends where it is moderate

Administrative: Onsite regimentation and controls present, but are subtle

Activity Planning Framework:

Management: No facilities currently provided. New facilities to include trailheads, designated OHV routes, developed trails, camping areas and hang gliding. Seasonal road closure from Nov. 1 to April 15.

Marketing: New brochure to be developed once facilities are developed and needed easements are in place.

Monitoring: Ongoing monitoring to be conducted during spring through fall months to monitor use, facility conditions and reduce user conflicts.

Administrative: Limited onsite administration, primarily patrols and law enforcement.

Upper Klamath River

Primary Market Strategy: Destination recreation tourism.

Niche: Outstanding summer whitewater boating, fishing and camping opportunities.

Management Objectives: Manage for semi-primitive motorized recreation objectives. Manage the area to emphasize whitewater boating, fishing and camping along the upper Klamath River. Improve and expand Stateline take-out, scouting trails for the Caldera and Hell's Corner rapids. Manage and maintain Topsy recreation site with camping units for overnight and day use visitors, boat ramp, the Spring Island rafting launch site, and several primitive camping sites along the Klamath River. Continue to follow the cooperative management agreement with the Pacific Power and Light Company for coordinated recreation trail and facility development. Nominate Topsy Road to the National Back Country Byway System. Maintain the Klamath River edge trail for non-motorized use.

Targeted Outcomes:

Activities: Whitewater boating, fishing, camping, off-highway vehicle driving, sightseeing

Experiences: Risk taking, opportunities for solitude, achievement/ stimulation, enjoying nature

Benefits: Greater self-reliance, improved outdoor skills, greater sense of adventure

Prescribed Setting Character:

Physical: Semi-primitive motorized

Social: Low to moderate interaction, (less on weekdays, moderate on weekends)

Administrative: Onsite regimentation and controls present but subtle

Activity Planning Framework:

Management: Facility development includes existing facilities (Topsy, Spring Island, Klamath River campground, Stateline, and dispersed camps), Future facilities include Bypass reach parking areas, boat launch and access trails, additional trails connecting Topsy campground with Copco village and Keno dam area.

Marketing: New brochure to be developed in conjunction with statewide developed facility brochure marketing. Other marketing done by commercial outfitters.

Monitoring: Ongoing monitoring for Wild and Scenic River and outfitter/guides to be done by primarily during the summer whitewater boating season.

Administrative: Limited onsite administration, primarily at Topsy campground, Spring Island boat launch and during regular seasonal patrols.

Wood River Wetland

Primary Market Strategy: Community

Niche: Provide opportunities for roaded natural and semi-primitive recreation experiences.

Management Objectives: Provide opportunities for roaded natural and semi-primitive recreation experiences (opportunities to have a high degree of interaction with the natural environment; to have moderate challenge and risk and to use outdoor skills). See Wood River RMP/EIS for additional management objectives and detailed guidance.

Targeted Outcomes:

Activities: Wildlife viewing, hiking, fishing, hunting, boating, dog walking.

Experiences: Exercise, Escape physical pressure, enjoying nature

Benefits: Greater self-reliance, improved outdoor skills, greater sense of adventure, physical fitness, rural recreation.

Prescribed Setting Character:

Physical: Provide roaded natural and semi-primitive recreation experiences.

Social: Low (6 to 10 parties per day) to moderate (10 to 50 parties per day) recreation use levels (moderate near developed sites and roads, and low to moderate in other areas).

Administrative: To manage the area for day use only. Recreation use and facilities would be secondary to the overall objective of wetland restoration and water quality improvement.

Activity Planning Framework:

Management: Facilities include a paved parking area, canoe/small boat launch, vault toilets, hiking trail, interpretive panels. Area closed to motorized use, and additional use restrictions (time of day, personal belongings, etc.).

Marketing: New brochure has been developed. Day use facilities and trail are developed as well as interpretive panels. Future development includes additional wetland and nature trails and environmental education gathering area. Area is identified as a site on the Klamath Basin Birding Trail map and is used for environmental and classroom education.

Monitoring: Area has a self-registration form, and additional monitoring occurs throughout the year by BLM staff and volunteers.

Administrative: Area is OHV closed (except for administrative uses), closed to overnight use, area open to hunting. Limited onsite administration, primarily patrols and law enforcement.

Appendix K. Wilderness Characteristics

This appendix provides background on the Evaluation and Planning Process for lands with wilderness characteristics.

In this appendix:

Wilderness Characteristics Analysis.....1257

Wilderness Characteristics Analysis

Introduction

BLM has developed an evaluation and planning process to consider wilderness characteristics during the western Oregon plan revisions. This process has been designed to: (1) review original wilderness inventories conducted by BLM between 1978 and 1980 to ensure current and accurate information exists to analyze the environmental impacts of alternatives on BLM lands with wilderness characteristics; and (2) address proposals from the public to inventory and protect BLM lands with wilderness characteristics.

BLM's authority to conduct wilderness reviews, including the establishment of new wilderness study areas, expired on October 21, 1993, pursuant to Section 603 of FLPMA. However, BLM has retained authority under Section 201 of FLPMA to inventory wilderness characteristics and to consider such information during land use planning. Through this planning process, BLM has discretion to determine which portions of BLM lands with wilderness characteristics would be protected under special management. However, BLM can not manage these areas under the non-impairment standard described in BLM's Interim Management Policy for Lands Under Wilderness Review (Handbook H-8550-1) which applies only to wilderness study areas.

BLM received scoping comments from the public to inventory and protect wilderness characteristics on specific BLM lands in western Oregon (hereinafter referred to as "public wilderness proposals"). These requests have been considered along with all other resource information during this land use planning process.

Protection of wilderness characteristics on O&C lands determined to be suitable for permanent timber production is considered to be inconsistent with the O&C Act. Information about the presence or absence of wilderness characteristics on these lands, therefore, is not necessary to make land use plan decisions. However, BLM has determined where O&C lands suitable for permanent timber production overlap public wilderness proposals in order to analyze how wilderness characteristics, if present, would be affected by each alternative.

Wilderness characteristics include: naturalness, outstanding opportunities for solitude, and outstanding opportunities for primitive and unconfined recreation. These characteristics must be present in a roadless area of at least 5,000 acres or a smaller roadless area that is of sufficient size to make practical its preservation in an unimpaired condition. A consideration used in this evaluation process is when a smaller BLM roadless area adjoins an identified roadless area of the U.S. Forest Service, and their combined acreage is a minimum 5,000 acres. In this situation, a determination has been made whether or not the BLM portion contains wilderness characteristics when considered in context with the U.S. Forest Service portion.

The size of the roadless area is a critical factor in the determination of the presence or absence of individual wilderness characteristics. If the size requirement is not met, then the area cannot be considered to possess wilderness characteristics, since such characteristics are dependent on the sufficient size of the roadless area. Wilderness characteristics within areas of sufficient size are defined as follows:

> *Naturalness.* Naturalness is present within an area that has been affected primarily by the forces of nature with the imprint of human activity substantially unnoticeable. Some imprints of human activity may exist if they are substantially unnoticeable. More consideration is given to "apparent naturalness" rather than "natural integrity." "Apparent naturalness" refers to whether or not an area appears to be in a natural condition to the average visitor who is not familiar with the biological composition of natural ecosystems versus human-affected ecosystems in a given area. Major influences on apparent naturalness are structures, evidence of past significant vegetative disturbance such as logging, and other obvious surface-disturbing activities. "Natural integrity" refers to the presence or absence of ecosystems that are relatively unaffected by human activity, such as the presence of native vegetative communities and absence of invasive species.
>
> *Outstanding Opportunities for Solitude.* "Solitude" is defined as the state of being alone or remote from others; isolation; a lonely or secluded place. "Outstanding" is defined as standing out among others of its kind; conspicuous; prominent; superior to others of its kind; distinguished; excellent. Presence of this wilderness characteristic considers an individual's opportunity to avoid the sights, sounds, and evidence of other people in the area. Factors that affect opportunities for solitude are the size and configuration of the unit; vegetative and topographic screening; ability of visitors to find a secluded spot, even when others are present in the area. Does not consider the sights and sounds of human activity outside of the unit's boundaries unless they are so extremely imposing that they cannot be ignored.
>
> *Outstanding Opportunities for Primitive and Unconfined Recreation.* Primitive and unconfined recreation includes activities that provide dispersed, undeveloped recreation which do not require facilities or motorized equipment. Some examples include but are not limited to: hiking, backpacking, fishing, hunting, caving, horseback riding, rock climbing, river running, cross-country skiing and bird watching. An area may possess outstanding opportunities for a primitive and unconfined type of recreation either through the diversity in the number of primitive and unconfined recreational activities possible or the outstanding quality of one opportunity.

The following includes a step-by-step evaluation and planning process that was used to: (1) review past wilderness inventories; (2) screen public wilderness proposals; (3) evaluate public wilderness proposals; (4) determine if proposed management would be applied to protect select units of BLM lands with wilderness characteristics; and (5) analyze each alternative's effect on all BLM lands with wilderness characteristics.

Step 1. Review past wilderness inventories.

BLM reviewed existing published wilderness inventory reports and maps that were prepared as a result of the original inventories conducted between 1978 and 1980, under Section 603 of FLPMA. This review enabled BLM to determine if public wilderness proposals contained any new information that was not considered as part of the original inventories.

Step 2. Screen public wilderness proposals.

All public wilderness proposals were organized by BLM district. These proposals were mapped in GIS and then overlaid with O&C lands suitable for permanent timber production. All proposals were considered in the evaluation process; however, portions of those that occur on O&C lands suitable for permanent timber production were not considered further for protection.

Step 3. Evaluate public wilderness proposals.

BLM then determined if lands specified in each public wilderness proposal overlap the boundary of an original wilderness inventory unit, and if so, if any wilderness characteristics were identified in the original inventory of those lands. If necessary, original inventories were updated. If an inventory was not previously completed for a portion of BLM lands contained within a public wilderness proposal, then an assessment was completed to determine if wilderness characteristics currently exist. In most cases, this assessment was completed using existing field knowledge of an area and remote-sensing techniques such as: digital ortho photography, forest operations inventory data, and ground transportation road network data. On-the-ground evaluations were conducted if a reasonable determination could not be made using these techniques. Evaluation reports that summarize these results were developed for all public wilderness proposals. These reports were the basis for making a final determination of which BLM lands contain wilderness characteristics.

Step 4. Determine if proposed management would be applied to protect selected lands with wilderness characteristics.

BLM districts selected one of the following outcomes for each unit of BLM lands that was determined to contain wilderness characteristics: (1) emphasize the protection of wilderness characteristics as a priority over other uses, excluding portions that occur on O&C lands suitable for permanent timber production; or (2) emphasize other uses as a priority over protecting wilderness characteristics.

Step 5. Analyze each alternative's affect on BLM lands with wilderness characteristics.

See the Planning Criteria for the process used to analyze each alternative's affect on BLM lands with wilderness characteristics.

Appendix L. Grazing

This appendix provides the background information regarding standards for range improvements, grazing allotments, and standards for rangeland health. These topics are referenced in Chapters 1 -3 in the Draft EIS.

In this appendix:

Standard Procedures and Design Elements for Range Improvements within the Klamath Falls Resource Area..... 1263

Grazing Allotments in the Klamath Falls Resource Area and Medford District..... 1270

Standards for Rangeland Health 1284

Standard Procedures and Design Elements for Range Improvements within the Klamath Falls Resource Area

Table 282. Proposed Klamath Falls Range Improvements by Allotment.

Allotment	Allotment Number	Type of Improvement	Number	Approximate Location
Edge Creek*	00102	Reservoirs	2 each	T41S, R5E, S.11; T40S, R5E, S.35
		Fencing	3 miles	T41S, R5E, S.11,12; T41S, R6E, S.4,5,6,7,8
Buck Mountain	00103	Fencing	2 miles	T39S, R5E, S.11,13
Buck Lake	00104	Fencing	2 miles	T38S, R5E, S.15,28,29; T38S, R6E, S.20
Dixie*	00107	Fencing	2 miles	T41S, R5E, S.5,7; T41S, R4E, S.1,2,12
Grubb Springs	00147	Reservoirs	2 each	T39S, R6E, S. 7,15
Stock Drive	00802	Fencing	1 mile	T39S, R11E, S.31
J Spring	00803	Fencing	1 mile	T38S, R14E, S.32
Barnwell	00807	Reservoirs	2 each	T39S, R11.5E, S.4,8
Drew	00817	Reservoir	1 each	T38S, R11.5E, S.5
		Fencing	2 miles	T38S, R11.5E, S.5,6; T37S, R11.5E, S.31,32
North Horsefly	00821	Reservoir	1 each	T37S, R14E, S.16
Stukel-O'Neill	00822	Fencing	3 miles	T39S, R10E, S.25,26; T40S, R10E, S.1,2
North Horsefly	00823	Reservoir	1 each	T37S, R14E, S.4,9
		Fencing	2 miles	T37S, R14E, S.4,9
Haskins	00826	Fencing	1 mile	T38S, R11.5E, S.29,30
Stukel-High	00827	Reservoir	1 each	T39S, R11.5E, S.30,31
Horton	00829	Reservoir	1 each	T39S, R11.5E, S.15
Ketcham	00835	Fencing	1 mile	T39S, R11E, S.19
Harpold Chaining	00836	Reservoir	1 each	T39S, R11E, S.21,27,28
		Fencing	2 mile	T39S, R11E, S.21,27,28
Windy Ridge	00838	Reservoirs	2 each	T39S, R11.5E, S.24,25
Bryant-Loveness	00839	Fencing	2 miles	T41S, R13E, S.5,6,7,8,17
Short Lake	00842	Fencing	2 miles	T39S, R11E, S.27,28
OK	00846	Reservoirs	2 each	T40S, R9E, S.15,21,22
		Fencing	2 miles	T40S, R9E, S.15,21,22,27,28
Swede Cabin	00847	Fencing	2 miles	T36S, R15E, S.28,30,32
Harpold Ridge	00851	Reservoirs	2 each	T39S, R11E, S.29,30,31,32
		Fencing	2 miles	T39S, R11E, S.29,30,31,32
Rodgers	00852	Reservoirs	2 each	T40S, R11E, S.5,6,7,8
		Fencing	3 miles	T40S, R11E, S.5,6,7,8,9,10
McCartie	00860	Fencing	1 mile	T38S, R11E, S.26,35
		Reservoir	1 each	T38S, R11E, S.26,35
Yainax	00861	Fencing	1 mile	T38S, R11E, S.1,12,13
Mills Creek	00865	Reservoir	1 each	T41S, R13E, S.7
		Fencing	2 miles	T41S, R13E, S.7

continued on next page

Bear Valley	00876	Reservoir	1 each	T40S, R15E, S.17,18
		Fencing	2 miles	T40S, R14.5E, S.24,25; T40S, R15E, S.19,30,31
DeVaul	00879	Fencing	1 mile	T39S, R13E, S.10,11,15
Goodlow	00881	Fencing	1 mile	T39S, R13E, S.9,10,15
Horton	00883	Reservoir	1 each	T39S, R12E, S.22
Panky Basin	00884	Reservoir	1 each	T39S, R13E, S.27,28
		Fencing	1 mile	T39S, R13E, S.27,28
Dry Prairie	00885	Reservoirs	2 each	T38S, R13E, S.27,34,36
Rock Creek	00888	Fencing	2 miles	T41S, R15E, S.9,17
Timber Hill	00889	Reservoirs	2 each	T41S, R14.5E, S.11,12,14,23
Williams	00892	Fencing	2 miles	T39S, R12E, S.10,15

* Located within the Pokegama Herd Management Area

The following standard procedures and design elements would be adhered to in implementation of the proposed construction of range improvements within the Klamath Falls Resource Area.

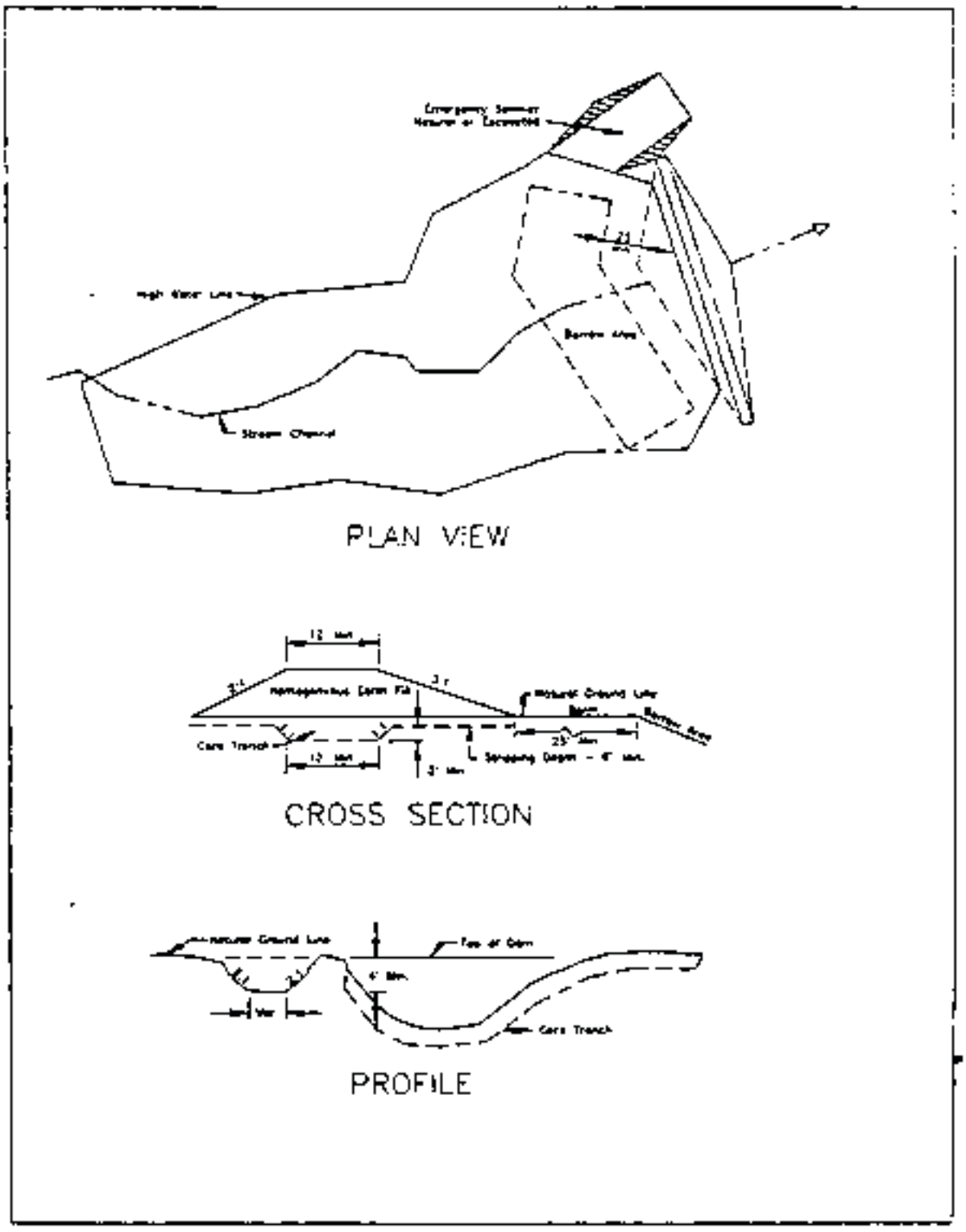
- Inventories and surveys for cultural resources, threatened and endangered species, and special status species would be conducted prior to authorization of any project construction, and appropriate mitigation implemented to reduce or eliminate potential effects.
- Surface disturbance at all project sites would be held to a minimum. Disturbed soil would be rehabilitated to blend into surrounding soil surface and reseeded as needed with a mixture of native grasses, forbs, and shrubs as applicable to replace ground cover, reduce soil loss from wind and water erosion, and discourage the potential establishment of any invasive, non-native plant species.
- Where possible, existing roads and trails would provide access for range improvement construction. If needed, unimproved trails and tracks would be created to reach construction sites and provide access for future maintenance of the improvements.

Additional design features specific to the individual types of improvements are described below.

Reservoirs

- Development of reservoirs would involve the construction of pits and dams to impound water for livestock and wildlife use as shown in Illustration 1.
- Pits would be in dry lake beds or other natural depressions. Dams would be constructed in drainages.
- Water rights applications would be coordinated with applicable agencies, irrigation districts, and other interested parties.
- Water rights would be obtained from the Oregon Water Resources Department prior to construction.
- Water storage capacity would range from 1.0 to 3.0 acre-feet.
- Dams would be located, if possible, to take advantage of natural spillway sites; otherwise a spillway would be constructed for the reservoir. The slopes of the dam must be a minimum 3 to 1 on the upstream face and minimum of 2 to 1 on the downstream face. Minimum width of the top of all dams would be 12 feet.
- The spillway would be designed to minimize the risk of the dam being overtopped during the design life of the structure.
- Fill material, if needed, would come from the impoundment area and/or a borrow area for dams.
- Excavated material from pits would be piled adjacent to the pit. Topsoil would be stockpiled and used to rehabilitate the borrow areas.

Figure 313. Reservoir Standards



Fencing

- Fences would be designed to prevent the passage of livestock without stopping the movement of wildlife as shown in Illustration 2.
- Wire spacing would follow the specifications found in Illustrations 3. The majority of fences would be constructed as follows: 4 wire with the bottom wire 16-18" off the ground with the sequence of the remaining three wires above this being 6", 6", and 12"; the maximum height of the fence (ground to top wire) would be 42".
- The bottom wire on all fencing would be two-strand smooth wire, not barbed, to facilitate antelope crossings.
- Steel "t-post" spacing would be between 16' and 24' depending on local conditions.
- Brace posts, tree scabs, and/or rock jacks (rock cribs) would be constructed to enhance fence integrity with one at least every ¼ mile.
- No woven wire "sheep" fences would be constructed on public lands.
- Brushing and tree limb removal will be limited to only that necessary for surveying, placement, and construction of a fence.
- Where fences cross existing roads, either gates or cattleguards would be installed.

Figure 314. Fence Standards

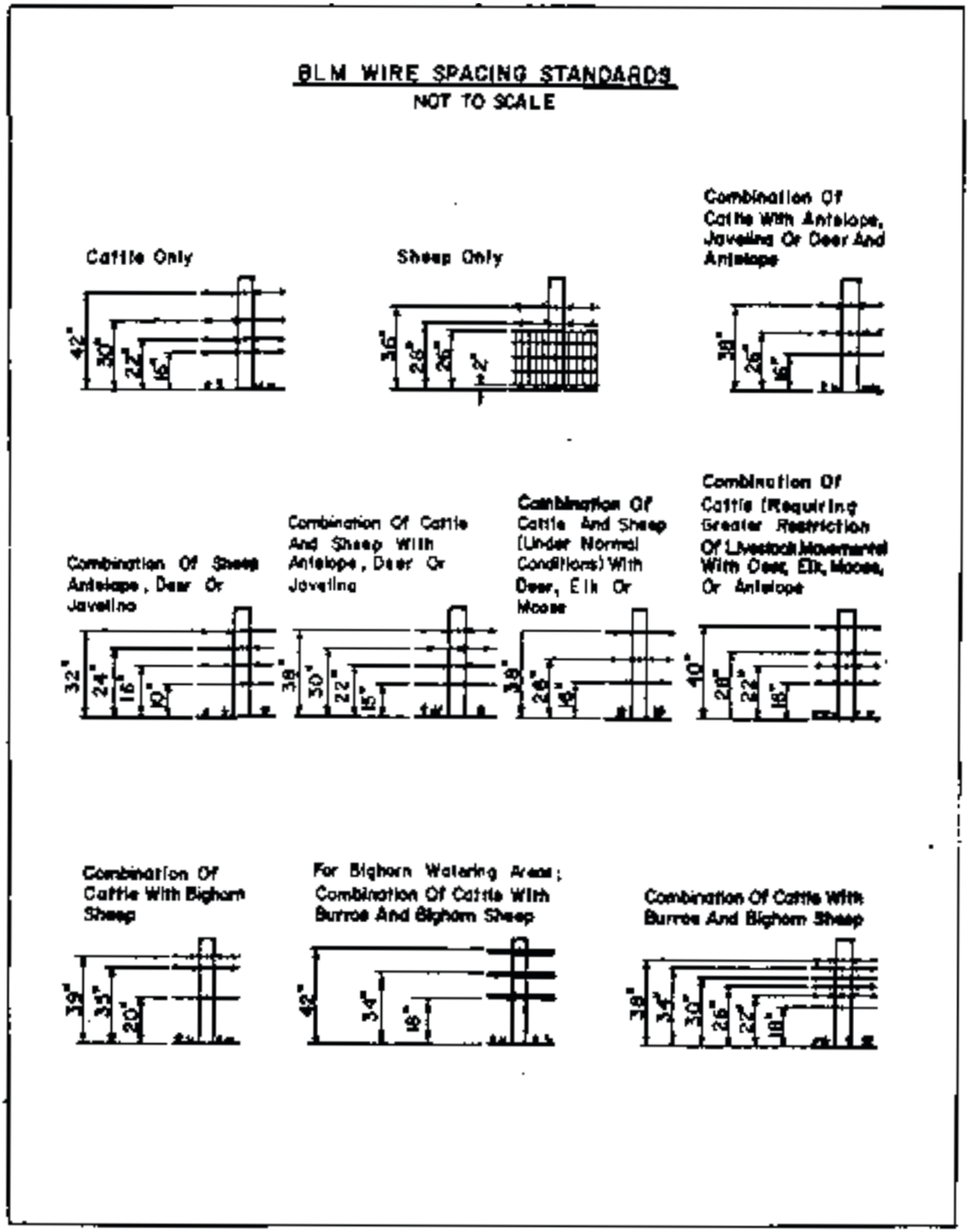
BLM Fence Standards for Livestock and Wildlife

Kinds of Use Combinations

Kinds of Livestock and Wild Horses...	Predominant Big Game Wildlife Species	Number Wires	Max. Fence Height in Inches	Wire Spacing (From Ground Up, in Inches)	Wire Type	Min. Steps Between Line Posts w/Spacing of 16.5' - 20'
STANDARD BOUNDARY FENCE:						
Cattle	None	4	42	16, 4, 8, 12	Barbed.	1 to 4
Sheep	None	—	36	2, 24 (Woven) 7, 8	Woven, barbed.	
STANDARD BOUNDARY MODIFICATIONS TO MEET MULTIPLE-USE NEEDS:						
Cattle (only)	Antelope, Javelina, or Deer and Antelope.	3	38	16, 10, 12	Bottom strand smooth, others barbed.	One w/post spacing of 16.5' — 1 or 2 w/post spacing of 20'.
Sheep (only)	Antelope, Javelina or Deer	4	32	12, 6, 8, 6 16.5' — 1 or 2	Bottom strand smooth, others barbed.	One w/post spacing of 16.5' — 1 to 3 w/post spacing of 20'.
Cattle and Sheep (Use only where sheep control is necessary.)	Antelope Javelina or Deer	4	38	12, 7, 8, 8	Bottom strand smooth, others barbed.	One w/post spacing of 16.5' — 1 to 3 w/post spacing of 20'.
Cattle and Sheep (normal conditions)	Deer, Elk, Moose, or Antelope.	3	38	16, 10, 12	Bottom strand smooth, others barbed.	3 to 4
Cattle and sheep (requires greater restriction of livestock movements.)	Deer, Elk, Moose, or Antelope.	4	40	16, 6, 6, 12	Barbed.	1 to 4
Cattle	Bighorn Sheep*	3	36	30, 12, 6	Barbed.	1 to 4
Cattle, Wild Horses	Bighorn Sheep* (Use around watering area)	—	42	16 to bottom rail; 34 and 42 to top of middle and top rails.	Rails 2"x3" diameter.	Line Post spacing 20 feet
Cattle, Wild Horses	Bighorn Sheep*	6	38	16, 4, 4, 4 6, 6	Bottom strand smooth, others barbed.	1 to 2

*These fences also meet antelope, and deer standards.

Figure 315. Wire Spacings



If future rangeland improvement projects are proposed beyond those listed above, additional site-specific analysis of the environmental consequences would be necessary. Such changes could result from new initiatives or funding sources, changes in management priorities, new laws/ regulations, litigation, site specific activity planning, or future Rangeland Health Assessments.

Grazing Allotments in the Klamath Falls Resource Area and Medford District

The Draft EIS provides a summary of the number and acres of grazing allotments for the Klamath Falls Resource Area and the Medford District. The following tables contain detailed information about these grazing allotments including proposed improvements.

Table 283. Klamath Falls Resource Area Grazing Allotments.

Allotment Name	Allotment Number	BLM Acres	Active Grazing Preference (AUMs)[2]	Suspended Grazing Preference (AUMs)	Season-of-Use	Selective Management Category[3]	Rangeland Health Assessment Completed	Rangeland Health Assessment Finding	Grazing System	Other Information
Chase Mountain	00101	8,823	195	0	5/15-8/13	C	2001	Not Meeting Standards, Grazing is not a factor	Yearly	None
Edge Creek	00102	8,860	207	0	5/1-9/1	I	2000	Not Meeting Standards, Grazing is not a factor	Deferred-Rotation	Proposed Range Improvement, Common Allotment, Exclosures or Other Areas Closed to Grazing, Portion Proposed for Closure
Buck Mountain[1]	00103	7,022	204	0	5/15-9/1	I	2000	Not Meeting Standards, Grazing is not a factor	Yearly	Proposed Range Improvement
Buck Lake	00104	11,971	280	0	6/15-10/15	C	2000	Not Meeting Standards, Grazing is not a factor	Yearly	Proposed Range Improvement, Common Allotment, Exclosures or Other Areas Closed to Grazing
Johnson Prairie	00105	120	12	0	5/1-10/1	C	2000	Not Meeting Standards, Grazing is not a factor	Yearly	None
Dixie[1]	00107	2,287	320	100	5/1-8/15	I	2002	Not Meeting Standards, Grazing is a factor	Yearly	Proposed Range Improvement Exclosures or Other Areas Closed to Grazing
Dry Lake	00140	145	10	0	5/1-6/30	C	2001	Not Meeting Standards, Grazing is not a factor	Yearly	None

Allotment Name	Allotment Number	BLM Acres	Active Grazing Preference (AUMs)[2]	Suspended Grazing Preference (AUMs)	Season-of-Use	Selective Management Category[3]	Rangeland Health Assessment Completed	Rangeland Health Assessment Finding	Grazing System	Other Information
Chicken Hills	00141	3,422	80	0	5/15-9/15	C	2001	Not Meeting Standards, Grazing is not a factor	Yearly	None
Long Lake	00142	363	18	0	6/16-9/30	C	2000	Meeting All Standards	Yearly	None
Grubb Springs	00147	3,524	130	0	5/1-9/30	C	2000	Not Meeting Standards, Grazing is not a factor	Yearly	Proposed Range Improvement
Adams	00800	40	6	0	4/15-7/15	C	2005	Not Meeting Standards, Grazing is a factor	Yearly	None
Haught	00801	400	27	0	5/1-7/31	C	Not Completed	Not Completed	Yearly	None
Stock Drive	00802	40	2	0	5/1-6/30	C	Not Completed	Not Completed	Yearly	Proposed Range Improvement
J Spring	00803	320	7	0	5/1-6/30	C	2003	Meeting All Standards	Yearly	Proposed Range Improvement
Bar CL	00804	480	20	22	5/1-5/31	C	Not Completed	Not Completed	Yearly	None
SE 80	00805	80	8	0	5/1-10/31	C	2006	Meeting All Standards	Yearly	None
Two Mile	00806	577	56	0	5/1-9/30	C	2006	Not Meeting Standards, Grazing is not a factor	Yearly	None
Barnwell	00807	1,708	100	0	5/1-6/15	C	Not Completed	Not Completed	Yearly	Proposed Range Improvement
Lee	00808	40	10	0	6/1-8/15	C	Not Completed	Not Completed	Yearly	None
Brown	00809	80	30	0	6/1-8/30	C	Not Completed	Not Completed	Yearly	None

Allotment Name	Allotment Number	BLM Acres	Active Grazing Preference (AUMs)[2]	Suspended Grazing Preference (AUMs)	Season-of-Use	Selective Management Category[3]	Rangeland Health Assessment Completed	Rangeland Health Assessment Finding	Grazing System	Other Information
Brenda	00810	185	18	0	5/16-6/30	C	2006	Meeting All Standards	Yearly	None
Cheyne	00811	875	51	0	5/1-6/15	C	2004	Meeting All Standards	Yearly	None
Stukel-Coffin	00812	760	55	0	5/1-7/1	C	2002	Meeting All Standards	Yearly	None
Cunningham	00814	840	108	0	5/1-6/15	C	Not Completed	Not Completed	Yearly	None
Stukel-Dehlinger C.	00815	1,680	240	0	4/15-8/8	I	2002	Meeting All Standards	Yearly	None
Stukel-Dehlinger H.	00816	440	30	0	5/10-8/10	C	2002	Meeting All Standards	Yearly	None
Drew	00817	720	72	0	5/1-6/30	C	2005	Meeting All Standards	Yearly	Proposed Range Improvement
Dupont	00819	79	7	0	4/15-6/1	C	Not Completed	Not Completed	Yearly	None
North Horsefly	00821	988	68	0	5/1-6/15	C	Not Completed	Not Completed	Yearly	Proposed Range Improvement
Stukel-O'Neill	00822	3,122	210	0	5/1-7/15	I	2002	Meeting All Standards	Yearly	Proposed Range Improvement Exclosures or Other Areas Closed to Grazing
North Horsefly	00823	920	60	0	6/16-8/1	C	Not Completed	Not Completed	Yearly	Proposed Range Improvement
Jeld-Wen	00824	240	24	0	6/1-7/15	C	2006	Meeting All Standards	Yearly	None
Naylox	00825	760	76	0	5/1-6/30	C	2005	Meeting All Standards	Yearly	None
Haskins	00826	560	80	0	5/1-7/15	C	2004	Meeting All Standards	Yearly	Proposed Range Improvement
Stukel-High	00827	239	17	0	5/1-6/15	C	2003	Meeting All Standards	Yearly	Proposed Range Improvement

Allotment Name	Allotment Number	BLM Acres	Active Grazing Preference (AUMs)[2]	Suspended Grazing Preference (AUMs)	Season-of-Use	Selective Management Category[3]	Rangeland Health Assessment Completed	Rangeland Health Assessment Finding	Grazing System	Other Information
Stukel-Hill	00828	960	60	0	5/1-6/15	C	2002	Meeting All Standards	Yearly	None
Horton	00829	760	26	0	4/21-6/30	C	Not Completed	Not Completed	Yearly	Proposed Range Improvement
Hungry Hollow	00830	280	40/H	0	6/1-8/30	C	2005	Meeting All Standards	Yearly	Proposed for Conversion from Horse to Cattle
Warlow	00831	460	50	0	5/1-9/30	C	Not Completed	Not Completed	Yearly	None
Jesperson	00832	1578	158	0	5/1-7/1	C	Not Completed	Not Completed	Yearly	None
Kellison	00834	335	19	0	5/1-6/13	C	2004	Not Meeting Standards, Grazing is a factor	Yearly	None
Ketcham	00835	320	20	0	5/1-6/15	C	Not Completed	Not Completed	Yearly	Proposed Range Improvement
Harpold Chaining	00836	900	96	0	5/1-5/30	C	Not Completed	Not Completed	Yearly	Proposed Range Improvement
Bryant-Horton	00837	1,249	130	0	6/1-7/9	C	2006	Meeting All Standards	Yearly	None
Windy Ridge	00838	600	52	0	5/1-5/31	C	Not Completed	Not Completed	Yearly	Proposed Range Improvement
Bryant-Loveness	00839	3,440	490	0	5/1-6/30	C	Not Completed	Not Completed	Yearly	Proposed Range Improvement
Bryant-Lyon	00840	565	38	0	5/1-9/30	C	Not Completed	Not Completed	Yearly	None
Marshall	00841	348	14	0	4/21-5/30	C	Not Completed	Not Completed	Yearly	None
Short Lake	00842	440	40	0	5/1-6/30	C	2005	Not Meeting Standards, Grazing is a factor	Yearly	Proposed Range Improvement

Allotment Name	Allotment Number	BLM Acres	Active Grazing Preference (AUMs)[2]	Suspended Grazing Preference (AUMs)	Season-of-Use	Selective Management Category[3]	Rangeland Health Assessment Completed	Rangeland Health Assessment Finding	Grazing System	Other Information
McAuliffe	00843	80	10	0	4/16-6/15	C	Not Completed	Not Completed	Yearly	None
Paddock	00844	440	31	0	5/1-6/30	M	2003	Meeting All Standards	Deferred-Rotation	None
Klamath Hills	00845	500	55	0	4/1-5/31	C	Not Completed	Not Completed	Yearly	None
OK	00846	1,260	105	35	5/1-6/15	C	Not Completed	Not Completed	Yearly	Proposed Range Improvement
Swede Cabin	00847	1,921	108	0	5/1-6/15	I	Not Completed	Not Completed	Yearly	Proposed Range Improvement
Pope	00848	724	57	0	5/1-7/31	C	Not Completed	Not Completed	Yearly	None
Rajnus Bros.	00849	240	16	0	5/1-6/17	C	Not Completed	Not Completed	Yearly	None
Wilkinson	00850	400	18	0	5/1-6/5	C	Not Completed	Not Completed	Yearly	None
Harpold Ridge	00851	1,043	108	0	4/21-6/30	M	2006	Meeting All Standards	Yearly	Proposed Range Improvement
Rodgers	00852	2,355	235	0	5/1-7/1	I	2003	Meeting All Standards	Yearly	Proposed Range Improvement Exclosures or Other Areas Closed to Grazing
7C	00853	688	104	0	5/1-6/30	C	Not Completed	Not Completed	Yearly	None
Jump	00854	200	20	0	5/1-5/30	C	Not Completed	Not Completed	Yearly	None
Bryant-Smith	00855	1,140	109	0	5/15-8/31	C	Not Completed	Not Completed	Yearly	None
Bryant-Stastny	00856	440	70	0	5/10-9/30	C	Not Completed	Not Completed	Yearly	None
Bryant-Taylor	00857	1,080	74	0	4/15-9/30	C	Not Completed	Not Completed	Yearly	None

Allotment Name	Allotment Number	BLM Acres	Active Grazing Preference (AUMs)[2]	Suspended Grazing Preference (AUMs)	Season-of-Use	Selective Management Category[3]	Rangeland Health Assessment Completed	Rangeland Health Assessment Finding	Grazing System	Other Information
Swan Lake Rim	00858	6,448	300	0	5/1-6/30	M	2006	Meeting All Standards	Rest-Rotation	Common Allotment
Cunard	00859	370	60/H	0	5/1-7/31	C	2002	Meeting All Standards	Rest-Rotation	Proposed for Conversion from Horse to Cattle
McCartie	00860	545	83	0	5/1-5/30	C	2004	Meeting All Standards	Rest-Rotation	Proposed Range Improvement
Yainax Butte	00861	2,520	120	0	7/1-9/30	M	2005	Meeting All Standards	Deferred-Rotation	Proposed Range Improvement Exclosures or Other Areas Closed to Grazing
Klamath Forest Estates	00862	2,520	47	0	5/1-5/31	M	2005	Meeting All Standards	Yearly	None
Wirth	00863	1,200	100	0	4/15-10/15	C	Not Completed	Not Completed	Yearly	None
Rajnus & Son	00864	1,440	110	0	5/1-6/30	C	Not Completed	Not Completed	Yearly	None
Mills Creek	00865	280	40	0	5/1-6/14	C	Not Completed	Not Completed	Yearly	Proposed Range Improvement
Bear Valley	00876	5,018	432	0	7/1-8/9	I	2000/2003	Meeting All Standards	Deferred-Rotation	Proposed Range Improvement, Common Allotment, Exclosures or Other Areas Closed to Grazing
Bumpheads	00877	9,220	420	265	4/21-6/30	I	2003	Not Meeting Standards, Grazing is a factor	Deferred-Rotation	Exclosures or Other Areas Closed to Grazing
Campbell	00878	1,465	47/H	13	5/1-10/26	C	2002	Meeting All Standards	Yearly	Proposed for Conversion from Horse to Cattle

Allotment Name	Allotment Number	BLM Acres	Active Grazing Preference (AUMs)[2]	Suspended Grazing Preference (AUMs)	Season-of-Use	Selective Management Category[3]	Rangeland Health Assessment Completed	Rangeland Health Assessment Finding	Grazing System	Other Information
DeVaul	00879	240	12	15	5/1-8/30	C	2003	Meeting All Standards	Yearly	Proposed Range Improvement
Goodlow	00881	285	32	52	5/1-8/31	C	2003	Meeting All Standards	Yearly	Proposed Range Improvement
Horsefly	00882	26,356	2656	2075	4/15-6/30, 10/1-11/15	I	1999/2003	Meeting All Standards	Rest-Rotation/ High Intensity-Short Duration	Exclosures or Other Areas Closed to Grazing, Common Allotment
Horton	00883	800	58	211	4/21-5/20	C	2002	Meeting All Standards	Yearly	Proposed Range Improvement
Pankey Basin	00884	282	43	38	5/15-8/31	C	2003	Not Meeting Standards, Grazing is a factor	Yearly	Proposed Range Improvement Exclosures or Other Areas Closed to Grazing
Dry Prairie	00885	7,231	642	358	5/1-9/30	I	1999/2003	Meeting All Standards	Rest-Rotation	Exclosures or Other Areas Closed to Grazing, Common Allotment, Proposed Range Improvement
Horse Camp Rim	00886	9,180	445	281	5/1-7/31	I	2003	Meeting All Standards	Rest-Rotation	Exclosures or Other Areas Closed to Grazing
Pitchlog	00887	9,280	434	796	5/10-6/30	I	1999/2003	Meeting All Standards	Rest-Rotation/ High Intensity-Short Duration	Exclosures or Other Areas Closed to Grazing
Rock Creek	00888	2,750	216	639	5/1-5/31	I	2003	Meeting All Standards	Rest-Rotation	Proposed Range Improvement
Timber Hill	00889	2,937	270	134	6/21-7/31	I	1999/2003	Meeting All Standards	Yearly	Proposed Range Improvement

Allotment Name	Allotment Number	BLM Acres	Active Grazing Preference (AUMs)[2]	Suspended Grazing Preference (AUMs)	Season-of-Use	Selective Management Category[3]	Rangeland Health Assessment Completed	Rangeland Health Assessment Finding	Grazing System	Other Information
Willow Valley	00890	20,460	1258	506	4/15-6/30	I	2000/2003	Not Meeting Standards, Grazing is a factor	Rest-Rotation	Exclosures or Other Areas Closed to Grazing, Common Allotment
Williams	00892	1,790	75	0	5/1-5/31	M	2004	Meeting All Standards	Yearly	Proposed Range Improvement
Fields	00893	180	6	0	4/21-5/20	C	2005	Meeting All Standards	Yearly	None
Voight	00894	112	8	0	5/1-6/15	C	2003	Meeting All Standards	Yearly	None
Harpold Canyon	00895	760	76	0	5/1-9/30	C	2006	Meeting All Standards	Yearly	None
McFall	00896	600	60	0	5/1-6/30	C	2006	Meeting All Standards	Yearly	Common Allotment
Bly Mountain	01800	120	9	0	6/1-8/31	C	Not Completed	Not Completed	Yearly	None
Wood River	30855	2,970	0	0	N/A	N/A	2000	Not Meeting Standards, Grazing is not a factor	N/A	Exclosures or Other Areas Closed to Grazing
		204,815	13,103	5,540						

[1]All or a portion of the allotment is located within the Cascade-Siskiyou National Monument

[2]Active Preference is cattle AUMs unless specified as H for domestic horse use

[3]Selective Management Categories: Improve (I)-managed to resolve a high level of resource conflicts and concerns and receive the highest priority for funding and management actions; Maintain (M)-managed to maintain satisfactory resource conditions and will be actively managed to ensure that resource values do not decline; Custodial (C)-managed custodially to protect resource conditions and values.

Table 284. Medford Grazing Allotments.

Allotment Name	Allotment Number	BLM Acres	Active Grazing Preference (AUMs)[2]	Suspended Grazing Preference (AUMs)	Season-of-Use	Selective Management Category[3]	Rangeland Health Assessment Completed	Rangeland Health Assessment Finding	Grazing System	Other Information
Lost Creek	10001	11,518	382	0	04/16-10/31	I	2001	Not Meeting Standards, Grazing is not a factor	Yearly	Common Allotment
Flat Creek	10002	12,421	328	0	05/01-10/15	C	2000	Not Meeting Standards, Grazing is not a factor	Yearly	None
Longbranch	10004	320	22	0	04/16-05/15	C	2002	Meeting All Standards	Yearly	Portion Proposed for Closure
Meadows	10007	1,564	92	0	04/16-06/30	I	2003	Meeting All Standards	Yearly	None
Neil-Tarbell	10008	552	56	0	04/16-05/31	C	2003	Meeting All Standards	Yearly	None
North Sams Valley	10009	120	8	0	06/16-07/31	C	2002	Not Meeting Standards, Grazing is not a factor	Yearly	None
Upper Table Rock	10012	1,240	66	0	05/01-05/30	I	2003	Not Meeting Standards, Grazing is not a factor	Yearly	None
Clear Creek	10013	3,790	45	0	05/16-10/31	C	2002	Meeting All Standards	Yearly	None
Lick Creek	10015	202	15	0	04/16-05/15	C	2003	Meeting All Standards	Yearly	None
Brownsboro Park	10016	381	68	0	04/16-05/31	I	2002	Not Meeting Standards, Grazing is not a factor	Yearly	None

Allotment Name	Allotment Number	BLM Acres	Active Grazing Preference (AUMs)[2]	Suspended Grazing Preference (AUMs)	Season-of-Use	Selective Management Category[3]	Rangeland Health Assessment Completed	Rangeland Health Assessment Finding	Grazing System	Other Information
Kanutchan Fields	10017	2,419	177	0	04/16-05/31	I	2002	Not Meeting Standards, Grazing is not a factor	Yearly	None
Sugarloaf	10019	1,566	15	0	04/16-06/30	C	2002	Meeting All Standards	Yearly	None
Section 9	10021	404	25	0	04/16-06/30	C	2003	Meeting All Standards	Yearly	None
Section 7	10022	371	11	0	04/16-05/31	C	2003	Not Meeting Standards, Grazing is not a factor	Yearly	None
Bull Run	10023	40	5	0	06/01-06/30	C	2003	Meeting All Standards	Yearly	None
Big Butte	10024	22,118	1,663	0	04/16-06/30	I	2000	Not Meeting Standards, Grazing is not a factor	Deferred-Rotation	Common Allotment
Reese Creek	10027	40	7	0	05/01-06/30	C	1999	Meeting All Standards	Yearly	Common Allotment
Derby Road Sawmill	10029	521	45	0	04/16-07/15	C	2003	Meeting All Standards	Yearly	None
Summit Prairie	10031	30,743	1,165	0	04/16-09/30	I	1999	Not Meeting Standards, Grazing is not a factor	Deferred-Rotation	Common Allotment
Vestal Butte	10035	2,240	120	0	04/16-06/15	I	2003	Not Meeting Standards, Grazing is not a factor	Yearly	None
Bear Mountain	10037	1,008	81	0	04/16-05/31	I	2002	Meeting All Standards	Yearly	None

Allotment Name	Allotment Number	BLM Acres	Active Grazing Preference (AUMs)[2]	Suspended Grazing Preference (AUMs)	Season-of-Use	Selective Management Category[3]	Rangeland Health Assessment Completed	Rangeland Health Assessment Finding	Grazing System	Other Information
Crowfoot	10038	7,393	365	0	04/15-16/30	I	2003	Meeting All Standards	Yearly	None
Crowfoot Creek	10039	521	70	0	04/16-06/30	C	1999	Meeting All Standards	Yearly	None
Cobleigh Road	10040	80	7	0	06/01-07/15	C	2003	Meeting All Standards	Yearly	None
Moser Mountain	10041	40	3	0	04/16-04/30	C	2003	Meeting All Standards	Yearly	None
Devon South	10043	402	33	0	04/16-06/30	C	1999	Meeting All Standards	Yearly	None
Salt Creek	10044	462	85	0	04/16-06/30	I	2002	Meeting All Standards	Yearly	None
Jenny Creek[1]	10108	1,417	115	0	05/16-09/10	I	Not Completed	Not Completed	Deferred-Rotation	
Agate[1]	10109	82	9	0	05/01-09/15	C	Not Completed	Not Completed	Yearly	
Soda Mountain[1]	10110	35,619	1,794	0	05/01-10/15	I	Not Completed	Not Completed	Deferred-Rotation	Common Allotment
Cove Creek	10112	1,207	75	0	05/01-06/15	I	Not Completed	Not Completed	Yearly	None
Buckpoint	10114	3,835	150	0	05/01-06/15	C	Not Completed	Not Completed	Yearly	None
Keene Creek[1]	10115	23,643	1,612	0	05/01-10/15	I	Not Completed	Not Completed	Yearly	Common Allotment
Howard Prairie	10116	320	60	0	10/16-11/15	M	Not Completed	Not Completed	Yearly	None
Siskiyou[1]	10118	2,163	200	0	05/01-09/15	I	Not Completed	Not Completed	Yearly	

Allotment Name	Allotment Number	BLM Acres	Active Grazing Preference (AUMs)[2]	Suspended Grazing Preference (AUMs)	Season-of-Use	Selective Management Category[3]	Rangeland Health Assessment Completed	Rangeland Health Assessment Finding	Grazing System	Other Information
Grizzly	10119	5,167	378	0	06/01-10/15	I	1999	Not Meeting Standards, Grazing is not a factor	Yearly	Common Allotment
Lake Creek Spring	10121	4,679	447	0	05/16-07/15	I	Not Completed	Not Completed	Yearly	None
Lake Creek Summer	10122	5,561	550	0	07/16-10/15	I	Not Completed	Not Completed	Yearly	None
Deer Creek-Reno Lease	10124	4,025	314	0	05/01-09/30	C	Not Completed	Not Completed	Yearly	None
Heppsie Mountain	10126	4,076	294	0	05/01-10/15	I	Not Completed	Not Completed	Yearly	None
Antelope Road	10132	200	19	0	04/16-05/30	C	2003	Not Meeting Standards, Grazing is not a factor	Yearly	None
Brownsboro	10133	80	7	0	04/01-06/15	C	2003	Meeting All Standards	Yearly	None
Yankee Reservoir	10134	120	15	0	05/01-06-15	I	2003	Meeting All Standards	Yearly	None
Canal	10136	440	58	0	05/01-06/15	C	2003	Meeting All Standards	Yearly	None
Box R Ranch[1]	10137	88	5	0	10/01-02/28	C	Not Completed	Not Completed	Yearly	None
Cove Ranch	10143	80	20	0	07/01-11/30	C	Not Completed	Not Completed	Yearly	None
North Cove Creek	10148	281	20	0	07/16-09/15	C	Not Completed	Not Completed	Yearly	None
Deadwood[1]	20106	8,004	788	0	06/16-08/15	I	Not Completed	Not Completed	Yearly	Common Allotment

Allotment Name	Allotment Number	BLM Acres	Active Grazing Preference (AUMs)[2]	Suspended Grazing Preference (AUMs)	Season-of-Use	Selective Management Category[3]	Rangeland Health Assessment Completed	Rangeland Health Assessment Finding	Grazing System	Other Information
Poole Hill	20113	1,760	25	0	10/01-10/15	C	2003	Not Meeting Standards, Grazing is not a factor	Yearly	None
Conde Creek	20117	5,346	591	0	06/16-09/30	I	Not Completed	Not Completed	Yearly	Common Allotment
Billy Mountain	20203	4,758	175	0	04/16-06/30	I	1999	Not Meeting Standards, Grazing is not a factor	Yearly	None
Lower Big Applegate	20206	11,712	258	0	04/16-06/15	I	Not Completed	Not Completed	Yearly	None
Foots Creek	20219	115	12	0	05/01-06/30	C	1999	Meeting All Standards	Yearly	None
Ferns Lease	20224	246	28	0	05/01-06/15	C	Not Completed	Not Completed	Yearly	None
Deer Creek	20308	887	77	0	04/01-12/15	C	2003	Not Meeting Standards, Grazing is not a factor	Yearly	Portion Proposed for Closure
		228,387	13,055	0						

[1]All or a portion of the allotment is located within the Cascade-Siskiyou National Monument

[2]Active Preference is cattle AUMs

[3]Selective Management Categories: Improve (I)-managed to resolve a high level of resource conflicts and concerns and receive the highest priority for funding and management actions; Maintain (M)-managed to maintain satisfactory resource conditions and will be actively managed to ensure that resource values do not decline; Custodial (C)-managed custodially to protect resource conditions and values.

Standards for Rangeland Health

The following section contains the Standards for Rangeland Health and Guidelines for Livestock Grazing Management for Public Lands Administered by the Bureau of Land Management in the States of Oregon and Washington. These standards and guidelines are referenced in Chapters 2, 3, and 4 of this Draft EIS. Livestock grazing would be managed in accordance with these standards and guidelines.

Figure 316. Standards for Rangeland Health.

STANDARDS FOR RANGELAND HEALTH

AND

GUIDELINES FOR LIVESTOCK GRAZING MANAGEMENT

FOR

PUBLIC LANDS ADMINISTERED BY THE BUREAU OF LAND MANAGEMENT IN THE STATES OF OREGON AND

WASHINGTON

AUGUST 12, 1997

Table of Contents

Introduction	1
Fundamentals of Rangeland Health	1
Standards for Rangeland Health	2
Standards and Guidelines in Relation to the Planning Process	3
Indicators of Rangeland Health	4
Assessments and Monitoring	5
Measurability	5
Implementation	6
Standards for Rangeland Health	7

Standard 1 Watershed Function – Uplands 7
Standard 2 Watershed Function - Riparian/Wetland Areas 9
Standard 3 Ecological Processes 11
Standard 4 Water Quality 13
Standard 5 Native, T&E, and Locally Important Species 14

Guidelines for Livestock Grazing Management 15
General Guidelines 15
Livestock Grazing Management 15
Facilitating the Management of Livestock Grazing 17
Accelerating Rangeland Recovery 17

Glossary 19

Standards for Rangeland Health and Guidelines for Livestock Grazing Management for Public Lands in Oregon and Washington

Introduction

These Standards for Rangeland Health and Guidelines for Livestock Grazing Management for Public Lands in Oregon and Washington were developed in consultation with Resource Advisory Councils and Provincial Advisory Committees, tribes and others. These standards and guidelines meet the requirements and intent of 43 Code of Federal Regulations, Subpart 4180 (Rangeland Health) and are to be used as presented, in their entirety. These standards and guidelines are intended to provide a clear statement of agency policy and direction for those who use public lands for livestock grazing, and for those who are responsible for their management and accountable for their condition. Nothing in this document should be interpreted as an abrogation of Federal trust responsibilities in protection of treaty rights of Indian tribes or any other statutory responsibilities including, but not limited to, the Taylor Grazing Act, the Clean Water Act, and the Endangered Species Act.

Fundamentals of Rangeland Health

The objectives of the rangeland health regulations referred to above are: "to promote healthy sustainable rangeland ecosystems; to accelerate restoration and improvement of public rangelands to properly functioning conditions; . . . and to provide for the sustainability of the western livestock industry and communities that are dependent upon productive, healthy public rangelands."

and soil stability. The biological components addressed in the standards focus on the roles and interactions of plants, animals and microbes (producers, consumers and decomposers), and their habitats in the ecosystem. The biological component of rangeland ecosystems is supported by physical function of the system, and it is recognized that biological activity also influences and supports many of the ecosystem's physical functions.

Guidance contained in 43 CFR 4180 of the regulations directs management toward the maintenance or restoration of the physical function and biological health of rangeland ecosystems. Focusing on the basic ecological health and function of rangelands is expected to provide for the maintenance, enhancement, or creation of future social and economic options.

The standards are based upon the ecological potential and capability of each site. In assessing a site's condition or degree of function, it must be understood that the evaluation compares each site to its own potential or capability. Potential and capability are defined as follows:

Potential-The highest level of condition or degree of function a site can attain given no political, social or economic constraints.

Capability-The highest level of condition or degree of function a site can attain given certain political, social or economic constraints. For example, these constraints might include riparian areas permanently occupied by a highway or railroad bed that prevent the stream's full access to its original flood plain. If such constraints are removed, the site may be able to move toward its potential.

In designing and implementing management strategies to meet the standards of rangeland health, the potential of the site must be identified, and any constraints recognized, in order that plan goals and objectives are realistic and physically and economically achievable.

Standards and Guidelines in Relation to the Planning Process

The standards apply to the goals of land use plans, activity plans, and project plans (Allotment Management Plans, Annual Operating Plans, Habitat Management Plans, etc.). They establish the physical and biological conditions or degree of function toward which management of publicly-owned rangeland is to be directed. In the development of a plan, direction provided by the standards and the social and economic needs expressed by local communities and individuals are brought together in formulating the goal(s) of that plan.

When the standards and the social and economic goals of the planning participants are woven together in the plan goal(s), the quantifiable, time specific objective(s) of the plan are then developed. Objectives describe and quantify the desired future conditions to be achieved within a specified timeframe. Each plan objective should address the physical, biological, social and economic elements identified in the plan goal.

To help meet these objectives, the regulations on rangeland health identify fundamental principles providing direction to the States, districts, and on-the-ground public land managers and users in the management and use of rangeland ecosystems.

A hierarchy, or order, of ecological function and process exists within each ecosystem. The rangeland ecosystem consists of four primary, interactive components: a physical component, a biological component, a social component, and an economic component. This perspective implies that the physical function of an ecosystem supports the biological health, diversity and productivity of that system. In turn, the interaction of the physical and biological components of the ecosystem provides the basic needs of society and supports economic use and potential.

The Fundamentals of Rangeland Health stated in 43 CFR 4180 are:

1.Watersheds are in, or are making significant progress toward, properly functioning physical condition, including their upland, riparian-wetland, and aquatic components; soil and plant conditions support infiltration, soil moisture storage and the release of water that are in balance with climate and landform and maintain or improve water quality, water quantity and the timing and duration of flow.

2.Ecological processes, including the hydrologic cycle, nutrient cycle and energy flow, are maintained, or there is significant progress toward their attainment, in order to support healthy biotic populations and communities.

3.Water quality complies with State water quality standards and achieves, or is making significant progress toward achieving, established Bureau of Land Management objectives such as meeting wildlife needs.

4.Habitats are, or are making significant progress toward being, restored or maintained for Federal threatened and endangered species, Federal Proposed, Category 1 and 2 Federal candidate and other special status species.

The fundamentals of rangeland health combine the basic precepts of physical function and biological health with elements of law relating to water quality, and plant and animal populations and communities. They provide direction in the development and implementation of the standards for rangeland health.

Standards for Rangeland Health

The standards for rangeland health (standards), based on the above fundamentals, are expressions of the physical and biological condition or degree of function necessary to sustain healthy rangeland ecosystems. Although the focus of these standards is on domestic livestock grazing on Bureau of Land Management lands, on-the-ground decisions must consider the effects and impacts of all uses.

Standards that address the physical components of rangeland ecosystems focus on the roles and interactions of geology and landform, soil, climate and water as they govern watershed function

Standards apply to all ecological sites and land forms on public rangelands throughout Oregon and Washington. The standards require site-specific information for full on-ground usability. For each standard, a set of indicators is identified for use in tailoring the standards to site-specific situations. These indicators are used for rangeland ecosystem assessments and monitoring and for developing terms and conditions for permits and leases that achieve the plan goal.

Guidelines for livestock grazing management offer guidance in achieving the plan goal and objectives. The guidelines outline practices, methods, techniques and considerations used to ensure that progress is achieved in a way, and at a rate, that meets the plan goal and objectives.

Indicators of Rangeland Health

The condition or degree of function of a site in relation to the standards and its trend toward or away from any standard is determined through the use of reliable and scientifically sound indicators. The consistent application of such indicators can provide an objective view of the condition and trend of a site when used by trained observers.

For example, the amount and distribution of ground cover can be used to indicate that infiltration at the soil surface can take place as described in the standard relating to upland watershed function. In applying this indicator, the specific levels of plant cover necessary to support infiltration in a particular soil should be identified using currently available information from reference areas, if they exist; from technical sources like soil survey reports, Ecological Site Inventories, and Ecological Site Descriptions, or from other existing reference materials. Reference areas are lands that best represent the potential of a specific ecological site in both physical function and biological health. In many instances potential reference areas are identified in Ecological Site Descriptions and are referred to as "type locations." In the absence of suitable reference areas, the selection of indicators to be used in measuring or judging condition or function should be made by an interdisciplinary team of experienced professionals and other trained individuals.

Not all indicators identified for each standard are expected to be employed in every situation. Criteria for selecting appropriate indicators and methods of measurement and observation include, but are not limited to: 1. the relationship between the attribute(s) being measured or observed and the desired outcome; 2. the relationship between the activity (e.g., livestock grazing) and the attribute(s) being measured or observed; and 3. funds and workforce available to conduct the measurements or observations.

Assessments and Monitoring

The standards are the basis for assessing and monitoring rangeland condition and trend. Carrying out well-designed assessment and monitoring is critical to restoring or maintaining healthy rangelands and determining trends and conditions.

Assessments are a cursory form of evaluation based on the standards that can be used at different landscape scales. Assessments, conducted by qualified interdisciplinary teams (which may

include but are not limited to physical, biological and social specialists, and interagency personnel) with participation from permittees and other interested parties, are appropriate at the watershed and sub-watershed levels, at the allotment and pasture levels and on individual ecological sites or groups of sites. Assessments identify the condition or degree of function within the rangeland ecosystem and indicate resource problems and issues that should be monitored or studied in more detail. The results of assessments are a valuable tool for managers in assigning priorities within an administrative area and the subsequent allocation of personnel, money and time in resource monitoring and treatment. The results of assessments may also be used in making management decisions where an obvious problem exists.

Monitoring, which is the well documented and orderly collection, analysis and interpretation of resource data, serves as the basis for determining trends in the condition or degree of function of rangeland resources and for making management decisions. Monitoring should be designed and carried out to identify trends in resource conditions, to point out resource problems, to help indicate the cause of such problems, to point out solutions, and/or to contribute to adaptive management decisions. In cases where monitoring data do not exist, professional judgment, supported by interdisciplinary team recommendation, may be relied upon by the authorized officer in order to take necessary action. Review and evaluation of new information must be an ongoing activity.

To be effective, monitoring must be consistent over time, throughout administrative areas, and in the methods of measurement and observation of selected indicators. Those doing the monitoring must have the knowledge and skill required by the level or intensity of the monitoring being done, as well as the experience to properly interpret the results. Technical support for training must be made available.

Measurability

It is recognized that not every area will immediately meet the standards and that it will sometimes be a long-term process to restore some rangelands to properly functioning condition. It is intended that in cases where standards are not being met, measurable progress should be made toward achieving those standards, and significant progress should be made toward fulfilling the fundamentals of rangeland health. Measurability is defined on a case-specific basis based upon the stated planning objectives (i.e., quantifiable, time specific), taking into account economic and social goals along with the biological and ecological capability of the area. To the extent that a rate of recovery conforms with the planning objectives, the area is allowed the time to meet the standard under the selected management regime.

Implementation

The material contained in this document will be incorporated into existing Land Use Plans and used in the development of new Land Use Plans. According to 43 CFR 4130.3-1, permits and leases shall incorporate terms and conditions that ensure conformance with 43 CFR 4180. Terms and conditions of existing permits and leases will be modified to reflect standards and guidelines at the earliest possible date with priority for modification being at the discretion of the authorized

officer. Terms and conditions of new permits and leases will reflect standards and guidelines in their development.

Indicators identified in this document will serve as a focus of interpretation of existing monitoring data and will provide the basis of design for monitoring and assessment techniques, and in the development of monitoring and assessment plans.

The authorized officer shall take appropriate action as soon as practicable but not later than the start of the next grazing year upon determining, through assessment or monitoring by experienced professionals and interdisciplinary teams, that a standard is not being achieved and that livestock are a significant contributing factor to the failure to achieve the standards and conform with the guidelines.

Standards for Rangeland Health

Standard 1 Watershed Function – Uplands

Upland soils exhibit infiltration and permeability rates, moisture storage and stability that are appropriate to soil, climate and landform.

Rationale and Intent

This standard focuses on the basic physical functions of upland soils that support plant growth, the maintenance or development of plant populations and communities, and promote dependable flows of quality water from the watershed.

To achieve and sustain rangeland health, watersheds must function properly. Watersheds consist of three principle components: the uplands, riparian/wetland areas and the aquatic zone. This standard addresses the upland component of the watershed. When functioning properly, within its potential, a watershed captures, stores and safely releases the moisture associated with normal precipitation events (equal to or less than the 25 year, 5 hour event) that falls within its boundaries. Uplands make up the largest part of the watershed and are where most of the moisture received during precipitation events is captured and stored.

While all watersheds consist of similar components and processes, each is unique in its individual makeup. Each watershed displays its own pattern of landform and soil, its unique climate and weather patterns, and its own history of use and current condition. In directing management toward achieving this standard, it is essential to treat each unit of the landscape (soil, ecological site, and watershed) according to its own capability and how it fits with both smaller and larger units of the landscape.

A set of potential indicators has been identified for which site-specific criteria will be used to determine if this standard is being met. The appropriate indicators to be used in determining attainment of the standard should be drawn from the following list.

Potential Indicators

Protection of the soil surface from raindrop impact; detention of overland flow; maintenance of infiltration and permeability, and protection of the soil surface from erosion, consistent with the potential/capability of the site, as evidenced by the:

° amount and distribution of plant cover (including forest canopy cover);
° amount and distribution of plant litter;
° accumulation/incorporation of organic matter;
° amount and distribution of bare ground;
° amount and distribution of rock, stone, and gravel;
° plant composition and community structure;
° thickness and continuity of A horizon;
° character of micro-relief;
° presence and integrity of biotic crusts;
° root occupancy of the soil profile;
° biological activity (plant, animal, and insect); and
° absence of accelerated erosion and overland flow.

Soil and plant conditions promote moisture storage as evidenced by:

° amount and distribution of plant cover (including forest canopy cover);
° amount and distribution of plant litter;
° plant composition and community structure; and
° accumulation/incorporation of organic matter.

Standard 2 Watershed Function - Riparian/Wetland Areas

Riparian-wetland areas are in properly functioning physical condition appropriate to soil, climate, and landform.

Rationale and Intent

Riparian-wetland areas are grouped into two major categories: 1. lentic, or standing water systems such as lakes, ponds, seeps, bogs, and meadows; and 2. lotic, or moving water systems such as rivers, streams, and springs. Wetlands are areas that are inundated or saturated by surface or ground water at a frequency and duration to support, and which under normal circumstances do support, a prevalence of vegetation typically adapted to life in saturated soil conditions. Riparian areas commonly occupy the transition zone between the uplands and surface water bodies (the aquatic zone) or permanently saturated wetlands.

Properly functioning condition of riparian and wetland areas describes the degree of physical function of these components of the watershed. Their functionality is important to water quality in the capture and retention of sediment and debris, the detention and detoxification of pollutants, and in moderating seasonal extremes of water temperature. Properly functioning riparian areas and wetlands enhance the timing and duration of streamflow through dissipation of flood energy, improved bank storage, and ground water recharge. Properly functioning condition should not be confused with the Desired Plant Community (DPC) or the Desired Future Condition (DFC) since, in most cases, it is the precursor to these levels of resource condition and is required for their attainment.

A set of indicators has been identified for which site-specific criteria will be used to determine if this standard is being met. The criteria are based upon the potential (or upon the capability where potential cannot be achieved) of individual sites or land forms.

Potential Indicators

Hydrologic, vegetative, and erosional/depositional processes interact in supporting physical function, consistent with the potential or capability of the site, as evidenced by:

° frequency of floodplain/wetland inundation;
° plant composition, age class distribution, and community structure;
° root mass;
° point bars revegetating;
° streambank/shoreline stability;
° riparian area width;
° sediment deposition;
° active/stable beaver dams;
° coarse/large woody debris;
° upland watershed conditions;
° frequency/duration of soil saturation; and
° water table fluctuation.

Stream channel characteristics are appropriate for landscape position as evidenced by:

° channel width/depth ratio;
° channel sinuosity;
° gradient;
° rocks and coarse and/or large woody debris;
° overhanging banks;
° pool/riffle ratio;
° pool size and frequency; and
° stream embeddedness.

Standard 3 Ecological Processes

Healthy, productive and diverse plant and animal populations and communities appropriate to soil, climate and landform are supported by ecological processes of nutrient cycling, energy flow and the hydrologic cycle.

Rationale and Intent

This standard addresses the ecological processes of energy flow and nutrient cycling as influenced by existing and desired plant and animal communities without establishing the kinds, amounts or proportions of plant and animal community compositions. While emphasis may be on native species, an ecological site may be capable of supporting a number of different native and introduced plant and animal populations and communities while meeting this standard. This standard also addresses the hydrologic cycle which is essential for plant growth and appropriate levels of energy flow and nutrient cycling. Standards 1 and 2 address the watershed aspects of the hydrologic cycle.

With few exceptions, all life on earth is supported by the energy supplied by the sun and captured by plants in the process of photosynthesis. This energy enters the food chain when plants are consumed by insects and herbivores and passes upward through the food chain to the carnivores. Eventually, the energy reaches the decomposers and is released as the thermal output of decomposition or through oxidation.

The ability of plants to capture sunlight energy, to grow and develop, to play a role in soil development and watershed function, to provide habitat for wildlife and to support economic uses depends on the availability of nutrients and moisture. Nutrients necessary for plant growth are made available to plants through the decomposition and metabolization of organic matter by insects, bacteria and fungi, the weathering of rocks and extraction from the atmosphere. Nutrients are transported through the soil by plant uptake, leaching and by rodent, insect and microbial activity. They follow cyclical patterns as they are used and reused by living organisms.

The ability of rangelands to supply resources and satisfy social and economic needs depends on the buildup and cycling of nutrients over time. Interrupting or slowing nutrient cycling can lead to site degradation, as these lands become increasingly deficient in the nutrients plants require.

Some plant communities, because of past use, frequent fire or other histories of extreme or continued disturbance, are incapable of meeting this standard. For example, shallow-rooted winter-annual grasses that completely dominate some sites do not fully occupy the potential rooting depth of some soils, thereby reducing nutrient cycling well below optimum levels. In addition, these plants have a relatively short growth period and thus capture less sunlight than more diverse plant communities. Plant communities like those cited in this example are considered to have crossed the threshold of recovery and often require great expense to be recovered. The cost of recovery must be weighed against the site's potential ecological/economic value in establishing treatment priorities.

The role of fire in natural ecosystems should be considered, whether it acts as a primary driver or only as one of many factors. It may play a significant role in both nutrient cycling and energy flows.

A set of indicators has been identified for which site-specific criteria will be used to determine if this standard is being met.

Potential Indicators

Photosynthesis is effectively occurring throughout the potential growing season, consistent with the potential/capability of the site, as evidenced by plant composition and community structure.

Nutrient cycling is occurring effectively, consistent with the potential/capability of the site, as evidenced by:

° plant composition and community structure;
° accumulation, distribution, incorporation of plant litter and organic matter into the soil;
° animal community structure and composition;
° root occupancy in the soil profile; and
° biological activity including plant growth, herbivory, and rodent, insect and microbial activity.

Standard 4 Water Quality

Surface water and groundwater quality, influenced by agency actions, complies with State water quality standards.

Rationale and Intent

The quality of the water yielded by a watershed is determined by the physical and chemical properties of the geology and soils unique to the watershed, the prevailing climate and weather patterns, current resource conditions, the uses to which the land is put and the quality of the management of those uses. Standards 1, 2 and 3 contribute to attaining this standard.

States are legally required to establish water quality standards and Federal land management agencies are to comply with those standards. In mixed ownership watersheds, agencies, like any other land owners, have limited influence on the quality of the water yielded by the watershed. The actions taken by the agency will contribute to meeting State water quality standards during the period that water crosses agency administered holdings.

Potential Indicators

Water quality meets applicable water quality standards as evidenced by:

° water temperature;
° dissolved oxygen;
° fecal coliform;
° turbidity;
° pH;

° populations of aquatic organisms; and
° effects on beneficial uses (i.e., effects of management activities on beneficial uses as defined under the Clean Water Act and State implementing regulations).

Standard 5 Native, T&E, and Locally Important Species

Habitats support healthy, productive and diverse populations and communities of native plants and animals (including special status species and species of local importance) appropriate to soil, climate and landform.

Rationale and Intent

Federal agencies are mandated to protect threatened and endangered species and will take appropriate action to avoid the listing of any species. This standard focuses on retaining and restoring native plant and animal (including fish) species, populations and communities (including threatened, endangered and other special status species and species of local importance). In meeting the standard, native plant communities and animal habitats would be spatially distributed across the landscape with a density and frequency of species suitable to ensure reproductive capability and sustainability. Plant populations and communities would exhibit a range of age classes necessary to sustain recruitment and mortality fluctuations.

Potential Indicators

Essential habitat elements for species, populations and communities are present and available, consistent with the potential/capability of the landscape, as evidenced by:

° plant community composition, age class distribution, productivity;
° animal community composition, productivity;
° habitat elements;
° spatial distribution of habitat;
° habitat connectivity; and
° population stability/resilience

Guidelines for Livestock Grazing Management

Guidelines for livestock grazing management offer guidance in achieving plan goals, meeting standards for rangeland health and fulfilling the fundamentals of rangeland health. Guidelines are applied in accordance with the capabilities of the resource in consultation, cooperation, and coordination with permittees/lessees and the interested public. Guidelines enable managers to

adjust grazing management on public lands to meet current and anticipated climatic and biological conditions.

General Guidelines

1. Involve diverse interests in rangeland assessment, planning and monitoring.

2. Assessment and monitoring are essential to the management of rangelands, especially in areas where resource problems exist or issues arise. Monitoring should proceed using a qualitative method of assessment to identify critical, site-specific problems or issues using interdisciplinary teams of specialists, managers, and knowledgeable land users.

Once identified, critical, site-specific problems or issues should be targeted for more intensive, quantitative monitoring or investigation. Priority for monitoring and treatment should be given to those areas that are ecologically at-risk where benefits can be maximized given existing budgets and other resources.

Livestock Grazing Management

1. The season, timing, frequency, duration and intensity of livestock grazing use should be based on the physical and biological characteristics of the site and the management unit in order to:

   a. provide adequate cover (live plants, plant litter and residue) to promote infiltration, conserve soil moisture and to maintain soil stability in upland areas;

   b. provide adequate cover and plant community structure to promote streambank stability, debris and sediment capture, and floodwater energy dissipation in riparian areas.

   c. promote soil surface conditions that support infiltration;

   d. avoid sub-surface soil compaction that retards the movement of water in the soil profile;

   e. help prevent the increase and spread of noxious weeds;

   f. maintain or restore diverse plant populations and communities that fully occupy the potential rooting volume of the soil;

   g. maintain or restore plant communities to promote photosynthesis throughout the potential growing season;

   h. promote soil and site conditions that provide the opportunity for the

establishment of desirable plants;

i. protect or restore water quality; and

j. provide for the life cycle requirements, and maintain or restore the habitat elements of native (including T&E, special status, and locally important species) and desired plants and animals.

2. Grazing management plans should be tailored to site-specific conditions and plan objectives. Livestock grazing should be coordinated with the timing of precipitation, plant growth and plant form. Soil moisture, plant growth stage and the timing of peak stream flows are key factors in determining when to graze. Response to different grazing strategies varies with differing ecological sites.

3. Grazing management systems should consider nutritional and herd health requirements of the livestock.

4. Integrate grazing management systems into the year-round management strategy and resources of the permittee(s) or lessee(s). Consider the use of collaborative approaches (e.g., Coordinated Resource Management, Working Groups) in this integration.

5. Consider competition for forage and browse among livestock, big game animals, and wild horses in designing and implementing a grazing plan.

6. Provide periodic rest from grazing for rangeland vegetation during critical growth periods to promote plant vigor, reproduction and productivity.

7. Range improvement practices should be prioritized to promote rehabilitation and resolve grazing concerns on transitory grazing land.

8. Consider the potential for conflict between grazing use on public land and adjoining land uses in the design and implementation of a grazing management plan.

Facilitating the Management of Livestock Grazing

1. The use of practices to facilitate the implementation of grazing systems should consider the kind and class of animals managed, indigenous wildlife, wild horses, the terrain and the availability of water. Practices such as fencing, herding, water development, and the placement of salt and supplements (where authorized) are used where appropriate to:

   a. promote livestock distribution;

b. encourage a uniform level of proper grazing use throughout the grazing unit;

c. avoid unwanted or damaging concentrations of livestock on streambanks, in riparian areas and other sensitive areas such as highly erodible soils, unique wildlife habitats and plant communities; and

d. protect water quality.

2. Roads and trails used to facilitate livestock grazing are constructed and maintained in a manner that minimizes the effects on landscape hydrology; concentration of overland flow, erosion and sediment transport are prevented; and subsurface flows are retained.

Accelerating Rangeland Recovery

1. Upland treatments that alter the vegetative composition of a site, like prescribed burning, juniper management and seedings or plantings must be based on the potential of the site and should:

   a. retain or promote infiltration, permeability, and soil moisture storage;

   b. contribute to nutrient cycling and energy flow;

   c. protect water quality;

   d. help prevent the increase and spread of noxious weeds;

   e. contribute to the diversity of plant communities, and plant community composition and structure;

   f. support the conservation of T&E, other special status species and species of local importance; and

   g. be followed up with grazing management and other treatments that extend the life of the treatment and address the cause of the original treatment need.

2. Seedings and plantings of non-native vegetation should only be used in those cases where native species are not available in sufficient quantities; where native species are incapable of maintaining or achieving the standards; or where non-native species are essential to the functional integrity of the site.

3. Structural and vegetative treatments and animal introductions in riparian and wetland areas must be compatible with the capability of the site, including the system's hydrologic regime, and contribute to the maintenance or restoration of

properly functioning condition.

Glossary

Appropriate action-implementing actions pursuant to subparts 4110, 4120, 4130 and 4160 of the regulations that will result in significant progress toward fulfillment of the standards and significant progress toward conformance with the guidelines. (see **Significant progress**)

Assessment-a form of evaluation based on the standards of rangeland health, conducted by an interdisciplinary team at the appropriate landscape scale (pasture, allotment, sub-watershed, watershed, etc.) to determine conditions relative to standards.

Compaction layer-a layer within the soil profile in which the soil particles have been rearranged to decrease void space, thereby increasing soil bulk density and often reducing permeability.

Crust, Abiotic-(physical crust) a surface layer on soils, ranging in thickness from a few millimeters to a few centimeters, that is much more compact, hard and brittle, when dry, than the material immediately beneath it.

Crust, Biotic-(microbiotic or cryptogamic crust) a layer of living organisms (mosses, lichens, liverworts, algae, fungi, bacteria, and/or cyanobacteria) occurring on, or near the soil surface.

Degree of function-a level of physical function relative to properly functioning condition commonly expressed as: properly functioning, functioning-at-risk, or non-functional.

Diversity-the aggregate of species assemblages (communities), individual species, and the genetic variation within species and the processes by which these components interact within and among themselves. The elements of diversity are: 1. community diversity (habitat, ecosystem), 2. species diversity; and 3. genetic diversity within a species; all three of which change over time.

Energy flow-the processes in which solar energy is converted to chemical energy through photosynthesis and passed through the food chain until it is eventually dispersed through respiration and decomposition.

Groundwater-water in the ground that is in the zone of saturation; water in the ground that exists at, or below the water table.

Guideline-practices, methods, techniques and considerations used to ensure that progress is made in a way and at a rate that achieves the standard(s).

Gully-a channel resulting from erosion and caused by the concentrated but intermittent flow of water usually during and immediately following heavy rains.

Hydrologic cycle-the process in which water enters the atmosphere through evaporation, transpiration, or sublimation from the oceans, other surface water bodies, or from the land and vegetation, and through condensation and precipitation returns to the earth's surface. The precipitation then occurring as overland flow, stream flow, or percolating underground flow to the oceans or other surface water bodies or to other sites of evapo-transpiration and recirculation to the atmosphere.

Indicators-parameters of ecosystem function that are observed, assessed, measured, or monitored to directly or indirectly determine attainment of a standard(s).

Infiltration-the downward entry of water into the soil.

Infiltration rate-the rate at which water enters the soil.

Nutrient cycling-the movement of essential elements and inorganic compounds between the reservoir pool (soil, for example) and the cycling pool (organisms) in the rapid exchange (i.e., moving back and forth) between organisms and their immediate environment.

Organic matter-plant and animal residues accumulated or deposited at the soil surface; the organic fraction of the soil that includes plant and animal residues at various stages of decomposition; cells and tissues of soil organisms, and the substances synthesized by the soil population.

Permeability-the ease with which gases, liquids or plant roots penetrate or pass through a bulk mass of soil or a layer of soil.

Properly functioning condition-Riparian-wetland: adequate vegetation, landform, or large (coarse) woody debris is present to dissipate stream energy associated with high water flows, thereby reducing erosion and improving water quality; filter sediment, capture bedload, and aid in flood plain development; improve flood-water retention and ground water recharge; develop root masses that stabilize streambanks against cutting action; develop diverse channel and ponding characteristics to provide the habitat and water depth, duration and temperature necessary for fish production, waterfowl breeding, and other uses; and support greater biodiversity. The result of interaction among geology, soil, water, and vegetation.

Uplands: soil and plant conditions support the physical processes of infiltration and moisture storage and promote soil stability (as appropriate to site potential); includes the production of plant cover and the accumulation of plant residue that protect the soil surface from raindrop impact, moderate soil temperature in minimizing frozen soil conditions (frequency, depth, and duration), and the loss of soil moisture to evaporation; root growth and development in the support of permeability and soil aeration. The result of interaction among geology, climate, landform, soil, and organisms.

Proper grazing use-grazing that, through the control of timing, frequency, intensity and duration of use, meets the physiological needs of the desirable vegetation, provides for the establishment of desirable plants and is in accord with the physical function and stability of soil and landform (properly functioning condition).

Reference area-sites that, because of their condition and degree of function, represent the ecological potential or capability of similar sites in an area or region (ecological province); serve as a benchmark in determining the ecological potential of sites with similar soil, climatic, and landscape characteristics.

Rill-a small, intermittent water course with steep sides; usually only a few inches deep.

Riparian area-a form of wetland transition between permanently saturated wetlands and upland areas. These areas exhibit vegetation or physical characteristics reflective of permanent surface or subsurface water influence. Lands along, adjacent to, or contiguous with perennially and intermittently flowing rivers and stream, glacial potholes, and shores of lakes and reservoirs with stable water levels area typical riparian areas. Excluded are such sites as ephemeral streams or washes that do not exhibit the presence of vegetation dependent upon free water in the soil. Includes, but is not limited to, jurisdictional wetlands.

Significant progress-when used in reference to achieving a standard: (actions), the necessary land treatments, practices and/or changes to management have been applied or are in effect; (rate), a rate of progress that is consistent with the anticipated recovery rate described in plan objectives, with due recognition of the effects of climatic extremes (drought, flooding, etc.), fire, and other unforeseen naturally occurring events or disturbances. Monitoring reference areas that are ungrazed and properly grazed may provide evidence of appropriate recovery rates. (See Proper Grazing Use)

Soil density-(bulk density)-the mass of dry soil per unit bulk volume.

Soil moisture-water contained in the soil; commonly used to describe water in the soil above the water table.

Special status species-species proposed for listing, officially listed (T/E), or candidates for listing as threatened or endangered by the Secretary of the Interior under the provisions of the Endangered Species Act; those listed or proposed for listing by the State in a category implying potential endangerment or extinction; those designated by each Bureau of Land Management State Director as sensitive.

Species of local importance-species of significant importance to Native American populations (e.g., medicinal and food plants).

Standard-an expression of the physical and biological condition or degree of function necessary to sustain healthy rangeland ecosystems.

Uplands-lands that exist above the riparian/wetland area, or active flood plains of rivers and streams; those lands not influenced by the water table or by free or unbound water; commonly represented by toe slopes, alluvial fans, and side slopes, shoulders and ridges of mountains and hills.

Watershed-an area of land that contributes to the surface flow of water past a given point. The watershed dimensions are determined by the point past, or through which, runoff flows.

Watershed function-the principal functions of a watershed include the capture of moisture contributed by precipitation; the storage of moisture within the soil profile, and the release of moisture through subsurface flow, deep percolation to groundwater, evaporation from the soil, and transpiration by live vegetation.

Wetland-areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and which under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions.

Appendix M. Areas of Critical Environmental Concern

This appendix provides detailed information about Areas of Critical Environmental Concern.

In this appendix:

Areas of Critical Environmental Concern 1307

Areas of Critical Environmental Concern

This section contains detailed information about Areas of Critical Environmental Concern (ACEC). Two tables are included. Table 285 shows Areas of Critical Environmental Concern by Alternative. It includes information about the categories of Relevant and Important Values and any management direction that applies to the area and contains more specific information about the Relevant and Important Values for each ACEC.

The ACEC's denoted by gray shading are those that were not further analyzed for designation under the action alternatives because they did not meet relevance and importance criteria and/or do not need special management attention. Management direction for these areas is the management direction in the current plans, and would only be applied under the no action alternative.

Table 285. Areas of Critical Environmental Concern.

Map #	District	ACEC Name	Status	Total Area (Acres)	Alt 1	Alt 2	Alt 3	Relevant and Important Value Category	Management Direction If Designated			
									Off-Highway Vehicle Desig.	Leasable Mineral Entry	Locatable/ Salable Mineral Entry	Timber Harvest
1	SALEM	Beaver Creek	Potential	44	no	no	no	Natural processes	NA	NA	NA	NA
2		Crabtree Complex RNA/ ONA	Existing	1,231	yes	yes_ without_ OC*	yes_ without_ OC	Scenic, natural processes, fish and wildlife	Closed	Open - No Surface Occupancy	Proposed Closed	None
3		Elk Creek	Existing	784	no	yes	no	Fish and wildlife	Closed	Open - No Surface Occupancy	Proposed Closed	Some thinning in stands <80 yrs old
4		Forest Peak RNA	Existing	155	yes	yes	yes	Natural processes, fish and wildlife	Closed	Open - No Surface Occupancy	Proposed Closed	None
5		Grass Mountain RNA	Existing	930	yes	yes	yes	Scenic, natural processes, fish and wildlife	Closed	Open - No Surface Occupancy	Proposed Closed	None
6		High Peak - Moon Creek RNA	Existing	1,490	yes	yes	yes	Natural processes, fish and wildlife	Closed	Open - No Surface Occupancy	Proposed Closed	None
7		Jackson Bend	Existing	15	yes_ without_ OC	yes_ without_ OC	yes_ without_ OC	Fish and wildlife, natural processes	Closed	Open - No Surface Occupancy	Proposed Closed	None
8		Little Grass Mountain	Existing	80				Scenic, natural processes, fish and wildlife	Closed	Open - No Surface Occupancy	Proposed Closed	None
9		Little North Fork Wilson River	Potential	1,822	yes	yes_ without_ OC	yes	Fish and wildlife, natural processes	Closed	Open - No Surface Occupancy	Proposed Closed	Some management of previously entered stands.
10		Little Sink	Existing	81	yes	yes	yes	Fish and wildlife, natural processes, natural hazards	Closed	Open - No Surface Occupancy	Proposed Closed	None

Map #	District	ACEC Name	Status	Total Area (Acres)	Alt 1	Alt 2	Alt 3	Relevant and Important Value Category	Management Direction If Designated			
									Off-Highway Vehicle Desig.	Leasable Mineral Entry	Locatable/ Salable Mineral Entry	Timber Harvest
11	SALEM	Lost Prairie	Existing	61	yes	yes	yes	Fish and wildlife, natural processes	Closed	Open - No Surface Occupancy	Proposed Closed	None
12		Lower Scappoose Eagle	Potential	179	yes_ without_ OC	no	no	Fish and wildlife	Closed	Open - No Surface Occupancy	Proposed Closed	None
13		Marys Peak ONA	Existing	353	yes	yes	no	Scenic, natural processes, fish and wildlife	Limited to designated roads	Open - No Surface Occupancy	Proposed Closed	None
14		Marys Peak B	Potential	75	yes	yes	yes	Scenic, natural processes	Limited to designated roads	Open - No Surface Occupancy	Proposed Closed	None
15		McCully Mountain	Potential	101	no	no	no	Natural processes	Closed	Open - No Surface Occupancy	Proposed Closed	None
16		Middle Santiam Terrace	Existing	182	yes	yes	yes	Natural processes	Closed	Open - No Surface Occupancy	Proposed Closed	None
17		Mill Creek Ridge	Potential	114	yes	yes	no	Natural processes	Closed	Open - No Surface Occupancy	Proposed Closed	None
18		Molalla Meadows	Potential	205	yes_ without_ OC	yes_ without_ OC	yes_ without_ OC	Natural processes	Closed	Open - No Surface Occupancy	Proposed Closed	None
19		Nestucca River	Existing	1,163	no	yes	no	Scenic, fish and wildlife	Limited to designated roads	Open - No Surface Occupancy	Proposed Closed	None
20		North Santiam	Existing	15	no	no	no	Natural processes	Closed	Open - No Surface Occupancy	Proposed Closed	None
21		Rickreall Ridge	Existing	368	yes	yes	yes_ without_ OC	Natural processes	Closed	Open - No Surface Occupancy	Proposed Closed	None

Map #	District	ACEC Name	Status	Total Area (Acres)	Alt 1	Alt 2	Alt 3	Relevant and Important Value Category	Management Direction If Designated			
									Off-Highway Vehicle Desig.	Leasable Mineral Entry	Locatable/ Salable Mineral Entry	Timber Harvest
22	SALEM	Saddleback Mountain RNA	Existing	300	yes	yes	yes	Fish and wildlife, natural processes	Closed	Open - No Surface Occupancy	Proposed Closed	None
23		Sandy River Gorge ONA	Existing	9,780	yes_ without_ OC	yes_ without_ OC	yes_ without_ OC	Scenic, cultural, historic values, fish and wildlife, natural processes	Closed	Open - No Surface Occupancy	Proposed Closed	Permitted within some portions
24		Sheridan Peak	Existing	310				Natural processes	Closed	Open - No Surface Occupancy	Open with additional restrictions	Some thinning in stands <110 yrs old
25		Silt Creek	Potential	140	yes_ without_ OC	yes_ without_ OC	yes_ without_ OC	Natural processes, natural hazards	Closed	Open - No Surface Occupancy	Proposed Closed	None
26		Snow Peak	Potential	1,667	no	no	no	Natural processes	Closed	Open - No Surface Occupancy	Proposed Closed	None
27		Soosap Meadows	Existing	343	yes	no	no	Natural processes	Closed	Open - No Surface Occupancy	Proposed Closed	None
28		The Butte RNA	Existing	39	yes	yes	yes	Natural processes	Closed	Open - No Surface Occupancy	Proposed Closed	None
29		Valley of the Giants ONA	Existing	1,311	yes	yes	no	Scenic, natural processes, fish and wildlife	Closed	Minerals not federally administered	Minerals not federally administered	None
30		Walker Flat	Existing	11	yes_ without_ OC	yes_ without_ OC	yes_ without_ OC	Natural processes	Closed	Open - No Surface Occupancy	Proposed Closed	None
31		Waterloo	Potential	9	yes	yes	yes	Natural processes	Closed	Open - No Surface Occupancy	Proposed Closed	None

Map #	District	ACEC Name	Status	Total Area (Acres)	Alt 1	Alt 2	Alt 3	Relevant and Important Value Category	Management Direction If Designated			
									Off-Highway Vehicle Desig.	Leasable Mineral Entry	Locatable/ Salable Mineral Entry	Timber Harvest
32	SALEM	Wells Island	Potential	73	no	no	no	Natural processes	Closed	Open - No Surface Occupancy	Proposed Closed	None
33		White Rock Fen	Existing	55	yes	no	no	Natural processes	Closed	Open - No Surface Occupancy	Proposed Closed	None
34		Wilhoit Springs	Existing	133	no	no	no	Natural processes	Limited to designated roads	Open - No Surface Occupancy	Proposed Closed	None
35		Williams Lake	Existing	90	no	no	no	Natural processes	Limited to designated roads	Open - No Surface Occupancy	Proposed Closed	None
36		Yampo	Existing	13	yes	yes	yes	Fish and wildlife, natural processes	Limited to designated roads	Open - No Surface Occupancy	Proposed Closed	None
37		Yaquina Head ONA	Existing	91	yes	yes	yes	Scenic, cultural, historic values, fish and wildlife, natural processes	Limited to designated roads	Open - No Surface Occupancy	Proposed Closed	None
38	EUGENE	Camas Swale RNA	Existing	308	yes	yes	yes	Fish and wildlife, natural processes	Limited to designated roads	Open - No Surface Occupancy	Proposed Closed	None
39		Coburg Hills RFI	Existing	855	no	no	no	Fish and wildlife, natural processes	Closed	Open - No Surface Occupancy	Proposed Closed	Potential selective harvest/ silvicultural prescriptions
40		Cottage Grove Lake RFI	Existing	15	no	yes	no	Fish and wildlife, natural processes	Closed	Open - No Surface Occupancy	Proposed Closed	Potential selective harvest/ silvicultural prescriptions

Map #	District	ACEC Name	Status	Total Area (Acres)	Alt 1	Alt 2	Alt 3	Relevant and Important Value Category	Management Direction If Designated			
									Off-Highway Vehicle Desig.	Leasable Mineral Entry	Locatable/ Salable Mineral Entry	Timber Harvest
41	EUGENE	Cottage Grove Old Growth	Existing	80				Fish and wildlife, natural processes	Closed	Open - No Surface Occupancy	Proposed Closed	None
42		Cougar Mountain Yew Grove	Existing	90	no	no	no	Fish and wildlife, natural processes	Closed	Open - No Surface Occupancy	Proposed Closed	Potential selective harvest/ silvicultural prescriptions and Conifer removal to maintain grassland
43		Dorena Lake RFI	Existing	18	no	no	no	Fish and wildlife, natural processes	Closed	Open - No Surface Occupancy	Proposed Closed	Potential selective harvest/ silvicultural prescriptions
44		Dorena Prairie	Potential	8	yes	yes	yes	Natural processes	Closed	Open - No Surface Occupancy	Proposed Closed	Potential conifer removal to maintain prairie
45		Esmond Lake	Potential	86	no	yes_ without_ OC	yes_ without_ OC	Fish and wildlife, natural processes	Closed	Open - No Surface Occupancy	Proposed Closed	None
46		Fox Hollow RNA	Existing	159	yes	yes	yes	Natural processes	Closed	Open - No Surface Occupancy	Proposed Closed	None
47		Grassy Mountain	Existing	74	yes_ without_ OC	yes_ without_ OC	yes_ without_ OC	Scenic, fish and wildlife, natural processes	Closed	Open - No Surface Occupancy	Proposed Closed	Potential conifer removal to maintain grassland

Map #	District	ACEC Name	Status	Total Area (Acres)	Alt 1	Alt 2	Alt 3	Relevant and Important Value Category	Management Direction If Designated			
									Off-Highway Vehicle Desig.	Leasable Mineral Entry	Locatable/ Salable Mineral Entry	Timber Harvest
48	EUGENE	Heceta Sand Dunes ONA	Existing	210	yes	yes	yes	Scenic, natural processes	Open/Closed	Open - No Surface Occupancy	Closed	None
49		Horse Rock Ridge RNA	Existing	378	yes	yes	yes	Scenic, fish and wildlife, natural processes	Closed	Open - No Surface Occupancy	Proposed Closed	Potential conifer removal to maintain grassland
50		Hult Marsh	Existing	177	yes_ without_ OC	yes_ without_ OC	yes_ without_ OC	Scenic, natural processes	Closed	Open - No Surface Occupancy	Proposed Closed	None
51		Lake Creek Falls	Existing	54				Scenic, natural hazard	Limited to designated roads	Open - No Surface Occupancy	Proposed Closed	None
52		Lorane Ponderosa Pine	Potential	104	yes_ without_ OC	yes_ without_ OC	yes_ without_ OC	Fish and wildlife, natural processes	Closed	Open - No Surface Occupancy	Closed	Potential selective harvest/ silvicultural prescriptions
53		Low Elevation Headwaters of the McKenzie River	Potential	9,765	no	no	no	Fish and wildlife, natural processes	Limited to designated roads	Open - No Surface Occupancy	Proposed Closed	Permitted if consistent with ACEC values
54		McGowan Meadow	Potential	75	yes_ without_ OC	yes_ without_ OC	yes_ without_ OC	Natural processes	Closed	Open - No Surface Occupancy	Proposed Closed	Potential conifer removal to maintain grassland
55		Mohawk RNA	Existing	290	yes	yes	yes	Fish and wildlife, natural processes	Closed	Open - No Surface Occupancy	Proposed Closed	None

Map #	District	ACEC Name	Status	Total Area (Acres)	Alt 1	Alt 2	Alt 3	Relevant and Important Value Category	Management Direction If Designated			
									Off-Highway Vehicle Desig.	Leasable Mineral Entry	Locatable/ Salable Mineral Entry	Timber Harvest
56	EUGENE	Oak Basin Prairies	Potential	223	yes_ without_ OC	yes_ without_ OC	yes_ without_ OC	Natural processes	Closed	Open - No Surface Occupancy	Proposed Closed	Potential selective harvest/ silvicultural prescriptions and Conifer removal to maintain grassland
57		Taylor Creek	Potential	155	no	no	no	Fish and wildlife	Closed	Open - No Surface Occupancy	Proposed Closed	Potential selective harvest/ silvicultural prescriptions
58		Upper Elk Meadows RNA	Existing	217	yes	yes	yes	Fish and wildlife, natural processes	Closed	Open - No Surface Occupancy	Proposed Closed	None
59		Willamette Valley Prairie/ Oak and Pine Area	Potential	1,486	yes_ without_ OC	yes_ without_ OC	yes_ without_ OC	Fish and wildlife, natural processes	Closed	Open - No Surface Occupancy	Proposed Closed	Potential selective harvest/ silvicultural prescriptions and Conifer removal to maintain grassland
60	ROSEBURG	Bear Gulch RNA	Existing	351	yes	yes	yes	Natural processes	Closed	Open - No Surface Occupancy	Proposed Closed	None
61		Beatty Creek RNA	Existing	864	yes	yes	yes	Natural processes	Closed	Open - No Surface Occupancy	Proposed Closed	None
62		Bushnell-Irwin Rocks RNA	Existing	1,085	yes	yes	yes	Natural processes	Closed	Open - No Surface Occupancy	Proposed Closed	None

Map #	District	ACEC Name	Status	Total Area (Acres)	Alt 1	Alt 2	Alt 3	Relevant and Important Value Category	Management Direction If Designated			
									Off-Highway Vehicle Desig.	Leasable Mineral Entry	Locatable/ Salable Mineral Entry	Timber Harvest
63	ROSEBURG	Callahan Meadows	Potential	34	yes	yes	yes	Natural processes	Closed	Open - No Surface Occupancy	Proposed Closed	None
64		China Ditch	Potential	60	no	no	no	Natural processes	Closed	Open - No Surface Occupancy	Proposed Closed	None
65		Myrtle Island RNA	Existing	19	yes	yes	yes	Natural processes	Closed	Open - No Surface Occupancy	Proposed Closed	None
66		North Bank	Existing	6,162	yes	yes	yes	Cultural, fish and wildlife, natural processes	Limited to designated roads	Open - No Surface Occupancy	Proposed Closed	None
67		North Myrtle Creek RNA	Existing	453	yes	yes	yes	Natural processes	Closed	Open - No Surface Occupancy	Proposed Closed	None
68		North Umpqua River	Existing	1,791				Scenic, fish and wildlife	Limited to designated roads	Open - No Surface Occupancy	Proposed Closed	None
69		Red Pond RNA	Existing	141	yes	yes	yes	Fish and wildlife, natural processes	Closed	Open - No Surface Occupancy	Proposed Closed	None
70		Stouts Creek	Potential	64	no	no	no	Natural processes	Closed	Open - No Surface Occupancy	Proposed Closed	None
71		Tater Hill RNA	Existing	303	yes	yes	yes	Natural processes	Closed	Open - No Surface Occupancy	Proposed Closed	None
72		Umpqua River Wildlife Area	Existing	855	no	no	no	Fish and wildlife	Limited to designated roads	Open - No Surface Occupancy	Proposed Closed	None

Map #	District	ACEC Name	Status	Total Area (Acres)	Alt 1	Alt 2	Alt 3	Relevant and Important Value Category	Management Direction If Designated			
									Off-Highway Vehicle Desig.	Leasable Mineral Entry	Locatable/ Salable Mineral Entry	Timber Harvest
73	COOS BAY	Brownson Ridge	Potential	399	no	no	no	Fish and wildlife, natural processes	Limited to designated roads	Open - No Surface Occupancy	Proposed Closed	None
74		Cherry Creek RNA	Existing	592	yes	yes	yes	Fish and wildlife, natural processes	Closed	Open - No Surface Occupancy	Proposed Closed	None
75		China Wall	Existing	302	yes	yes	yes_ without_ OC	Cultural, natural processes	Closed	Open - No Surface Occupancy	Proposed Closed	None
76		Euphoria Ridge	Potential	241	no	no	no	Cultural, fish and wildlife, natural processes	Closed	Open - No Surface Occupancy	Proposed Closed	None
77		Hunter Creek Bog	Existing	721	yes	yes	yes	Natural processes	Limited to designated roads	Open - No Surface Occupancy	Proposed Closed	None
78		New River	Existing	876	yes	yes	yes	Cultural, fish and wildlife, natural processes	Limited to designated roads	Open - No Surface Occupancy	Proposed Closed	None
79		North Fork Chetco	Existing	603	yes	yes	yes	Cultural, natural processes	Limited to designated roads	Open - No Surface Occupancy	Proposed Closed	None
80		North Fork Coquille River	Existing	311	yes	yes_ without_ OC	no	Fish and wildlife, natural processes	Limited to designated roads	Open - No Surface Occupancy	Proposed Closed	None
81		North Fork Hunter Creek	Existing	1,757	yes	yes	yes	Cultural, fish and wildlife, natural processes	Limited to designated roads	Open - No Surface Occupancy	Proposed Closed	None
82		North Spit	Existing	682	yes	yes	yes	Cultural, scenic, fish and wildlife, natural processes	Limited to designated roads	Open - No Surface Occupancy	Proposed Closed	None

Map #	District	ACEC Name	Status	Total Area (Acres)	Alt 1	Alt 2	Alt 3	Relevant and Important Value Category	Management Direction If Designated			
									Off-Highway Vehicle Desig.	Leasable Mineral Entry	Locatable/ Salable Mineral Entry	Timber Harvest
83	COOS BAY	Rocky Peak	Potential	1,827	yes	yes	yes	Cultural, scenic, fish and wildlife, natural processes	Limited to designated roads	Open - No Surface Occupancy	Proposed Closed	None
84		Roman Nose	Potential	205	yes	yes	yes_ without_ OC	Natural processes	Limited to designated roads	Open - No Surface Occupancy	Proposed Closed	None
85		Steel Creek	Potential	1,381	yes_ without_ OC	yes_ without_ OC	no	Historic, fish and wildlife, natural processes	Limited to designated roads	Open - No Surface Occupancy	Proposed Closed	None
86		Tioga Creek	Existing	42	yes	yes	no	Fish and wildlife, natural processes	Closed	Open - No Surface Occupancy	Proposed Closed	None
87		Upper Rock Creek	Existing	472	yes	no	no	Fish and wildlife, natural processes	Limited to designated roads	Open - No Surface Occupancy	Proposed Closed	None
88		Wassen Creek	Existing	3,394	yes	no	no	Scenic, fish and wildlife, natural processes	Limited to designated roads	Open - No Surface Occupancy	Proposed Closed	None
89	MEDFORD	Baker Cypress	Existing	11	no	no	no	Scenic, cultural, natural processes	Limited to designated roads	Open - No Surface Occupancy	Open	None
90		Bobby Creek RNA	Existing	1,915	yes	yes	yes	Fish and wildlife, natural processes	Limited to designated roads	Open - No Surface Occupancy	Proposed Closed	None
91		Brewer Spruce RNA	Existing	1,707	yes	yes	yes	Fish and wildlife, natural processes	Limited to designated roads	Open - No Surface Occupancy	Proposed Closed	None
92		Cobleigh Road	Potential	261	yes_ without_ OC	yes_ without_ OC	yes_ without_ OC	Fish and wildlife, natural processes	Closed	Open - No Surface Occupancy	Proposed Closed	None

Map #	District	ACEC Name	Status	Total Area (Acres)	Alt 1	Alt 2	Alt 3	Relevant and Important Value Category	Management Direction If Designated			
									Off-Highway Vehicle Desig.	Leasable Mineral Entry	Locatable/ Salable Mineral Entry	Timber Harvest
93	MEDFORD	Crooks Creek	Existing	147	no	yes	no	Fish and wildlife, natural processes	Limited to designated roads	Open - No Surface Occupancy	Proposed Closed	None
94		Dakubetede Wildland	Potential	1,796	yes_ without_ OC	yes_ without_ OC	yes_ without_ OC	Natural processes	Closed	Open - No Surface Occupancy	Proposed Closed	None
95		East Fork Whiskey Creek	Potential	3,188	no	yes	no	Fish and wildlife, natural processes	Closed	Open - No Surface Occupancy	Proposed Closed	None
96		Eight Dollar Mountain	Existing	1,249	yes	yes	yes	Natural processes	Limited to designated roads	Open - No Surface Occupancy	Open	None
97		French Flat	Existing	651	yes_ without_ OC	yes_ without_ OC	yes_ without_ OC	Cultural, natural processes	Closed	Open - No Surface Occupancy	Open	None
98		Grayback Glades RNA	Existing	1,022	yes	yes	yes	Natural processes	Closed	Open - No Surface Occupancy	Proposed Closed	None
99		Hole-In-The-Rock	Existing	63	no	no	no	Scenic, natural processes	Limited to designated roads	Open - No Surface Occupancy	Proposed Closed	None
100		Holton Creek RNA	Existing	421	yes	yes	yes	Scenic, natural processes	Closed	Open - No Surface Occupancy	Proposed Closed	None
101		Hoxie Creek	Existing	255	no	no	no	Scenic, fish and wildlife, natural processes	Limited to designated roads	Open - No Surface Occupancy	Proposed Closed	None
102		Iron Creek	Existing	286				Fish and wildlife, natural processes	Limited to designated roads	Open - No Surface Occupancy	Proposed Closed	None
103		Jenny Creek	Existing	966				Fish and wildlife, natural processes	Limited to designated roads	Open - No Surface Occupancy	Proposed Closed	None

Map #	District	ACEC Name	Status	Total Area (Acres)	Alt 1	Alt 2	Alt 3	Relevant and Important Value Category	Management Direction If Designated			
									Off-Highway Vehicle Desig.	Leasable Mineral Entry	Locatable/ Salable Mineral Entry	Timber Harvest
104	MEDFORD	King Mountain Rock Garden	Existing	68	yes_ without_ OC	yes_ without_ OC	yes_ without_ OC	Natural processes	Limited to designated roads	Open - No Surface Occupancy	Open	None
105		Long Gulch	Potential	1,020	no	no	no	Fish and wildlife, natural processes	Closed	Open - No Surface Occupancy	Proposed Closed	Density management for ACEC values
106		Lost Lake RNA	Existing	387	yes	yes	yes	Scenic, natural processes	Closed	Open - No Surface Occupancy	Proposed Closed	None
107		Moon Prairie	Existing	92	no	no	no	Fish and wildlife, natural processes	Limited to designated roads	Open - No Surface Occupancy	Open	None
108		North Fork Silver Creek RNA	Existing	499	yes	yes	yes	Fish and wildlife, natural processes	Closed	Open - No Surface Occupancy	Proposed Closed	None
109		Oregon Gulch RNA	Existing	1,051	yes	yes	yes	Natural processes	Closed	Open - No Surface Occupancy	Proposed Closed	None
110		Pickett Creek	Potential	32	yes	yes	yes	Natural processes	Closed	Open - No Surface Occupancy	Proposed Closed	None
111		Pilot Rock	Existing	544				Fish and wildlife, natural processes	Closed	Open - No Surface Occupancy	Proposed Closed	None
112		Pipe Fork RNA	Existing	516	yes	yes	yes	Natural processes	Closed	Open - No Surface Occupancy	Proposed Closed	None
113		Poverty Flat	Existing	29	yes	yes	yes	Natural processes	Limited to designated roads	Open - No Surface Occupancy	Open	None
114		Reeves Creek	Potential	117	no	no	no	Natural processes	Closed	Open - No Surface Occupancy	Proposed Closed	None

Map #	District	ACEC Name	Status	Total Area (Acres)	Alt 1	Alt 2	Alt 3	Relevant and Important Value Category	Management Direction If Designated			
									Off-Highway Vehicle Desig.	Leasable Mineral Entry	Locatable/ Salable Mineral Entry	Timber Harvest
115	MEDFORD	Rough and Ready	Existing	1,189	yes_ without_ OC	yes_ without_ OC	yes_ without_ OC	Natural processes	Limited to designated roads	Open - No Surface Occupancy	Open	None
116		Round Top Butte RNA	Existing	605	yes	yes	yes	Natural processes	Closed	Open - No Surface Occupancy	Proposed Closed	None
117		Scotch Creek RNA	Existing	1,799	yes	yes	yes	Natural processes	Closed	Open - No Surface Occupancy	Proposed Closed	None
118		Sterling Mine Ditch	Existing	143	no	no	no	Cultural, historic	Closed	Open - No Surface Occupancy	Open	None
119		Table Rocks ONA	Existing	1,244	yes	yes	yes	Scenic, natural processes	Closed	Open - No Surface Occupancy	Open	None
120		Tin Cup	Existing	83	no	no	no	Fish and wildlife, natural processes	Limited to designated roads	Open - No Surface Occupancy	Open	None
121		Waldo-Takilma	Potential	1,760	yes	yes	yes	Historic, natural processes	Closed	Open - No Surface Occupancy	Proposed Closed	None
122		Woodcock Bog RNA	Existing	265	yes	yes	yes	Natural processes	Closed	Open - No Surface Occupancy	Proposed Closed	None
123	KLAMATH	Bumpheads	Potential	112	yes	yes	yes	Scenic, cultural, natural processes	Limited to designated roads	Open - No Surface Occupancy	Proposed Closed	None
124		Four Mile Wetland	Potential	1,173	yes	yes	yes	Scenic, fish and wildlife, natural processes	Closed	Open - No Surface Occupancy	Proposed Closed	None
125		Miller Creek	Existing	939	yes	yes	yes	Scenic, fish and wildlife, natural processes	Closed	Open - No Surface Occupancy	Proposed Closed	None

Map #	District	ACEC Name	Status	Total Area (Acres)	Alt 1	Alt 2	Alt 3	Relevant and Important Value Category	Management Direction If Designated			
									Off-Highway Vehicle Desig.	Leasable Mineral Entry	Locatable/ Salable Mineral Entry	Timber Harvest
126	KLAMATH	Old Baldy RNA	Existing	355	yes	yes	yes	Natural processes	Closed	Open - No Surface Occupancy	Proposed Closed	None
127		Tunnel Creek	Potential	72	yes_ without_ OC	yes_ without_ OC	yes_ without_ OC	Fish and wildlife, natural processes	Limited to designated roads	Open - No Surface Occupancy	Proposed Closed	None
128		Upper Klamath River	Existing	5,092	yes_ without_ OC	yes_ without_ OC	yes_ without_ OC	Historic, cultural, scenic, fish and wildlife, natural processes	Limited to designated roads	Open - No Surface Occupancy	Proposed Closed	Forest health treaments
129		Upper Klamath River Addition	Potential	910	yes_ without_ OC	yes_ without_ OC	yes_ without_ OC	Historic, cultural, scenic, fish and wildlife, natural processes	Limited to designated roads	Open - No Surface Occupancy	Proposed Closed	Forest health treaments
130		Wood River Wetland	Existing	3,225	yes	yes	yes	Cultural, fish and wildlife, natural processes	Closed	Open - No Surface Occupancy	Proposed Closed	None
131		Yainax Butte	Existing	707	yes	yes	yes	Cultural, natural processes	Limited to designated roads	Open - No Surface Occupancy	Proposed Closed	None

***yes_without_OC = area would be designated without the O&C timber harvest base acres included.**

MAP #	District	ACEC Name	Status	Historic, cultural, scenic	Relevant and Important Value Category		
					Fish and wildlife	Natural process or system	Natural hazard
1	SALEM	Beaver Creek	Potential			Natural system associated with mid-elevation oak meadow and native prairie flora seldom seen along the western slopes of the northern Cascades in Oregon. Contributes to the regional oak meadow network as described in the Nature Conservancy's nomination letter (dated 01/06/2006) and the Willamette Valley-Puget Trough-Georgia Basin, Ecoregional Assessment.	
2		Crabtree Complex RNA/ ONA	Existing	Scenic values for this area are high in the immediate vicinity. Scenic qualities such as forest cover type, complex of habitats and geologic features are considered exceptional within the Salem District.	The relatively undisturbed forest is used by northern spotted owls (FT). Cliffs provide unique habitat with potential for raptor use. Evening fieldslug (Derocerus Hesperium) (BSO), northern goshawk (BSO), Cascades torrent salamander (BAO) have all been documented within the ACEC.	West Cascades, Oregon Ecoregion Cells: Western hemlock/devil's club and old-growth western redcedar types. Evidence of glaciation along with a relatively undisturbed old-growth forest at a relatively low elevation contributes to relevance for natural systems at this site. This area has a population of Alaska-cedar which is fairly uncommon in this region. Rare botanical species reported from this area include: Phaeocollybia californica (BSO)	

MAP #	District	ACEC Name	Status	Historic, cultural, scenic	Relevant and Important Value Category		
					Fish and wildlife	Natural process or system	Natural hazard
3	SALEM	Elk Creek	Existing		An ACEC since 1980, it was originally established for management of rare inland bald eagle (FT) nest site. In addition to continued use by eagles, also contains a known marbled murrelet site and an historic spotted owl site. The ACEC is a rare northern coast range example of a relatively large contiguous block of old forest that contains excellent habitat for all three of these species, and is expected to continue to contribute to their recovery. Elk Creek is also considered to be the most important and biologically complex tributary to the Nestucca River system because Oregon Coastal coho (BSO), chinook, summer and winter steelhead (FC), sea-run and resident cutthroat trout and Pacific lamprey all spawn in this stream.	This contiguous block of old forest is a rare example of a fully functional natural system in the north Oregon Coast Range as evidenced by the extensive list of late-successional forest dependent species that occur there. While there are other patches of old forest in the northern coast range, few are of the size and contiguity of the Elk Creek area while also remaining relatively undisturbed.	
4		Forest Peak RNA	Existing		Undisturbed valley margin meadows are rare in this vicinity. This meadow may provide habitat for several rare invertebrate species including: Fender's blue butterfly (FT), Taylor's checkerspot (FC), and Siskiyou grasshopper (BSO). This meadow also offers habitat for declining willamette valley songbirds, including common nighthawk (BSO), Oregon vesper sparrow (BSO), western bluebird, and acorn woodpecker.	Willamette Vallley Ecoregion cells: Douglas-fir/poison oak forest, Douglas-fir/bigleaf maple forest with some grand fir , Lemmon's needlegrass-moss bald. Valley margin cell\, undisturbed 3rd order stream in valley fringe. Cimicifuga elata (BSO)	
5		Grass Mountain RNA	Existing	Scenic	High elevation grassy bald habitat is juxaposed with mature noble fir and forest and offers undisturbed refugia for rare and endemic invertebrate species including an un-named blind ground beetle. The older forest stands have a long history of use and offer nesting habitat for spotted owls (FT) and marbled murrelets (FT)	Coast Range Ecoregion Cells: Noble fir-western hemlock forest, Grass bald on Coast Range mountain. Meets the needs of a high elevation noble fir and grass meadow community and an undisturbed 3rd order stream system.	

MAP #	District	ACEC Name	Status	Historic, cultural, scenic	Relevant and Important Value Category		
					Fish and wildlife	Natural process or system	Natural hazard
6	SALEM	High Peak - Moon Creek RNA	Existing		The Moon Creek ACEC contains active northern spotted owl (FT) and marbled murrelet (FT) sites. The area is comprised of contiguous late-successional forest habitat that is relatively inaccessible and undisturbed within a very steep canyon that is ideal for supporting owls and murrelets. Elevations within the ACEC range from over 2800 feet on High Peak to about 600 feet on Moon Creek itself. Trees as much as 500 years old are found there. One of the few remaining relatively large contiguous blocks of old forest found in north Oregon coast range. Moon Creek is also high quality habitat for anadromous fish of regional significance, including Oregon Coastal coho (BSO) and steelhead (FC on BLM list).	Rare example of northern Oregon coast range old-growth forest with intact functioning late-successional forest system. Coast Range Ecoregion Cells: Western hemlock/ swordfern, Western hemlock/vine maple-salal. Douglas-fir/sword fern community natural processes also for riparian hardwoods/streamside forest on third to fifth order stream at low elevation.	
7		Jackson Bend	Existing		Roosting and nesting sites for bald eagle (FT), great blue heron and osprey are documented within this ACEC.	This parcel is on the banks of and within the floodplain of the Willamette River. The entire area is seasonally flooded during high water events. Very little land of this type is in Federal ownership and the habitat in this parcel is unique from all other BLM lands in NW Oregon.	
8		Little Grass Mountain	Existing	scenic vistas	Example of grassy bald habitat adjacent to mature conifer forest. Rare or endemic invertebrate species are possible.	Grass balds are uncommon in the Oregon Coast Range Mountains. There are no specific values within this area that sets it apart from other grassy balds that are not designated as ACECs.	

MAP #	District	ACEC Name	Status	Historic, cultural, scenic	Relevant and Important Value Category		
					Fish and wildlife	Natural process or system	Natural hazard
9	SALEM	Little North Fork Wilson River	Potential		High quality habitat and known sites for northern spotted owl (FT), marbled murrelet (FT) and bald eagle (FT) exists within the potential Little North Fork Wilson River ACEC. All three species have nested either now or in the recent past within the area. Due to its inaccessibility, ruggedness, lack of fragmentation, and proximity to highly managed state and private forest lands, this area is one of the few remaining areas in the northern coast range where late-successional dependent species exist largely undisturbed. The Little North Fork Wilson River is also a tier 1 key watershed and supports 5 salmonid species including coastal winter steelhead (FC), Oregon Coast coho (BSO) and chum salmon, and is the only stream on BLM managed lands in the northern coast range that supports chum salmon.	Intact old-growth conifer riparian habitat is rare throughout the state of Oregon and is especially rare in coastal ecosystems. This potential ACEC contains old-growth components in a biologically diverse and natural condition not only within the riparian areas but throughout the adjacent slopes and tributary drainages as well. A relict old-growth plant community of Douglas-fir, Sitka spruce, Western hemlock, and Western redcedar that is approximately 450 years old within the canyon of the Little North Fork of the Wilson River. The riparian plant community is essentially natural, having large conifers shading and contributing downed material to the river system.	
10		Little Sink RNA	Existing		Parcel provides excellent example of low elevation coast range old-growth forest adjacent to Willamette Valley margin. Ponds support healthy populations of native amphibians (no bullfrogs). Potential release site for western pond turle. Historic nest site for spotted owl (FT). Refugia for invertebrate species, with potential presence of Johnson's hairstreak (BSO), spotted taildropper slug (BSO), and other uncommon mollusks.	Willamette Valley Ecoregion Cells: Douglas-fir grand fir/ vine maple -salal, Slump pond at margin of valley, with aquatic beds and marshy shore. "Instant Study (wilderness) Area in the foothills of the Willamette Valley. Rare botanical species reported from this location include: Wolffia columbiana (BAO) and Wolffia boraelis (BAO).	The past slumping soils or unstable ground at Little Sink has created at least 3 distinct ponds.

MAP #	District	ACEC Name	Status	Historic, cultural, scenic	Relevant and Important Value Category		
					Fish and wildlife	Natural process or system	Natural hazard
11	SALEM	Lost Prairie	Existing		Large bog and wetland habitat supports a diverse assemblage of uncommon invetebrate species, which may include: evening field slug (BSO), crowned tightcoil snail (BSO), and spotted tail-dropper slug (BSO). Site also offers nesting habitat for songbirds, such as the olive-sided flycatcher, western bluebird, and willow flycatcher.	Unique high elevation sphagnum bog and associated species located in the northern Oregon Coast Range. Rare botanical species reported from Lost Prairie ACEC include: Fritillaria camschatcensis (BAO), Erythronium elegans (STO), Anemone oregana var. felix (BAO), Tetraplodon mnioides (BAO).	
12		Lower Scappoose Eagle	Potential		Lower Scappoose Eagle PACEC includes an active and productive bald eagle (FT) nest site and a communal winter roost, a circumstance that is highly unusual. Surrounded by private industrial forestland and expanding urban areas, this site provides refuge for eagles due to its relative inaccessibility and ruggedness and has contributed to the resurgence of eagle numbers in the lower Columbia River recovery zone.		
13		Marys Peak ONA	Existing	Marys Peak is the highest mountain in the Oregon Coast Range Mountains.	This unique high elevation grassy bald habitat is juxaposed with mature and old-growth forests and is known to support populations of several rare or endemic invertebrates including: Haddocks caddisfly (BSO), and Roth's blind ground beetle (BSO). The older forest stands have a long history of use and offer nesting habitat for spotted owls (FT) and marbled murrelets (FT).	Marys Peak is the highest mountain in the Oregon Coast Range Mountains. Special habitats or natural values include: high elevation grass meadows, noble fir community, shallow soils with 'rock garden' plants.	
14		Marys Peak B	Potential	High scenic values in the immediate vicinity.	Uncommon or endemic invertebrates are possible in high elevation tributaries of Parker Creek, including the Haddock's caddisfly (BSO). The older forest stands have a long history of use and offer nesting habitat for spotted owls (FT) and marbled murrelets (FT).	Marys Peak Parcel B includes a high elevation Coast Range old-growth forest with a noble fir component, which is rare.	

MAP #	District	ACEC Name	Status	Historic, cultural, scenic	Relevant and Important Value Category		
					Fish and wildlife	Natural process or system	Natural hazard
15	SALEM	McCully Mountain	Potential			Natural system associated with mid-elevation oak meadow and native prairie flora seldom seen along the western slopes of the northern Cascades in Oregon. Importance is met through regional interest in oak habitats within and adjacent to the Willamette valley. Contributes to the regional oak meadow network as described in the Nature Conservancies nomination letter (dated 01/06/2006) and the Willamette Valley-Puget Trough-Georgia Basin, Ecoregional Assessment. The McCully Mountain PACEC meets regional significance based on the limited number of mid-elevation oak meadows that remain intact. Potential for nesting raptors, use by Neotropical Migratory birds and occurrence of wildlife species associated with older forest.	
16		Middle Santiam Terrace	Existing	A Native Amarican cultural site at this location is one of few in the region on public lands.		Old-growth fir and hemlock forest at a relatively low elevation river terrace. Habitat of this type is relatively unique and has an increased value as a research site. All forest surrounding this ACEC is privately owned and has been previously logged, leaving this as the last remaining natural habitat in a matrix of young managed forests.	

MAP #	District	ACEC Name	Status	Historic, cultural, scenic	Relevant and Important Value Category		
					Fish and wildlife	Natural process or system	Natural hazard
17	SALEM	Mill Creek Ridge	Potential			Oregon white oak community in NW Oregon on east slopes of the Coast Range. Rare valley margin oak habitat juxaposed with coast range conifer forests is likely to support great diversity of uncommon or endemic invertebrate species, and provide nesting habitat for declinging willamette valley songbirds, including common nighthawk (BSO), western bluebird, and white-breasted nuthatch.	

MAP #	District	ACEC Name	Status	Historic, cultural, scenic	Relevant and Important Value Category		
					Fish and wildlife	Natural process or system	Natural hazard
18	SALEM	Molalla Meadows	Potential	The river corridor has a high level of public use and meets relevance criteria for both recreation and scenic values. The Molalla River has been found to be both eligible and suitable for inclusion into the National Wild and Scenic River (WSR) System for outstandingly remarkable values that include geology, scenic and recreation. The general area including the PACEC has been recognized for both its scenic and recreation values and has been designated a BLM Special Recreation Management Area. While there may be some overlap between the WSR and the PACEC boundaries, the protections and guidance provided under WSR guidance are interim unless the river is actually added to the WSR System by Congress. In addition, the interim guidance only addresses management within a 1/4-mile of either side of the Molalla River. As long as any management prescriptions for the PACEC met WSR interim guidance, these would be complimentary not competing designations.	The area meets relevance for Wildlife Resources due to presence of raptor nests, use by Neotropical Migratory birds and occurrence of wildlife species associated with older forest. Golden eagles, Oregon slender salamander (BSO), harlequin duck (BAO), and band-tailed pigeon (Continental/Regional Species of Concern) occur here.	The meadows represent a unique ecotype with natural systems and geologic features seldom seen on BLM lands in the Salem District. The oak meadows represent a rare transition from valley oak savannas' to upland conifer forests. This site contributes to the regional oak meadow network as described in the Nature Conservancies nomination letter (dated 01/06/2006) and the Willamette Valley-Puget Trough-Georgia Basin, Ecoregional Assessment. The oak meadow at this site are the largest of this habitat type under BLM ownership in the Cascades Range, within the Salem District.	

MAP #	District	ACEC Name	Status	Historic, cultural, scenic	Relevant and Important Value Category		
					Fish and wildlife	Natural process or system	Natural hazard
19	SALEM	Nestucca River	Existing	Designated State scenic waterway & BLM backcountry byway. The upper Nestucca River is eligible for inclusion in National Wild & Scenic River system (recreational designation). The river corridor is designated VRM 1.	The Nestucca River corridor includes high quality nesting, roosting and foraging habitat for bald eagles (FT) and marbled murrelets (FT). The river provides important connectivity to other high quality habitat areas, most notably the Elk Creek drainage and ACEC. Marbled murrelets are known to use the river corridor to access nesting habitat within the drainage. The Nestucca River is also a high quality anadromous fish stream and contributes significantly to wild fish production on the north Oregon Coast. Oregon Coastal coho (BSO) , chinook, summer and winter steelhead (FC), sea-run and resident cutthroat trout and Pacific lamprey are all present.		
20		North Santiam	Existing			Represents a natural system not common in the region. The primary natural system operating in the area are the relatively undisturbed river meander channels which are rare and sensitive to additional disturbance. This area contributes to the habitat used by species in combination with Kingston prairie and Stout Mountain (adjacent areas with unique values). Existing alluvial forest provides potential nesting and roosting habitat for resident and migratory birds. With its unique habitat this area contributes to overall RNA values for this habitat type but it is not large enough to meet the needs of the RNA cell.	

MAP #	District	ACEC Name	Status	Historic, cultural, scenic	Relevant and Important Value Category		
					Fish and wildlife	Natural process or system	Natural hazard
21	SALEM	Rickreall Ridge	Existing			Rocky “hogback” ridge, steep talus slopes and unique vegetation in the Oregon Coast Range Mountains. Rickreall Ridge has a disjunct flora as the vegetation is similar to vegetation known from the Cascade Mountain Range. High elevation rocky outcrops and adjoining older forest support a diversity of rare or endemic invertebrate species, including Johnson’s hairstreak (BSO), and spotted tail-dropper (BSO). Older forest provides potential nesting habitat for spotted owls (FT) and marbled murrelets (FT).	
22		Saddleback Mountain RNA	Existing		Exceptionally rare old-growth Pacific silver fir forest in Oregon Coast Range supports a diversity of rare invertebrate species that could include: Johnson’s hairstreak (BSO), and spotted tail-dropper (BSO). Forest provides potential nesting habitat for spotted owls (FT) and marbled murrelets (FT).	Old-growth Pacific silver fir and western hemlock community. Saddlebag may be the last remaining mature naturally occurring Pacific silver fir stand in the Oregon Coast Range. Pacific silver fir was once thought to be more widespread but due to climatic changes may now be isolated to a few areas in the Oregon Coastal Mountains. Rare botanical species reported from Saddlebag Mountain RNA: Erythronium elegans (STO)	

MAP #	District	ACEC Name	Status	Historic, cultural, scenic	Relevant and Important Value Category		
					Fish and wildlife	Natural process or system	Natural hazard
23	SALEM	Sandy River Gorge ONA	Existing	Cultural: Barlow Road and Rock Corral (currently listed) are National Register sites within the corridor. A prehistoric site eligible for the National Register also exists. Scenic: The inner gorge has steep canlyon walls, deep, trench-like pools, waterfalls and cliff-dwelling plant communities. The Mt Hood corridor (Highway 26) has a VRM 1 classification due to it scenic qualities and is congressionally designated as the Mt Hood Scenic Corridor.	Stocks of Lower Columbia River chinook, winter steelhead, and coho (all FT); cutthroat trout are present in this portion of the Sandy River. Spawning grounds for chinook salmon, rearing habitat for steelhead and chinook salmon are also present. Peregrine falcons (BSO), bald eagles (FT) and harlequin ducks (BAO) have been known to use the Sandy River Gorge. Migratory birds such as the willow flycatcher (Continental/ Regional species of Concern) have been documented within the ACEC.	Recognize that some of the lands are currently not in forest condition (agricultural). Value of the lands as a whole is greater than the value of individual parcels. Riparian old-growth forests in the Middle Sandy are rare in the watershed downstream from Marmot Dam. Bureau sensitive fungus species, Bridgeoporus noblissimus (BSO) is reported from the PACEC.	Precipitous slopes and canyon walls that line the inner gorge are a threat to outdoor enthusiasts enjoying the captivating views.
24		Sheridan Peak	Existing			Former special status botanical species, Poa marcida is reported from this location. This species no longer has special status.	
25		Silt Creek	Potential			Active, natural landslide with an old-growth forest and unique habitat related to the slow but continual mass earth movement. The area is also host to an abnormally large population of Pseudocyphellaria rainierensis.	Large scale, active natural landslide

MAP #	District	ACEC Name	Status	Historic, cultural, scenic	Relevant and Important Value Category		
					Fish and wildlife	Natural process or system	Natural hazard
26	SALEM	Snow Peak	Potential		Contains one occupied known northern spotted owl (FT) site and core area. Known to be used by various migratory bird species such as the olive-sided flycatcher (Continental/Regional Species of Concern). Band-tailed pigeon, and the nighthawk (BSO) are also known to use the area. Oregon slender salamander (BSO), Cascades torrent salamander (BAO) and the Evening fieldslug (BSO) (Derocerus Hesperium), have been documented within the PACEC.	Snow Peak's elevation of 4280 feet makes it an uncharacteristically high point very close to the Willamette Valley. The PACEC hosts a variety of special habitats including wet meadows, dry meadows, rock outcrops/crevice habitat, talus slopes, mature to old-growth forests, headwater streams with adjacent riparian and brushy thickets in close proximity to one another. This habitat complex provides for an abundant array of wildlife species and rare botanicals including Bridgeoporus noblissimus (BSO) ,Corydalis aquae-gelidae (BSO) , Pilophorus nigricaulis (BAO), Lobaria linita (BAO). A wetland botanical species (Fauria crista-galli) found nowhere else in Oregon is also found here.	
27		Soosap Meadows	Existing			These meadows are the only large, undisturbed expanse of natural Cascadian subalpine meadows in the Salem District. Streams which have cut through the glacial moraine have left behind a unique and diverse remnant of subalpine habitat.	
28		The Butte RNA	Existing			Willamette Valley & Coast Range Ecoregion Cells: Douglas-fir/poison oak forest, Oregon white oak/grass savanna. Uncommon transitional ecotone involving Willamette Valley margin plant communities and upland Coast Range forested communities. Rare botanical species reported from The Butte RNA include: Cimicifuga elata (BSO)	

MAP #	District	ACEC Name	Status	Historic, cultural, scenic	Relevant and Important Value Category		
					Fish and wildlife	Natural process or system	Natural hazard
29	SALEM	Valley of the Giants ONA	Existing	Outstanding example of coastal old-growth forest	Valley of the Giants ONA lies within the largest contiguous patch of old-growth forest habitat in the northern Oregon Coast Range (over 800 acres, 400+ years old). This older forest provides nesting habitat for one of the largest concentrations of breeding marbled murrelets (FT) in Oregon. The proposed area also provides habitat for northern spotted owls (FT), bald eagles (FT), and Oregon Coastal steelhead (summer-run and winter-run; both FC). These old-growth stands provide an exceptionally large refugia for invertebrate species that are closely associated with older forest conditions.	Although not designated as a RNA, Valley of the Giants is well studied as a remnant 'old-growth' western hemlock plant association. Rare botanical species reported from this location include: Schistostega pennata (BAO), Filipendula occidentalis (BSO), and Tetraphis geniculata (BAO)	
30		Walker Flat	Existing			The only naturally occurrence of Sidalcea nelsonia (FT) in the Salem District is within the Walker Flat ACEC.	
31		Waterloo	Potential			The BLM's Waterloo parcel is within The Nature Conservancy's Waterloo Rocks portfolio site. This is the only known Salem District parcel with naturally-occurring Ponderosa Pine. The map of historic (mid-1800s) vegetation shows this as part of a large oak-fir-pine savanna, with prairie located just to the east. Considered in the context of the The Nature Conservancy's Ecoregional Assessment and the Waterloo Rocks portfolio site, in particular, the Waterloo parcel becomes an important part of a larger system of target conservation areas for the oak-pine-fir habitats.	

MAP #	District	ACEC Name	Status	Historic, cultural, scenic	Relevant and Important Value Category		
					Fish and wildlife	Natural process or system	Natural hazard
32	SALEM	Wells Island	Potential		Diverse floodplain forest, seasonally exposed gravel bars, and side-channel habitats. Supports nesting herons, ospreys and numerous songbird species. Invertebrates may include: Willamette floater mussel (BSO), and Oregon Floater.	Wells Island is an island in the Willamette River. Very little land from within the Willamette Valley is in Federal ownership. This island includes habitat that is unique from all BLM ownership in NW Oregon.	
33		White Rock Fen	Existing			The ACEC is centered around four fens differing in size. These four fens provide special habitat to an array of botanical species seldom seen in the Cascade Resource Area. Each fen is unique and may represent various stages in succession. Formation of the fens appears to be the result of an ancient large-scale mass wasting of the local ridge system which created a system of landslide scraps and sag ponds. Hydrologic features associated with bogs are the natural systems of interest. Bogs within this ACEC are unique to the region and are considered fragile.	
34		Wilhoit Springs	Existing			Contributes to low elevation old-growth cell as described by the Nature Conservancy . A rare community with regionally significance as an intact low elevation old-growth conifer forest.	
35		Williams Lake	Existing			Cascade lake and bog habitats with lakeside plant community that are unique and fragile. William's Lake and its bog ecosystem is the best example within the Salem District of a Cascadian massive seep formed lake undergoing peat bog/quaking bog succession.	

MAP #	District	ACEC Name	Status	Historic, cultural, scenic	Relevant and Important Value Category		
					Fish and wildlife	Natural process or system	Natural hazard
36	SALEM	Yampo	Existing			Yampo ACEC supports a late seral Willamette Valley bottom plant community which includes occurrences of rare botanical species Cimicifuga elata (BSO) and Lathyrus holochlorus (BSO). Lathyrus holochlorus has not been seen in this parcel since the 1980s.	
37		Yaquina Head ONA	Existing	Headland on the Pacific Ocean . The area is known as a cultural site for past native Americans use and as a historical site with an operating lighthouse.	A diverse assemblage of coastal habitats such as tide pools, rocky islands, and upland meadow provide for a great diversity of marine invertebrates, nesting seabirds, and marine mammals.	This headland on the eastern Pacific Ocean provides for several unique habitats including: Sitka spruce forest, lodgepole forest, headland grass/shrub communities, wildlife roosts and nesting habitat, tide pools and associated ocean organisms. Rare bryophyte species Eucladium verticillatum (BAO) is reported from the Yaquina Head ONA.	
38	EUGENE	Camas Swale RNA	Existing		Provides habitat for wildlife species, but does not explicitly list distinct species.	The site fills the natural heritage cell or element as: Douglas-fir/swordfern and Douglas-fir/Oregon-grape forest	
39		Coburg Hills RFI	Existing		Raptors (bald eagles (FT), northern spotted owl (FT), western screech owl, northern sawwhet owl, osprey red-tailed hawk; great gray owl, northern pygmy-owl, American kestrel)	Relict Forest Islands provide representative examples of mature and old-growth plant communities in areas where few to no other such communites exist.	
40		Cottage Grove Lake RFI	Existing		Raptors: (bald eagles (FT), northern spotted owl (FT), western screech owl, northern sawwhet owl, osprey red-tailed hawk; great gray owl, northern pygmy-owl, American kestrel, osprey)	Relict Forest Islands provide representative examples of mature and old-growth plant communities in areas where few to no other such communites exist.	
41		Cottage Grove Old Growth	Existing			Douglas-fir old-growth stand. Multiple canopy layers represent the late-successional stage of mesic Douglas-fir plant community with some existing older trees representing ages of 500 years old or more. Cimicifuga elata (BSO).	

MAP #	District	ACEC Name	Status	Historic, cultural, scenic	Relevant and Important Value Category		
					Fish and wildlife	Natural process or system	Natural hazard
42	EUGENE	Cougar Mountain Yew Grove	Existing		Good cavity nester habitat	Site represents one of the lowest elevation stands of Pacific Yew remaining in the Willamette Valley	
43		Dorena Lake RFI	Existing		Raptors (bald eagles (FT), northern spotted owl (FT), western screech owl, northern sawwhet owl, osprey, red-tailed hawk; great gray owl, northern pygmy-owl, American kestrel, osprey).	Relict forest islands provide representative examples of mature and old-growth plant communities in areas where few to no other such communites exist.	
44		Dorena Prairie	Potential			Considered one of the few remaining representative examples of native upland prairie within the Willamette Valley Province.	
45		Esmond Lake	Potential		Coho salmon and steelhead migrate through Esmond Lake and spawn in tributaries above the lake. This lake appears to contain one of the best Coho rearing habitats in the Siuslaw Basin on BLM-administered lands.	Esmond lake has an uncommon geologic feature formed by a large deep-seated landslide. It is the one of only tow significantly sized lakes found in the Siuslaw Resource Area and has experienced very little human disturbance.	
46		Fox Hollow RNA	Existing			The site fills the natural area cell or element described in the oregon natural heritage plan as : Douglas-fir/swordfern and Douglas-fir/ Oregon-grape forest. A mixed stand of Douglas-fir and ponderosa pine is found on the south slopes and ridgtopes,with minor amounts of Oregon white oak and Incense-cedar.	
47		Grassy Mountain	Existing	Highly visible grassy bald.	Screening results recoginize contribution to wildlife habitat, but no species explicitly mentioned.	The site fills the natural heritage cell or element as: Blue wildrye or red fescue grass bald communities; vernal seepage slopes on low to mid elevation rocky bald communities, with monkey flower, saxigrages and moss. One of the finest, undisturbed representative examples of a grassy bald on the western margin of the Cascades.	

MAP #	District	ACEC Name	Status	Historic, cultural, scenic	Relevant and Important Value Category		
					Fish and wildlife	Natural process or system	Natural hazard
48	EUGENE	Heceta Sand Dunes ONA	Existing	Scenic dune system		Seashore bluegrass association; Red Fescue association; Shore pine/ slough sedge association; Shore pine/bearberry association; shore pine/hairy manzanita association. Bureau Assessment Species - Erioderma sorediatum; Leptogium brebissonii; Pannaria rubiginosa; Camplyopus schmidii	
49		Horse Rock Ridge RNA	Existing	Highly visible grassy bald.	Provides habitat for wildlife species, but does not explicitly list distinct species.	The site fills the natural area cell or element in the Oregon Natural Heritage Plan as: West Cascades Ecoregion/shrub and Grassland type blue wildrye or Roemer's fescue grass bald communities.	
50		Hult Marsh	Existing	scenic values		Bureau Assessment Species - Utricularia gibba and Lycopodiella inundata	
51		Lake Creek Falls	Existing				The algae that creates a slippery rock slide, also creates a very unstable walking surface in the stream. Sharp, poorly visible, underwater boulders in pools present hazards to divers. Unstable logs tend to jam up in the pools following winter floods and present hazards to swimmers.
52		Lorane Ponderosa Pine	Potential			Willamette Valley Ponderosa Pine; The Willamette Valley population of ponderosa pine is considered a separate and distinct population from other ponderosa pine populations within Oregon.	
53		Low Elevation Headwaters of the McKenzie River	Potential	McKenzie River (11 miles) suitable for inclusion in National Wild and Scenic System as a Recreational Segment	Bull trout; Upper Willamette spring chinook; cutthroat trout; northern spotted owl, tailed frog; Harlequin duck	Unique nature of a large contnuous block of native forest. Minimally disturbed blocks of land under 2,000 feet on the east side of Willamette Valley.	

MAP #	District	ACEC Name	Status	Historic, cultural, scenic	Relevant and Important Value Category		
					Fish and wildlife	Natural process or system	Natural hazard
54	EUGENE	McGowan Meadow	Potential	Proposed Celebrating Wildflower Site		Site exemplifies a wet meadow with flora of both the Cascades and Willamette Valley ecoregions. Bureau Sensitive - Sidalcea campestris	
55		Mohawk RNA	Existing		Provides habitat for wildlife species, but does not explicitly list distinct species (Spotted Owls?).	The site fills the natural heritage cell or element as: Douglas-fir/western hemlock/Oregon-grape and salal forest. Old-growth Douglas-fir and western hemlock within low elevation Willamette Valley foothills. Site contains small marsh. Tributaries of McGowan Creek flow throuogh or originate in the area.	
56		Oak Basin Prairies	Potential		Fender's Blue Butterfly (Icaricia icariodes fenderi), Taylors Checkerspot butterfly (Rare).	Threse tracts are portions of a large upland prairie complex on the west side of the Coburg hills. Kincaids Lupine (Lupinus sulphureous ssp. kincaidii) (FT), Hitchcock's blue-eyed grass (BSO).	
57		Taylor Creek	Potential		Bald eagle (FT), northern spotted owl (FT), osprey. Western parcel is a significant spawning channel of the McKenzie River.		
58		Upper Elk Meadows RNA	Existing			Four distinct plant communities are in the area: open, wet sedge meadow; wet red alder/willow/hawthorn thickets; open forest dominated by old-growth silver and grand fir; and closed forest dominated by old-growth Douglas-fir.	
59		Willamette Valley Prairie/ Oak and Pine Area	Potential			These sites represent some of the few remaining upland red fescue prairies and oak habitats in the Willamette Valley Province.	

MAP #	District	ACEC Name	Status	Historic, cultural, scenic	Relevant and Important Value Category		
					Fish and wildlife	Natural process or system	Natural hazard
60	ROSEBURG	Bear Gulch RNA	Existing			Douglas-fir/canyon live oak woodland w/ poison oak and dwarf Oregon-grape; and Douglas-fir/canyon live oak forest	
61		Beatty Creek RNA	Existing			Jeffrey pine community on serpentine. Eucephalus vialis, Polystichum californicum, Pseudoleskeella serpentinensis	
62		Bushnell-Irwin Rocks RNA	Existing			Oregon white oak savanna; Oregon white oak/Douglas-fir/poison oak woodland; Romanzoffia thompsonii, Polystichum californicum	
63		Callahan Meadows	Potential			Kincaid's lupine (Lupinus sulphureous ssp. kincaidii) (FT), serpentine meadow, Calochortus umpquaensis	
64		China Ditch	Potential			Kincaid's lupine (Lupinus sulphureous ssp. kincaidii) (FT), serpentine meadow, Calochortus umpquaensis	
65		Myrtle Island RNA	Existing			Old-growth stand of California bay laurel and Douglas-fir (riparian hardwood forest along a major river)	
66		North Bank	Existing	important cultural site	Columbian white-tailed deer	Arabis koehleri var. k., Perideridia erythrorhiza, Plagiobothrys hirtus, Sulcaria badia	
67		North Myrtle Creek RNA	Existing			Douglas-fir/ponderosa pine forest; white fir/dwarf Oregon-grape; Douglas-fir/bigleaf maple forest	
68		North Umpqua River	Existing	scenic	Fish		
69		Red Pond RNA	Existing		Northern spotted owl, western pond turtle	low elevation permanent pond; Wolffia borealis, Phaeocollybia californica	
70		Stouts Creek	Potential			Kincaid's lupine (Lupinus sulphureous ssp. kincaidii) (FT), serpentine meadow, Calochortus umpquaensis	

MAP #	District	ACEC Name	Status	Historic, cultural, scenic	Relevant and Important Value Category		
					Fish and wildlife	Natural process or system	Natural hazard
71	ROSEBURG	Tater Hill RNA	Existing			western hemlock/oceanspray community	active landslide
72		Umpqua River Wildlife Area	Existing		Bald eagle (FT)		
73	COOS BAY	Brownson Ridge	Potential		Marbled murrelet occupied site (FT), northern spotted owl (FT) known site.	Well developed Port-Orford-cedar stand with all age classes	
74		Cherry Creek RNA	Existing		Northern spotted owl (FT), marbled murrelet (FT).	Fills two (Western hemlock/oxalis; Western hemlock/rhododendron-Oregon-grape) ONHP Coast Range Ecological Cells	
75		China Wall	Existing	Remnant of historic Brewster Trail; prehistoric site.		unique plants associated with bald meadows;	
76		Euphoria Ridge	Potential			Old-growth western redcedar stand series rare in Coast Range at this elevation (potential ONHP Coast Range cell)	
77		Hunter Creek Bog	Existing			Fills ONHP Coast Range Ecoregion Cell -- Port Orford Cedar on ultramafic soils. Botany - large, diverse serpentine bog.	
78		New River	Existing	Prehistoric sites	Western snowy plover (FT), Northwestern pond turtle (BSO). Coho, Chinook, Cutthroat Trout (FC), Steelhead (FC).	Fills two ONHP Coastal lowlands ecological cells (lacustrine and palustrine); nine special status plants -- Abronia umbellata ssp. breviflora pink sand verbena (BSO), Calypogeia sphangnicola Liverwort (BAO), Cicendia quadrangularis timwort (BAO), Eriophorum chamissonis russet cotton-grass (BAO), Lilium occidentale western lily (FE), Phacelia argentea silvery phacelia (BSO), Scirpus subterminalis water clubrush (BAO))	
79		North Fork Chetco	Existing	Undisturbed cultural site	Anadromous fish habitat -- searun cutthroat trout.	Oregon myrtle/evergreen shrub riparian forest ONHP Coast Range cell.	

MAP #	District	ACEC Name	Status	Historic, cultural, scenic	Relevant and Important Value Category		
					Fish and wildlife	Natural process or system	Natural hazard
82	COOS BAY	North Spit	Existing	Scenic coastal landscapes comprised of dunes, deflation plain wetlands and Sitka Spruce forest islands. Historic US Lifeguard Service sites and artifacts, and potential prehistoric site.	Western snowy plover (FT), marbled murrelet (FT), northwestern pond turtle (BSO), purple martin (BSO).	Numerous outstanding plant associations and wetlands. Special status plants: Bryoria pseudocapillaris lichen (BSO), Byoria spiralifera lichen (BSO), Cordylanthes maritimus ssp. Palustris Point Reyes bird's-beak (BSO), Heterodermia leucomelos lichen (BAO), Niebla cephalota lichen (BAO).	
83		Rocky Peak	Potential	Historic trail and lookout sites. Panoramic views of coastline plains, foothills and ocean.	Habitat for marbled murrelet (FT), northern spotted owl (FT), fringed myotis (BAO), foothill yellow-legged frog (BAO), spotted tail-dropper (BSO), and northern goshawk (BSO).	ONHP Special species Monardella purpurea Siskiyou monardella (BA); rare meadow, knob-cone pine plant communities.	
84		Roman Nose	Potential	Outstanding, sweeping views of forest landscape from highest point in local region.		Outstanding example of Oregon Coast Range grassy bald system.	
85		Steel Creek	Potential	Portion of historic Brewster Trail.	One of the most productive spawning reaches in Coquille Basin; supports searun and resident cutthroat trout, chinook, coho,, steelhead and Pacific lamprey.	Large, structurally complex unmanaged and undisturbed late-successional forest communityuncommon in Coast Range.	
86		Tioga Creek	Existing		High quality stream/riparian conditions and spawning habitat for coho, steelhead, and cutthroat trout.	Old-growth riparian Douglas-fir/ hardwood community on 4th order stream with high value as reference site.	
87		Upper Rock Creek	Existing			Large redcedar dominated forest with sedge dominated wetlands; Fills Western redcedar-western hemlock/ skunk cabbage ONHP Coast Range Ecological cell.	
88		Wassen Creek	Existing	Scenic -- Large block of undisturbed mid-age forest dissected by creek with several waterfalls, plunge pools, and small palustrine lake.	Pure strain of native cutthroat trout; northern spotted owl (FT);	Fills ONHP Coast Range Ecoregion Palustrine Wetlands pond at mid to high elevation); fits two ONHP Western Hemlock association cells.	

MAP #	District	ACEC Name	Status	Historic, cultural, scenic	Relevant and Important Value Category		
					Fish and wildlife	Natural process or system	Natural hazard
89	MEDFORD	Baker Cypress	Existing			Most northern Cupressus bakeri stand in north America	
90		Bobby Creek RNA	Existing		Northern spotted owl (LT), northern goshawk (BSO), pileated woodpecker (BSO), tailed frog (BA), western bluebird	Intact, uninfected Chamaecyparis lawsoniana stands, Natural heritage cell, Lithocarpus densiflorus - Douglas-fir communities, late-successional reference stands, hydrological reference watershed.	
91		Brewer Spruce RNA	Existing		Northern spotted owl (FT), northern goshawk (BSO)	Unique conifer assemblage, Picea breweri, Chamaecyparis lawsoniana and Chamaecyparis nootkatensis community (rare inland), Natural heritage cell, serpentine pockets, the most resistant, uninfected stands of Chamaecyparis lawsoniana, critical seed/tree improvement collection area, late sucessional reference area, small natural lake	
92		Cobleigh Road	Potential			Limnanthes floccosa ssp. bellingeriana (BSO), Fritillaria gentneri (FE) bulb collection site	
93		Crooks Creek	Existing		Plecotus townsendii (Townsends big eared bat) (BSO), Siskiyou salamander (BAO)	Fritillaria glauca (BAO), Limestone caves, ponds, later successional Lithocarpus densiflorus - Douglas-fir communities	
94		Dakubetede Wildland	Potential	Sterling Mine Ditch	Northern spotted owl (FT), Siskiyou salamander (BSO)	Camissonia graciliflora (BAO), Cimicifuga elata (BSO), Cirsium ciliolatum (BSO), Crumia latifolia (BAO), Cypripedium fasciculatum (BSO), Fritillaria gentneri (FE), Sedum oblanceolatum (BSO), Tripterocladium leucoladulum (BAO) western most stands of Juniperus occidentalis, rare Betula occindentalis var. onapina, intact native grasslands	

MAP #	District	ACEC Name	Status	Historic, cultural, scenic	Relevant and Important Value Category		
					Fish and wildlife	Natural process or system	Natural hazard
95	MEDFORD	East Fork Whiskey Creek	Potential		Northern spotted owl (FT), northern goshawk (BSO), peregrine falcon (BSO), clouded salamander, Pacific fisher (C), fringed myotis (bat), tailed frog (BAO). Intact functioning riparian habitat with cutthroat trout and sculpins.	Sedum moranii (BSO), late-successional reference stands of Lithocarpus densiflorus - Douglas-fir communities, inclusions of knobcone pine, Natural Heritage cell	
96		Eight Dollar Mountain	Existing	Historic mining, mining claims		Calochortus howellii (STO), Epilobium oreganum (BS), Gentiana setigera (BS), Micoseris howellii (ST), Monardella purpurea (BA), Perideridia erythrorhiza (BS), Pseudoleskeella serpentinensis (BA), Senecio hesperius (BS), Viola primulifolia ssp. occidentalis (BS). Serpentine communities and Darlingtonia fens	
97		French Flat	Existing	Historic mining		Erythronium howellii (BSO), Limnanthes gracilis ssp. gracilis (BSO), Lomatium cookii (FE), Microseris howellii (STO), Senecio hesperius (BSO), serpentine plant communities (Jeffery pine-Arcotostaphylos visida-Festuca roemerii-Stipa lemonii), vernal meadows with Deschapsia caespitosa-Danthonia californica.	
98		Grayback Glades RNA	Existing			Natural heritage cells, aquatic (1st to 3rd order cell), Port-Orford-cedar and white fir systems, uninfected with Port-Orford-cedar disease, Sitka alder and vine maple glades, Shasta red fir	
99		Hole-In-The-Rock	Existing			Unique geological feature, a natural basalt arch, creating a ‘hole’ in the rock.	
100		Holton Creek RNA	Existing			Natural Heritage cell, reference site for low elevation late-successional Douglas-fir/white fir community	

MAP #	District	ACEC Name	Status	Historic, cultural, scenic	Relevant and Important Value Category		
					Fish and wildlife	Natural process or system	Natural hazard
101	MEDFORD	Hoxie Creek	Existing	High scenic value, high recreation use	Bald eagle (FT), osprey	Relict remnant late-successional Douglas-fir community, with few ponderosa pine.	
102		Iron Creek	Existing			Douglas-fir, Pacific madrone and California black oak communities	
103		Jenny Creek	Existing		Jenny Creek sucker (BSO), Red band trout (BSO)	Calochortus greenii (BSO), Nemacladus capillaris (BAO)	
104		King Mountain Rock Garden	Existing	Scenic location, view point, high recreation use.		Frillaria glauca (BSO), Phacelia verna (G3/S3), high elevation serpentine outcrop community	
105		Long Gulch	Potential		Northern spotted owl (FT)	Crumia latifolia (BAO), unique trellised watershed, late-successional Douglas-fir/Arctostaphylos visicida chaparral	
106		Lost Lake RNA	Existing		Northern spotted owl (FT)	Cimicifuga elata (BSO), Natural heritage cell, Aquatic (natural lake), mixed conifer low elevation communities	
107		Moon Prairie	Existing	Scenic and special education value for relict old-growth	Northern spotted owl (FT)	Last remaining old-growth stand on Moon prairie, old-growth, multi-layered stand of Douglas-fir and white fir with Pacific yew, ponderosa pine and sugar pine.	
108		North Fork Silver Creek RNA	Existing			Leucothoe davisiae (BAO), Tripterocladium leucocladulum (BAO), Natural heritage cells, white fir, Douglas-fir/Port-Orford-cedar, and sugar pine/Quercus saddleriana communities, serpentine outcrops and Darlingtonia fens, burned area reference site (1987 & 2002)	
109		Oregon Gulch RNA	Existing		Northern goshawk (BSO)	Calochortus greenei (BSO), Microseris laciniata ssp. detlingii (BSO), Fritillaria gentneri (FE), Natural heritage cell, Mixed conifer forest and mixed chaparral (Arctostaphylos viscida-Ceanothus-Rosaceous species), grasslands.	
110		Pickett Creek	Potential			Fritillaria gentneri (FE)	

MAP #	District	ACEC Name	Status	Historic, cultural, scenic	Relevant and Important Value Category		
					Fish and wildlife	Natural process or system	Natural hazard
111	MEDFORD	Pilot Rock	Existing	Geologic feature, scenic, high recreation use	Peregrine falcon (LE)	Calochortus greenei (BSO), Fritillaria gentneri (FE)	
112		Pipe Fork RNA	Existing		Northern spotted owl (FT), Siskiyou salamander (BSO)	Cypripedium fasciculatum (BSO)	
113		Poverty Flat	Existing			Limnanthes floccosa ssp. bellingeriana (BSO), vernal pool systems	
114		Reeves Creek	Potential			Limnanthes gracilis ssp. gracilis (BSO), Lomatium cookii (FE)	
115		Rough and Ready	Existing	Scenic, Adjacent State Botanical Wayside, Recreation Use.		Hastingsia bracteosa var. bracteosa (BSO), Delphinium nudicale (BAO), Calochortus howellii (STO), Erthronium howellii (BSO), Limnanthes gracilis ssp. gracilis (BSO), Lomatium cookii (FE), Microseris howellii (BSO), Unique flood plane and Hyporheic zone	
116		Round Top Butte RNA	Existing			Natural heritage cell, oak woodland savannah, Danthonia californica, Festuca roemerii, Stipa lemmonii, Agropyron spicatum grasslands, vernal pool, unique Calaochortus uniflorus population (un-common but not listed).	
117		Scotch Creek RNA	Existing			Astragalus californicus (BAO), Carex serratodens (BAO), Fritillaria gentneri (FE), Microseris laciniata ssp. detlingii (BSO), Solanum parishii (BSO), Natural heritage cell: rosaceous chaparral	
118		Sterling Mine Ditch	Existing	Historic mining ditch, National Register of Historic Places.		Fritillaria gentneri (FE) (also in proposed Dakubetede ACEC)	
119		Table Rocks ONA	Existing		Vernal pool fairy shrimp (LT)	Limnanthes floccosa ssp. pumila (STO), Microseris laciniata ssp. detlingii (BSO), Plagiobothrys austiniae (BAO), Plagiobothrys greenei (BAO), Ranunculus austrooreganus (BSO), Tripterocladium leucocladulum (BAO), vernal pools	

MAP #	District	ACEC Name	Status	Historic, cultural, scenic	Relevant and Important Value Category		
					Fish and wildlife	Natural process or system	Natural hazard
120	MEDFORD	Tin Cup	Existing			Relict late-successional white fir community	
121		Waldo-Takilma	Potential	Historic Mining, National Register of Historic places		Calochortus howellii (STO), Crumia latifolia (BAO), Cypripedium fasciculatum (BS), Erythronium howellii (BSO), Fritillaria glauca (BAO), Limnanthes gracilis ssp. gracilis (BSO), Lomatium cookii (FE), Microseris howellii (STO), Pseudoleskeella serpentinensis (BAO), Senecio hesperius (BSO), Eucephalus vialis (BSO), Streptanthus howellii (BSO).	
122		Woodcock Bog RNA	Existing			Lomatium cookii (FE), Carex livida (BAO), Epilobium oreganum (BSO) , Gentiana setigera (BSO), Hastingsia bracateosa var. bracteosa (STO), Mircroseris howellii (STO), Monardella purpurea (BAO), Senecio hesperius (BSO), Viola primulifolia ssp. occidentalis (BSO), Jeffrey pine/ serpentine communities, Darlingtonia fens	
123	KLAMATH	Bumpheads	Potential	Numerous, undisturbed prehistoric sites		Western juniper/Idaho fescue (Juniperus occidentalis/Festuca idahoensis) plant community that has been naturally somewhat isolated from grazing	
124		Four Mile Wetland	Potential	Adjacent to National Scenic Byway	Endangered shortnose and Lost River suckers, bald eagle (FT) foraging and nesting, spotted frogs (FC), yellow rails (BSO), bull trout (FT) habitat, greater sandhill crane (S)	Complex of wetland plant communities	
125		Miller Creeek	Existing	Deep canyon within high desert plateau	Riparian habitat for migratory songbirds and raptors	Old-growth ponderosa pine community, perennial stream within high desert environment	

MAP #	District	ACEC Name	Status	Historic, cultural, scenic	Relevant and Important Value Category		
					Fish and wildlife	Natural process or system	Natural hazard
126	KLAMATH	Old Baldy RNA	Existing			Natural Heritage cells: high elevation white fir communities with Shasta red fir, mountain hemlock, Pacific silver fir, and Western white pine; Southern Oregon Cascades chapparel.	
127		Tunnel Creek	Potential		Oregon spotted frog (Rana pretiosa), a federal candidate species.	Lodgepole pine swamp with bog blueberry (Vaccinium uliginosum) and sedges. Riparian and wetland processes. English sundew (Drosera anglica), an insectivorous plant, is listed as endangered by the state of Maine and as threatened by the state of Wisconsin.	
128		Upper Klamath River	Existing	Historic road, prehistoric cultural artifacts/sites. The Klamath River Canyon holds great spiritual and religious significance for the Klamath Tribe and the Shasta Nation. The unique landform, diverse vegetation, water, and a low level of adverse cultural modifications has been given a Scenic Quality A classification.	Lost River and shortnose suckers (E), Klamath largescale sucker (BSO), native inland redband trout, bald eagle (FT) nests, Townsend's big-eared bat (BSO).	Unique plant communities bisecting the Cascade Mountains which range from montane conifer forest communities to high desert communities, and from riparian communities to oak savannah communities. Red-root yampah (Perideridia erythrorhiza a BSO plant species).	
129		Upper Klamath River Addition	Potential	Historic road, prehistoric cultural artifacts/site. The Klamath River Canyon holds great spiritual and religious significance for the Klamath Tribe and the Shasta Nation. The unique landform, diverse vegetation, water, and a low level of adverse cultural modifications has been given a Scenic Quality A classification.	Lost River and shortnose suckers (FE), Klamath largescale sucker (BSO), native inland redband trout, bald eagle (FT) nests.	Unique plant communities bisecting the Cascade Mountains which range from montane conifer forest communities to high desert communities, and from riparian communities to oak savannah communities. Red-root yampah (Perideridia erythrorhiza a BSO plant species).	
130		Wood River Wetland	Existing	Native American village and wocus gathering sites.	Lost River suckers (FE), bald eagle (FT) foraging and nesting, spotted frogs (FC), yellow rails (BSO), wild trout, migratory waterfowl	Complex of wetland plant communities	

MAP #	District	ACEC Name	Status	Historic, cultural, scenic	Relevant and Important Value Category		
					Fish and wildlife	Natural process or system	Natural hazard
131	KLAMATH	Yainax Butte	Existing	Yainax Butte is considered to be a very important place in the traditional beliefs of the Klamath Tribes, and is probably eligible for inclusion to the National Register of Historic Properties as a Traditional Cultural Property.		Unusual variation of bitterbrush/ bluebunch wheatgrass plant community; blue-leaved penstemon (Penstemon glaucinus), a BSO plant species	

Appendix N. Cultural Resources

This appendix provides the background on federally recognized Tribes in the Planning Area.

In this appendix:

Federally Recognized Native American Tribes in or with Interests in the Planning Area 1353

Federally Recognized Native American Tribes in or with Interests in the Planning Area

Confederated Tribes of the Coos, Lower Umpqua and Siuslaw Indians

The Confederated Tribes of the Grand Ronde

Confederated Tribes of Siletz

The Confederated Tribes of Warm Springs

Coquille Indian Tribe

Cow Creek Band of Umpqua Tribe of Indians

The Klamath Tribes

Modoc Tribe of Oklahoma

Quartz Valley Indian Community

Indian tribes represent unique legal entities in the United States and are distinct political communities with extensive powers of self-government. Tribal sovereignty predates the U.S. government. Treaties, Federal statutes and executive agreements over the past 200 years have established a special trust relationship between tribes and the Federal government. The Federal Bureau of Indian Affairs has been designated by the Secretary of the Interior as the primary agency to protect tribal interests and administer trust responsibilities.

During the 1950s, in a move to assimilate Native Americans into mainstream America, the U.S. government ended Federal trusteeship of roughly three percent of the country's Native American population through a process called termination. Of the 109 tribes and bands terminated, 62 were native to Oregon. Even though the tone of the termination legislation was emancipation, the net effect of the policy on terminated tribes was cultural, political and economic devastation.

In recent years, however, vigorous efforts have been mounted by terminated tribes to reestablish or restore the trust relationship. In 1977, the Confederated Tribes of Siletz won restoration; followed by the Cow Creek Band of Umpqua Indians in 1982; the Confederated Tribes of the Grand Ronde in 1983; the Confederated Tribes of the Coos, Lower Umpqua and Siuslaw Indians in 1984; the Klamath Tribes in 1986 and the Coquille Tribe of Oregon in 1989.

Confederated Tribes of the Coos, Lower Umpqua and Siuslaw Indians of Oregon

These tribes are the descendents of the aboriginal inhabitants of the central and south-central coast of Oregon. Their homeland includes the estuaries of Coos Bay, and the Umpqua and Siuslaw Rivers. The Tribes have been operating under a confederated government since the signing of the Treaty of August, 1855. They currently possess a 6.1 acre reservation and a tribal hall erected in 1940, but past claims have not yet been settled. The Tribes hope to work out a reservation agreement with the Federal government. The Tribes had a relationship with the US government from 1853 until their termination by Congress in the year of 1956. The majority of their members were removed in 1856 from their aboriginal homelands and held on a wind swept spit at the mouth of the Umpqua River at a place called Fort Umpqua. Their territory encompassed part of Coos, Curry, Douglas, Lane and Lincoln counties. Federal recognition was restored to the Confederated Tribes of Coos, Lower Umpqua and Siuslaw Indians in October of 1984.

Confederated Tribes of the Grand Ronde Community of Oregon

These tribes include over 20 Tribes and bands from western Oregon and northern California that were relocated to the Grand Ronde Reservations in the 1850s. These included the Rogue River, Umpqua, Chasta, Kalapuya, Molalla, Salmon River, Tillamook, and Nestucca Indians. The Grand Ronde Reservation was established by treaty arrangements in 1854 and 1855 and an Executive Order of June 30, 1857. The Reservation contained over 60,000 acres and was located on the eastern side of the coastal range on the head-waters of the South Yamhill River. In 1887, under the General Allotment Act, 270 allotments totaling slightly over 33,000 acres of the Grand Ronde Reservation were made to individual Indians. The result of this action was the loss of major portions of the reservation to non-Indian ownership. Then, in 1901, U.S. Inspector James McLaughlin declared a 25,791 tract of the reservation "surplus" and the land was sold. In 1954, Congress passed the Termination Act which severed the trust relationship between the Federal government and the Tribe. On November 22, 1983, with the signing of Public Law 98-165, the Grand Ronde Restoration Act, the Tribe was restored to Federal recognition. In addition, on September 9, 1988, the Tribe regained 9,811 acres of the original reservation when President Ronald Reagan signed the Grand Ronde Reservation Act into law. The reservation lies just north of the community of Grand Ronde. The mission of the Grand Ronde Natural Resources Division is to manage, develop, and protect the natural resources of the Grand Ronde Tribes, such as timber, non-merchantable young stands of trees, fish, wildlife, recreation, minerals, air, streams, roads, minor forest products. The NRD strives to manage the Tribes' resources in a unique, creative, and efficient manner, taking care to meet mandates while balancing the importance of non-revenue-producing elements of the reservation.

Confederated Tribes of the Siletz Reservation, Oregon

These tribes are a federally recognized confederation of 27 bands originating from northern California, western Oregon and southern Washington. Termination was imposed on the Siletz by the United States government in 1955. In November of 1977, the Tribe was restored to Federal recognition. The Tribe occupies and manages a 3,666 acre reservation located in Lincoln County, Oregon. The Tribe manages resources on their reservation including wildlife, timber, water, fish and air quality.

Confederated Tribes of the Warm Springs Reservation of Oregon

These tribes include bands of the Wasco, Warm Springs and Paiute. The Wasco bands on the Columbia River were the eastern-most group of Chinookan-speaking Indians living along the Columbia River. The Warm Springs bands who lived along the Columbia's tributaries. The Paiutes lived in southeastern Oregon. In 1855, Joel Palmer, superintendent for the Oregon Territory, negotiated a series of Indian treaties including the one establishing the Warm Springs Reservation. Under the Treaty of 1855, the Warm Springs and Wasco Tribes relinquished approximately ten million acres of land, but reserved the Warm Springs Reservation for their exclusive use. The Tribes also kept their rights to harvest fish, game and other foods off the reservation in their usual and accustomed places. The Tribes' Natural Resource Management Services exist to plan and execute a balanced direction for the protection, use, and enhancement of all tribal natural resources. Resources shall be managed as sustainable assets available for cultural, subsistence, economic and social purposes or opportunities in perpetuity consistent with the Confederated Tribes sovereign and treaty status.

Coquille Tribe of Oregon

This tribe's members are descended from people who inhabited the watersheds of the Coquille River system, a small portion of Coos Bay at the South Slough, and areas north and south of the Coquille River mouth where it enters the ocean at present day Bandon. Coquille ancestral territory encompassed more than 700,000 acres, ceded to the U.S. Government. Coquille headmen signed the treaties in 1851 and 1855. Because neither treaty was ever ratified by Congress, those Coquille people and their descendants were denied a permanent homeland. The Coquille Indian Tribe was terminated by the U.S. Government in 1954. On June 28, 1989, the Coquilles regained their status as a federally recognized Indian tribe. The modern Coquille Tribe negotiated several land purchases, which constitute a 6,400 acre tribal land base. By an Act of Congress in 1996, the Coquille Tribe now has reservation acreage totaling 6,512 acres.

Cow Creek Band of Umpqua Indians of Oregon

Their traditional use area lies primarily in Douglas County, from the Umpqua River headwaters to the Pacific Ocean. The Tribe's ceded lands lie in the Cow Creek drainage of the South Umpqua River. In 1853 seeking a peaceful solution to tensions that had intensified after gold was discovered in their territory, the Cow Creek Umpqua Indians entered into a treaty with the Federal government that resulted in their ceding their homeland in exchange for $12,000. The treaty left the Cow Creek Umpquas without land, a place to live, or protection. The Cow Creeks had been drawn into the Rogue Indian wars in the early 1850s and as a result of the fighting and their new treaty in 1856 survivors were rounded up and forcefully marched 150 miles north to the Grand Ronde Reservation. In 1954 the government declared that there were no Indians left in western Oregon, the existing Cow Creeks notwithstanding, and the Tribe was terminated. In 1982 the Tribe was restored and entered into formal relations with the United States government through the Bureau of Indian Affairs. Public Law 100-139 (1987), the Cow Creek Umpqua "Distribution Judgment Funds Act", adopted the tribal endowment plan. The Bureau of Indian Affairs allowed the Tribe to use the settlement funds as collateral for the purchase of what was known as the "Evergreen" land. In addition, the Tribe was allowed to draw the interest on their endowment for the purpose of economic development, education, housing, and elderly assistance.

Klamath Indian Tribe of Oregon

This tribe includes the Klamaths, the Modocs and the Yahooskin. The Tribes' traditional territory is in the Klamath Basin of Oregon. The Klamath Tribes ceded more than 23 million acres of land in 1864 and entered the reservation. In 1954, the Klamath Tribes were terminated from Federal recognition as a tribe by act of Congress. In 1974 the Federal Court ruled that the Klamath Tribes had retained their Treaty Rights to hunt, fish and gather, and to be consulted in land management decisions when those decisions affected their Treaty Rights. In 1986, the Tribe was successful in regaining restoration of Federal recognition.

Modoc Tribe of Oklahoma

This tribe originally lived on Little Klamath Lake, Modoc Lake, Tule Lake, Clear Lake, Goose Lake, and in the Lost River Valley. In 1864, the Modoc ceded lands and moved to the Klamath Reservation. Due to starvation conditions and tensions with the Klamath Indians, some Modocs returned to their original territory in northern California in 1870. In 1872, attempts to force their return to Oregon began the Modoc War and the Modocs retreated to lava beds for months. Finally overrun, 153 survivors were sent to Quapaw Agency in Oklahoma. Other survivors were sent to the Klamath Reservation. In 1909, some Modocs were permitted to return to Klamath Agency. In 1954, the Oklahoma and Oregon Modoc Tribes were terminated. In 1978, the Oklahoma Modoc Tribes were reinstated.

Quartz Valley Indian Community of the Quartz Valley Reservation of California

Located in Siskiyou County, California, they include the members Shasta Tribe that traditionally lived in southern Oregon and northern California. A treaty signed by Shasta Tribal chiefs on Nov. 4, 1851 was never ratified by the Congress and the Tribe did not get their own reservation. Some members of the Shasta Tribe joined the Confederated Tribes of the Grand Ronde Community of Oregon. Other members were included in California reservations.

Appendix O. Lands

This appendix provides detailed data about lands, realty, and access information found in Chapters 2 and 3 of the Draft EIS.

In this appendix:

Land Tenure Adjustment Criteria 1361

Land Withdrawals and Land Tenure Zone 3 Lands 1363

Inventory of Communication Sites 1426

Analytical Methods to Determine Legal Public Accessibility of BLM Lands in the Planning Area 1430

Land Tenure Adjustment Criteria

In accordance with FLPMA and other laws, Executive Orders, and Departmental and Bureau policy, the following factors will be considered in evaluating opportunities for disposal or acquisition of lands or interests in lands. This list is not considered all inclusive but represents the major factors to be considered.

General Land Tenure Adjustment Evaluation Factors

- Improves the manageability of specific areas.
- Maintains or enhances important public values and uses.
- Consolidates Federal mineral estate and/or reuniting split surface and mineral estates.
- Facilitates development of energy and mineral potential.
- Reduces difficulty or cost of public land administration.
- Provides accessibility to the land for public recreation and other uses.
- Amount of public investments in facilities or improvements and the potential for recovering those investments.
- Suitability of the land for management by another Federal agency.
- Significance of the decision in stabilizing or enhancing business, social and economic conditions, and/or lifestyles.
- Meets long-term public management goals as opposed to short-term.
- Facilitates National, State, and local BLM priorities or mission statement needs.
- Consistency with cooperative agreements and plans or policies of other agencies.
- Facilitates implementation of other aspects of the approved Resource Management Plans.

Acquisition Criteria

- Facilitates access to public land and resources retained for long-term public use.
- Secures Threatened or Endangered or Sensitive plant and animal species habitat.
- Protects riparian areas and wetlands.
- Contributes to biodiversity.
- Protects high-quality scenery.
- Enhances the opportunity for new or emerging public land uses or values.
- Facilitates management practices, uses, scales of operation, or degrees of management intensity that are viable under economic program efficiency standards.
- Secures lands adjacent to rivers eligible for designation under the National Wild and Scenic Rivers Act
- Protects significant cultural resources and sites eligible for inclusion on the National Register of Historic Places
- Whether private sites exist for the proposed use.

Disposal Criteria

The following criteria will be used to identify parcels in Land Tenure Zones 2 or 3.

- Suitability for purposes including but not limited to community expansion or economic development, such as industrial, residential, or agricultural development.
- Lands of limited public value.
- Lands that are difficult for the BLM to manage and unsuitable for transfer to other federal agencies or State and local governments.
- Lands that would aid in aggregating or repositioning other public lands or public land resource values in retention areas to facilitate National, State, and local objectives where the public values to be acquired outweigh the values to be exchanged.

O&C Land Exchange Criteria

Forest management and related factors to consider when evaluating the feasibility of an O&C land exchange include the following:

- Land exchanges which maintain the existing balance between the various land use allocations will be considered favorably.
- Offered lands which are primarily suitable for agriculture, business, or home sites, or which would require extensive post-acquisition management will not be favorably considered. O&C lands designated for timber production will generally not be exchanged for lands which will be managed solely for a single use, such as species protection.
- Generally, where cutting rights are reserved on existing and future timber stands by the proponent, the proposed exchange will not be considered favorably.
- Proposals which result in a material reduction in the number of acres of O&C or CBWR land or acres of harvestable timber should not be considered favorably. See I.M. No. OR-99-081, dated August 4, 1999, for an interpretation of Section 3 of Public Law 105-321 which established a requirement of "No Net Loss" of O&C and CBWR lands in western Oregon.
- The exchange of O&C and CBWR lands specifically for lands located outside of the 18 O&C counties is prohibited by regulations in 43 CFR 2200.0-6(e). This restriction applies to timber and other interests in lands as well.

Land Withdrawals and Land Tenure Zone 3 Lands

The following tables contain detailed information about existing and proposed land withdrawals. Zone 3 lands are available for disposal.

Table 286. Existing land withdrawals and recommendations for continuance.

District	Serial Number	Authority	Legal Description	Acres	Purpose/Name	Managing Agency	Segregation Effect	Recommendation (C/R)
Salem	OR 23947	Act of Congress 3/5/80	T. 10 S., R. 11W., SEC. 30	100	Yaquina Head	BLM, USCG	A	C
	OR 8920	PLO 5372	T. 8 S., R. 6 W., SEC 33	80	Little Sink	BLM	B	C
	OR 37275	Act of Congress 6/26/84	T. 7 S., R. 3 & 4 E.	5800	TABLE ROCK WILDERNESS	BLM	A	C
	OR 05555	ANS-58-1	T. 15 S., R. 7 W., SEC. 7	40	AIR NAVIGATION/ PRAIRIE MTN	FAA	B	C
	OR 3060	PLO 989	T. 3 S., R. 5 E., SEC 27 & 28	600	FISH HACTCHERY & EAGLE CREEK	USFWS	B	C
	OR 15487	PLO 3609	T. 4 S., R. 3 E., SEC. 13	320	SEED ORCHARD/ WALTER HORNING	BLM	B	C
	OR 16183	PLO 3869	T. 3 S., R. 7 W., SEC 32	35	REC SITE/ ALDER GLENN	BLM	B	C
	OR 16183	PLO 3869	T. 14 S., R. 7 W., SEC 25 & 26	40	REC SITE/ ALSEA FALLS	BLM	B	C
	OR 16183	PLO 3869	T. 9 S., R. 3 E., SEC 7	80	REC SITE/ CANYON CREEK	BLM	B	C
	OR 16183	PLO 3869	T. 12 S., R. 3 E., SEC 3	80	REC SITE/ DOGWOOD	BLM	B	C
	OR 16183	PLO 3869	T. 9 S., R. 3 E., SEC 9	120	REC SITE/ ELKHORN VALLEY	BLM	B	C
	OR 16183	PLO 3869	T. 9 S., R. 2 E., SEC 25	160	REC SITE/ FISHERMEN'S BEND	BLM	B	C
	OR 16183	PLO 3869	T. 3 N., R. 3 W., SEC 21	20	REC SITE/ LITTLE BEND	BLM	B	R
	OR 16183	PLO 3869	T. 7 S., R. 6 W., SEC 4 & 9		REC SITE/ MILL CREEK	BLM	B	C
	OR 16183	PLO 3869	T. 14 S., R. 9 W., SEC 13	40	REC SITE/ MISSOURI BEND	BLM	B	C
	OR 16183	PLO 3869	T. 3 S., R. 4 E., SEC 11	160	REC SITE/ NORTH FORK EAGLE CREEK	BLM	B	C
	OR 16183	PLO 3869	T. 4 N., R. 3 W., SEC 7	30	REC SITE/ SCAPONIA	BLM	B	C
	OR 16183	PLO 3869	T. 11 S., R. 4 E., SEC 19	80	REC SITE/ YELLOWBOTTOM	BLM	B	C
	OR 16183	PLO 4305	T. 14 S., R. 7 W., SEC 25	133	REC SITE/ ALSEA FALLS	BLM	B	C
	OR 16183	PLO 4537	T. 2 S., R. 7 E., SEC 31	360	REC SITE/ WILDWOOD	BLM	B	C
	OR 16183	PLO 4537	T. 14 S., R. 9 W., SEC 13	10	REC SITE/ MISSOURI BEND	BLM	B	C
	OR 16183	PLO 4537	T. 8 S., R. 4 E., SEC 31	159	REC SITE/ SALMON FALLS	BLM	B	C

District	Serial Number	Authority	Legal Description	Acres	Purpose/Name	Managing Agency	Segregation Effect	Recommendation (C/R)
	OR 5344	PLO 4846	T 8 S., R. 10 W., SEC 27	12	ROAD USE	USFS	B	R
	OR 6363	PLO 5136	T. 12 S., R. 7 W., SEC 28	40	ADMIN SITE/AMARYS PEAK	USFS	B	C
	OR 50856	PLO 7215	T . 3 S., R., 10 W., SEC 30		PROTECT LANDS/ PACIFIC COAST HWY	BLM	B	C
	OR 50856	PLO 7215	T . 4 S., R., 10 W., SEC 19 & 29		PROTECT LANDS/ PACIFIC COAST HWY	BLM	B	C
	OR 50856	PLO 7215	T . 5 S., R., 10 W., SECS 5, 6, & 20		PROTECT LANDS/ PACIFIC COAST HWY	BLM	B	C
	OR 50856	PLO 7215	T . 8 S., R., 11 W., SEC 3		PROTECT LANDS/ PACIFIC COAST HWY	BLM	B	C
	OR 50856	PLO 7215	T . 9 S., R., 11 W., SEC 4		PROTECT LANDS/ PACIFIC COAST HWY	BLM	B	C
	OR 50856	PLO 7215	T . 13 S., R., 11 W., SEC 28		PROTECT LANDS/ PACIFIC COAST HWY	BLM	B	C
	OR 50856	PLO 7215	T . 14 S., R., 12 W., SEC 35		PROTECT LANDS/ PACIFIC COAST HWY	BLM	B	C
	OR 18842	PP 477	T. 2 S., R. 4 E., SEC 1	24	ELECTRIC POWER GENERATOR/ SANDY RIVER -MARMOT DAM BULL RUN PROJ	FERC/BLM	B	C
	OR 18842	PP 477	T. 2 S., R. 5 E., SECS 13 & 15	24	ELECTRIC POWER GENERATOR/ SANDY RIVER -MARMOT DAM BULL RUN PROJ	FERC/BLM	B	C
	OR 18884	PP 2195	T. 4 S., R. 4 E., SEC 13	100	ELECTRIC POWER GENERATOR/ CLACKAMAS	FERC/BLM	B	C
	OR 18884	PP 2195	T. 4 S., R. 5 E., SEC 7	97	ELECTRIC POWER GENERATOR/ CLACKAMAS	FERC/BLM	B	C
	OR 19146	PSC 170	T. 7 S., R. 3 & 4 E.,	1879	POTENTIAL PWR DEVELOPMENT/ MOLALLA RVR	BLM	C	R
	OR 19147	PSC 171	T. 8 S., R. 8 W.,	957	POTENTIAL PWR DEVELOPMENT/ SILETZ RVR	BLM	C	R
	OR 19166	PSC 304	T. 5 N., R. 6 & 7 W.,	34	POTENTIAL PWR DEVELOPMENT/ NEHALEM RVR	BLM	C	R

District	Serial Number	Authority	Legal Description	Acres	Purpose/Name	Managing Agency	Segregation Effect	Recommendation (C/R)
	OR 19166	PSC 304	T. 3 N., R. 8 W.,	34	POTENTIAL PWR DEVELOPMENT/ NEHALEM RVR	BLM	C	R
	OR 19183	PSC 413	T. 14 & 15 S., R. 8 W.,	316	POTENTIAL PWR DEVELOPMENT/ ALSEA RVR	BLM	C	R
	OR 19038	PSR 89	T. 3 N., R. 8 W.,	61	POTENTIAL PWR DEVELOPMENT/ NEHALEM RVR	BLM	C	R
	OR 19039	PSR 94	T. 6 & 7 S., R. 3 E.,	1325	POTENTIAL PWR DEVELOPMENT/ MOLALLA RVR	BLM	C	R
	OR 19074	PSR 458	T. 12 S., R. 1 W.,	11	POTENTIAL PWR DEVELOPMENT/ SANTIAM RVR	BLM	C	R
	OR 19112	PSR 658, WPD 15	T. 2 S., R. 4 E., T. 3 S., R. 3 E.	5	ELECTRIC TRANS LINES	BLM	C	R
	OR 19113	PSR 659, WPD 14	VARIOUS	6,149	POTENTIAL PWR DEVELOPMENT/ ALSEA, NEHALEM, SCAPPOOSE & TRASK RVRS	BLM	C	R
	OR 19115	PSR 661, WPD 14	VARIOUS	10,370	POTENTIAL PWR DEVELOPMENT/ CLACKAMAS RVR	BLM	C	R
	OR 19118	PSR 664	VARIOUS	1,143	POTENTIAL PWR DEVELOPMENT/ EAGLE CREEK, SO. YAMHILL, MOLALLA AND n. SANTIAM RVRS	BLM	C	R
	OR 19127	PSR 730, WPD 14 & 16	VARIOUS	1,900	POTENTIAL PWR DEVELOPMENT/ CLACKAMAS, NESTUCCA, SANDY, SANTIAM RVRS	BLM	C	R
Note:	Location description indicates sections within which withdrawn lands are located. Information on which portions of the cited sections are withdrawn is available at the District Office.							

District	Serial Number	Authority	Legal Description	Acres	Purpose/Name	Managing Agency	Segregation Effect	Recommendation (C/R)
Eugene	ORE 05555		T.15S., R.7W.	40	Air Navigation	FAA/BLM	A	C
			Section 7					
	ORE 013117	(PLO 3610)	T.18S., R.1E.	81.2	Fall Creek	COE/BLM	B	C
			Section 31		Reservoir			
			T.19S., R.1E.					
			Section 6					
	OR 19234	(PLO 497)	T.17S., R.5W.	5.27	Fern Ridge	COE	A	C
			Section 27		Reservoir			
			Section 28					
	OR 19240	(PLO 727)	T.19S., R.1E.	1.37	Lookout Point	COE	A	C
			Section 34		Reservoir			
	OR 711	(PLO 4395)	T.16S., R.12W.	1	Oregon Islands	USFWS	B	C
			Section 33		National Wildlife			
					Refuge			
	OR 25306	(PLO 6287)	T.16S., R.12W.	1	Oregon Islands	USFWS	B	C
			Section 33		National Wildlife			
	ORE 016183A	(PLO 3869)	T.16S., R.7W.	440.12	Lake Creek	BLM	B	
			Section 19		Whittaker Creek			
			T.18S., R.8W.		Clay Creek			
			Section 21		Haight Creek			
			T.19S., R.7W.		Sharps Creek			

District	Serial Number	Authority	Legal Description	Acres	Purpose/Name	Managing Agency	Segregation Effect	Recommendation (C/R)
			Section 19		Rec. Sites			
			Section 35					
			T.22S., R.1W.					
			Section 15					
	ORE 012093	(PLO 5490)	*	9000.52	Reserved for	BLM	A	
					multiple use			
					management			
	OR 8754	(PLO 5229)	T.15S., R.1W.	260	Shotgun Creek	BLM	B	
			Section 29		Recreation Site			
			Section 30					
			Section 31					
			Section 32					
	OR 37548	(PLO 6662)	T.20S., R.5W.	832.5	Tyrrell Seed	BLM	B	
			Section 9		Orchard			
			Section 15					
			Section 21					
	OR 46473	(PLO 6963)	T.18S., R.12W.	257.6	Florence	BLM	B	C
			Section 3		Sand Dunes			
			Section 15					
	OR 48744	(PLO 7081)	T.17S., R.3E.	292.25	Eagle Rock	BLM	B	C
			Section 3		Section			
			Section 9		McKenzie			
			Section 10		River			
			Section 11					

District	Serial Number	Authority	Legal Description	Acres	Purpose/Name	Managing Agency	Segregation Effect	Recommendation (C/R)
	OR 19133**	(PSC 41)	T.19S., R.7W.	550.49	Protect water-	BLM/FERC	A	
			Section 21		power and			
			Section 25		reservoir			
			Section 35		development			
			T.20S., R.6W.		potential			
			Section 5					
	OR 19148**	(PSC 180)	T.20S., R.2W.	300.6	Protect water-	BLM/FERC	A	
			Section 31		power and			
			T.21S., R.1W.		reservoir			
			Section 33		development			
			Section 35		potential			
			T.21S., R.2W.					
			Section 15					
	OR 19164	(PSC 287)	T.18S., R.6W.	120	Protect	BLM/FERC	A	
			Section 5		electric			
					transmission			
					line			
	OR 19186**	(PSC 426)	T.16S., R.2E.	276.64	Protect water-	BLM/FERC	A	
			Section 23		power and			
			Section 24		reservoir			
			Section 27		development			
					potential			
	OR 19040**	(PSR 95)	T.16S., R.2E.	152.28	Protect water-	BLM/FERC	A	
			Section 28***		power and			
			Section 34***		reservoir			
			T.17S., R.2E.		development			

District	Serial Number	Authority	Legal Description	Acres	Purpose/Name	Managing Agency	Segregation Effect	Recommendation (C/R)
			Section 2***		potential			
			T.17S., R.3E.					
			Section 4					
	OR 19059**	(PSR 285)	T.16S., R.3E.	163.56	Protect water-	BLM/FERC	A	
			Section 31***		power and			
			T.17S., R.3E.		reservoir			
			Section 4		development			
					potential			
	OR 19113**	(PSR 659)	T.15S., R.6W.	5961.48	Protect water-	BLM/FERC	A	
			Section 7		power and			
			T.16S., R.7W.		reservoir			
			Section 19		development			
			T.17S., R.8W.		potential			
			Section 17***					
			T.18S., R.7W.					
			Section 31					
			Section 33					
			T.18S., R.8W.					
			Section 21					
			Section 27					
			Section 35					
			T.19S., R.6W.					
			Section 7					
			Section 9					
			Section 29					
			Section 31					
			T.19S., R.7W.					
			Section 1					

District	Serial Number	Authority	Legal Description	Acres	Purpose/Name	Managing Agency	Segregation Effect	Recommendation (C/R)
			Section 3					
			Section 5					
			Section 9					
			Section 19					
			Section 21					
			Section 27					
			Section 35					
			T.19S., R.8W.					
			Section 3					
			Section 11					
			Section 13					
			T.20S., R.6W.					
			Section 1					
			Section 3					
			Section 5					
			Section 9					
			Section 11					
			T.20S., R.7W.					
			Section 3					
	OR 19115**	(PSR 661)	T.16S., R.2E.	1103.6	Protect water	BLM/FERC	A	
			Section 33***		power and			
			Section 35***		reservoir			
			T.17S., R.2E.		development			
			Section 1***		potential			
			T.17S., R.3E.					
			Section 3***					
			Section 5***					
			Section 9***					
			T.20S., R.2W.					

District	Serial Number	Authority	Legal Description	Acres	Purpose/Name	Managing Agency	Segregation Effect	Recommendation (C/R)
			Section 31					
			T.21S., R.1W.					
			Section 31***					
			Section 33					
			Section 35					
			T.21S., R.2W.					
			Section 7					
			T.22S., R.2W.					
			Section 5					
			Section 15					
			Section 23					
			T.23S., R.2W.					
			Section 1					
	OR 19116**	(PSR 662)	T.18S., R.8W.	40	Protect water	BLM/FERC	A	
			Section 28		power and			
					reservoir			
					development			
					potential			
	OR 19127**	(PSR 730)	T.22S., R.1W.	1249.16	Protect water	BLM/FERC	A	
			Section 5		power and			
			Section 9		reservoir			
			Section 15****		development			
			Section 23		potential			
			Section 27					

District	Serial Number	Authority	Legal Description	Acres	Purpose/Name	Managing Agency	Segregation Effect	Recommendation (C/R)
			Section 35					
			T.23S., R.1W.					
			Section 1					
			Section 7					
	OR 19014**	(WPD 14)	T.15S., R.6W.	8234.24	Protect water-	BLM/FERC	A	
			Section 7		power and			
			T.16S., R.2E.		reservoir			
			Section 33***		development			
			Section 35***		potential			
			T.16S., R.7W.					
			Section 19					
			T.17S., R.2E.					
			Section 1***					
			T.17S., R.3E.					
			Section 3***					
			Section 5***					
			Section 9***					
			T.17S., R.8W.					
			Section 17***					
			T.18S., R.7W.					
			Section 31					
			Section 33					
			T.18S., R.8W.					
			Section 21					
			Section 27					
			Section 35					
			T.19S., R.6W.					
			Section 7					
			Section 9					

District	Serial Number	Authority	Legal Description	Acres	Purpose/Name	Managing Agency	Segregation Effect	Recommendation (C/R)
			Section 29					
			Section 31					
			T.19S., R.7W.					
			Section 1					
			Section 3					
			Section 5					
			Section 9					
			Section 19					
			Section 21					
			Section 27					
			Section 35					
			T.19S., R.8W.					
			Section 3					
			Section 11					
			Section 13					
			T.20S., R.2W.					
			Section 31					
			T.20S., R.6W.					
			Section 1					
			Section 3					
			Section 5					
			Section 9					
			Section 11					
			T.20S., R.7W.					
			Section 3					
			T.21S., R.1W.					
			Section 31***					
			Section 33					
			Section 35					
			T.21S., R.2W.					

District	Serial Number	Authority	Legal Description	Acres	Purpose/Name	Managing Agency	Segregation Effect	Recommendation (C/R)
			Section 7					
			Section 31					
			T.22S., R.1W.					
			Section 5					
			Section 9					
			Section 15****					
			Section 23					
			Section 27					
			Section 35					
			T.22S., R.2W.					
			Section 5					
			Section 15					
			Section 23					
			T.23S., R.1W.					
			Section 1					
			Section 7					
			T.23S., R.2W.					
			Section 1					
	OR 19016**	(WPD 16)	T.23S., R.1W.	80	Protect water-	BLM/FERC	A	
			Section 1		power and			
					reservoir			
					development			
					potential			
			T.20S.,R2W.	178.95	Row River Trail	BLM	B	
			Section 30		and associated			
			Section 31		Recreation			
			Section 32		Facilities			
			Section 33					

District	Serial Number	Authority	Legal Description	Acres	Purpose/Name	Managing Agency	Segregation Effect	Recommendation (C/R)
			Section 34					
			T.20S.,R3W.					
			Section 25					
			Section 36					
			T.21S.,R.1W.					
			Section 19					
			Section 30					
			Section 31					
			Section 32					
			T.21S.,R.2W					
			Section 2					
			Section 3					
			Section 11					
			Section 13					
			Section 14					
			Section 24					
			T.21S.,R.3W.					
			Section 1					
			T.22S.,R.1W.					
			Section 5					
	OR 50856	(PLO7215)	T.18S.,R12W.	36.52	Pacific Coastline	BLM	B	
			Section 2		Highway 101			
	OR 905	(R&PP)	T.14S., R.2W.	2	McKercher	BLM/Linn	B	
			Section 13		County Park	County		
	ORE 06095	(R&PP)	T.16S., R.2E.	61.73	Whitewater	BLM/Lane	B	
			Section 34		County Park	County		
			Section 35					

District	Serial Number	Authority	Legal Description	Acres	Purpose/Name	Managing Agency	Segregation Effect	Recommendation (C/R)
	ORE 011226	(R&PP)	T.17S., R.2E.	2.4	Martin Rapids	BLM/Lane	B	
			Section 1		County Park	County		
	ORE 012264	(R&PP)	T.16S., R.6W.	2	Solid waste	BLM/Lane	B	
			Section 7		transfer Site	County		
	OR 37243	(R&PP)	T.19S., R.3W.	2.79	Willamette	BLM/State	B	
			Section 35		River	of Oregon		
					Greenway			
	* All public domain lands in and west of Range 8 East and all lands within the area, which become public domain lands in the future.							
	** Withdrawals remaining to be reviewed through the FLPMA withdrawal review process or under authority of DM 603.							
	*** Opened to entry subject to Sec. 24 of the Federal Power Act.							
	**** Opened to entry in part subject to Sec. 24 of the Federal Power Act.							
	Note: Table does not include lands that have been transferred out of Federal ownership subsequent to withdrawal or lands within National Forest boundaries.							
Roseburg	OR 19101	PSR* 629, WPD* 11	20S,7W,25	200	Protect Water	BLM/FERC	C	C
			20S,7W,27	40	Power & Reservoir			
			20S,7W,33	280	Development			
			20S,7W,35	80	Potential			
	OR 16183B	PLO 3869	21S,6W,1	80	Gunter Recreation Site	BLM	B	C
	OR 19101	PSR* 629, WPD* 11	21S,7W,5	352.59	Protect Water	BLM/FERC	C	C
	OR 19011		21S,7W,9	40	Power & Reservoir			

District	Serial Number	Authority	Legal Description	Acres	Purpose/Name	Managing Agency	Segregation Effect	Recommendation (C/R)
					Development			
					Potential			
	OR 19112	WPD* 15, PSR* 658	22S,5W,33		Transmission Line	BLM/FERC	C	C
					Purposes (unconstructed)			
	OR 19105	PSR* 633,WPD* 11	22S,7W,19	29.93	Protect Water	BLM/FERC	C	C
	OR 19011		22S,7W,31	17.52	Power & Reservoir			
					Development			
					Potential			
	OR 19105	PSR* 280, 633, WPD* 11	23S,7W,15	94	Protect Water	BLM/FERC	C	C
	OR 19057		23S,7W,23	134.27	Power & Reservoir			
	OR 19011		23S,7W,27	74.2	Development			
			23S,7W,32	1.7	Potential			
			23S,7W,33	118.2				
	OR 19105	PSR* 280, 633, WPD* 11	24S,7W,3	146.05	Protect Water	BLM/FERC	C	C
	OR 19057		24S,7W,11	186.32	Power & Reservoir			
	OR 19011		24S,7W,13	26.62	Development			
			24S,7W,15	122.19	Potential			
			24S,7W,17	116.06				
			24S,7W,20	14.35				
			24S,7W,21	75.58				
			24S,7W,23	40.03				
			24S,7W,28	34.62				
			24S,7W,33	95.2				
	OR 16183B	PLO 3869	24S,7W,13	23.7	Tyee Recreation Site	BLM	B	C
	OR 19341	PLO 754	24S,7W,20	14.35	Timber	BLM	A	C
			24S,7W,21	13.93	Preservation			

District	Serial Number	Authority	Legal Description	Acres	Purpose/Name	Managing Agency	Segregation Effect	Recommendation (C/R)
	OR 16183B	PLO 3869	25S,1W,23	20	Scaredman	BLM	B	C
			25S,1W,24	40	Recreation Site			
			25S,1W,25	20				
			25S,1W,30	40	Forest			
	OR 16183B	PLO 3869	25S,2W,15	160	Rock Creek	BLM	B	C
					Recreation Site			
			25S,2W,21	320	Mill Pond	BLM	B	
					Recreation Site			
	OR 19105	PSR* 280,	25S,7W,5	37	Protect Water	BLM/FERC	C	C
	OR 19103	630,633,	25S,7W,6	105.25	Power & Reservoir			
	OR 19057	WPD* 11	25S,7W,7	205.49	Development			
	OR 19011		25S,7W,9	78.39	Potential			
			25S,7W,15	13.83				
			25S,7W,17	80				
			25S,7W,21	40				
			25S,7W,23	80				
			25S,7W,27	80				
	OR 3660-A	PLO 4537	25S,7W,9	78.4	Umpqua	BLM	B	C
			25S,7W,10	0.15	Recreation Site			
			25S,7W,15	13.33				
	OR 19144	PSC* 162,	25S,8W,12	20.8	Protect Water	BLM/FERC	C	C
					Power & Reservoir			
					Development Potential			
	OR 44740	Public Law*	26S,2W,7,8,13,14		North Umpqua Wild	BLM	C	C
		100-557	26S,2W,15,16,17,		and Scenic River			
			26S,2W,18,20,21,					
			26S,2W,22,23,24	1620				
	OR 18874	PP 1927*	26S,2W,7		Electric	BLM/FERC	B	C

District	Serial Number	Authority	Legal Description	Acres	Purpose/Name	Managing Agency	Segregation Effect	Recommendation (C/R)
			26S,2W,13		transmission line.			
			26S,2W,14		Occupies 100 foot			
			26S,2W,15		wide strip of land.			
			26S,2W,17					
			26S,2W,21					
			26S,2W,29					
			26S,2W,30					
			26S,2W,31	110.11				
	OR 19184	PSC* 416,	26S,2W,7	397.3	Protect Water	BLM/FERC	C	C
	OR 19103, 19057	PSR* 631, 280	26S,2W,13	40	Power & Reservoir			
	OR 19011	WPD* 11,16	26S,2W,14	300	Development Potential			
	OR 19016		26S,2W,15	160				
			26S,2W,17	280				
			26S,2W,21	33.78				
			26S,2W,22	220				
			26S,2W,23	353.94				
			26S,2W,24	250				
	OR 16183B	PLO 3869	26S,2W,14	160	Susan Creek Falls	BLM	B	C
	OR 18874	PP* 1927	26S,3W,1	5.88	Electric Trans-	BLM/FERC	B	
			26S,3W,35	6.29	mission line. Occupies			
					100 foot wide strip of			
					land.			
	OR 5263	PLO 4848	26S,3W,1	80	Swiftwater	BLM	B	C
					Recreation Site			
	OR 16183B	PLO 3869	26S,3W,9	6.44	Lone Rock	BLM	B	C
	OR 19103,19057	PSR* 631,280	26S,3W,1	120	Protect Water	BLM/FERC	C	C
	OR 19011	WPD* 11	26S,3W,9	25+	Power & Reservoir			
		SO Intpr* 83	26S,3W,11	121.44	Development Potential			

District	Serial Number	Authority	Legal Description	Acres	Purpose/Name	Managing Agency	Segregation Effect	Recommendation (C/R)
	OR 19103	PSR* 631	26S,4W,17	11.56	Protect Water	BLM/FERC	C	C
	OR 19011	WPD* 11			Power & Reservoir			
					Development Potential			
	OR 19057	PSR* 280,	26S,6W,7	139.87	Protect Water	BLM/FERC	C	C
	OR 19105	633,	26S,6W,8	62.43	Power & Reservoir			
	OR 19011	WPD* 11			Development Potential			
		PLO 4521	27S,2W,1	0.8	Negro Creek Road	USDA,FS	B	C
		Executive Order* 865	27S,2W,9	320.4	Umpqua National	USDA,FS	None	C
			27S,2W,32	110.25	Forest			
								C
	OR 5263	PLO 4848	27S,2W,1	80	Emile Creek	BLM	B	
					Recreation Site			
			27S,2W,8	80	Little River	BLM	B	
					Wayside			
	OR 16183B	PLO 3869	27S,2W,16	178.53	Wolf Creek Trail	BLM	B	C
	OR 16183B	PLO 3869	27S,3W,23	80	Cavitt Creek	BLM	B	C
					Forest			C
	OR 13683	PLO 4448	29S,7W,17	40	Umpqua River	BR BLM	B	C
			29S,7W,21	20.22	Reclamation			
					Project			
	OR 19113	PSR* 659,	29S,9W,35	40	Protect Water	BLM/FERC	C	C
	OR 19014	WPD* 14			Power & Reservoir Development Potential			
	OR 13683	PLO 4448	29S,7W,32	58.43	Umpqua River	BR BLM	B	C
					Reclamation			
					Project			
	OR 19152	PSC* 198,	30S,2W,12	80	Protect Water	BLM/FERC	C	C
	OR 19171	315,			Power &			
	OR 19057	PSR* 280,	30S,2W,23	80	Reservoir			
			30S,2W,28	40	Development			

District	Serial Number	Authority	Legal Description	Acres	Purpose/Name	Managing Agency	Segregation Effect	Recommendation (C/R)
			30S,2W,29	120	Potential			
			30S,2W,31	80				
	OR 3621	PLO 4626	30S,2W,23	1.3	Pickett Butte Road	USDA,FS	B	C
	OR 19171	PSC* 315,	30S,3W,19	120	Protect Water	BLM/FERC	C	C
	OR 19113	PSR*659,	30S,3W,25	120	Power and			
	OR 19011	WPD* 11	30S,3W,29	80	Reservoir			
			30S,3W,31	164.62	Development			
			30S,3W,33	40	Potential			
			30S,3W,35	80				
			30S,4W,15	99.34	Protect Water	BLM/FERC	C	C
			30S,4W,21	80.14	Power and			
			30S,4W,23	161.95	Reservoir			
			30S,4W,25	112.76	Development			
			30S,4W,27	40	Potential			
			30S,4W,29	76.84				
			30S,4W,35	167.76				
	OR 13683	PLO 4448,	30S,7W,5	20	Umpqua River	BR	B	C
			30S,7W,6	31.15	Reclamation			
					Project			
	OR 19113	PSR 659,	30S,9W,3	40	Protect Water	BLM/FERC	C	C
	OR 19014	WPD 14			Power and			
					Reservoir			
					Development Potential			
	OR 19171	PSC* 315	31S,3W,3	83.61	Protect Water	BLM/FERC	C	C
					Power and			
					Reservoir			
					Development Potential			
	16183B	PLO 3869	31S,8W,35	20	Darby Creek	BLM	B	C
					Recreation Site			

District	Serial Number	Authority	Legal Description	Acres	Purpose/Name	Managing Agency	Segregation Effect	Recommendation (C/R)
	OR 12693	PLO 5490	All Public	18,426	Multiple Use	BLM	D	C
			Domain					
			(PD) lands					
		Small Tract	24S,7W,	4.43	Community	BLM	B	C
		Act	Sec 3; Lot 3		Site Lease			
					OR 011654			
		R&PP	26S,2W,	7.5	County Park	BLM	B	C
			Sec 7; E1/2SE1/4		Lease OR 012162			
		R&PP	26S,	147.99	State Park	BLM	B	C
			2W,		Lease (expired)			
			Sec 23 and 24;		OR 010044			
			Metes and Bounds					
		Small Tract	Sec 15; Lot 6	2.69	Occupancy	BLM	B	R
		Act			Lease OR 05564			
		Small Tract	28S,4W,	0.61	Occupancy	BLM	B	C
		Act	Sec. 13; SE1/4NE1/4		Lease			
					OR 16775			
	OR 53486	PLO 7413	T 31 S, R 7 W,	36.6	Gold Panning Area	BLM	B	C
			Sec. 4	58.72	Island Creek Rec. site	BLM		
	OR 53486	PLO 7413	T 30 S, R 7 W,				B	C
			Sec. 36					
			T 31 S, R 7 W,					
			Sec. 1					
	OR 53486	PLO 7413	T 30 S, R 7 W,	40	Picket Bridge Rec. Site	BLM	B	C
			Sec. 23					
	OR 53486	PLO 7413	T 30 S, R 7 W,	25	Olalla-Thompson Cr. Day	BLM	B	C
			Sec. 5		Use Site			

District	Serial Number	Authority	Legal Description	Acres	Purpose/Name	Managing Agency	Segregation Effect	Recommendation (C/R)
Medford	OR016674	PLO 5105		2483.48	Lost Cr. Resv.	Corps of Eng.	B	R 716.88 ac.
	OR016753	PLO 6373		840.59	Elk Cr. Resv.	Corps of Eng.	B	C
	OR49	PLO 4132		200	Sprague Orch.	BLM	B	C
	OR10729	PLO 5481		160	Sprague Orch.	BLM	B	C
	OR04135	PLO 1726		15481.14	Recreation area	BLM	B	R 519.80 ac.
	OR12261	PLO 3165		174.21	Recreation area	BLM	B	Needs review
	OR016183D	PLO 3869		444.35	Recreation area	BLM	B	R
	OR19008	WPD 3		5631.54	Water power	BLM	C	R
	OR19010	WPD 10		12228.88	Water power	BLM	C	Needs review
	OR19013	WPD 13		127.27	Water power	BLM	C	R
	OR19018	WPD 18		872.35	Water power	BLM	C	Needs review
	OR19047	PSR 161		157.49	Power site	BLM	C	Needs review
	OR19048	PSR 167		495.38	Power site	BLM	C	Needs review
	OR19054	PSR 258		1573.16	Power site	BLM	C	R 400 ac.
	OR19078	PSR 528		2.17	Power site	BLM	C	Needs review
	OR19085	PSR 579		313.95	Power site	BLM	C	R
	OR19087	PSR 582		3632.57	Power site	BLM	C	R
	OR19088	PSR 583		1799.03	Power site	BLM	C	R
	OR19089	PSR 584		160	Power site	BLM	C	R
	OR19094	PSR 619		3360.34	Power site	BLM	C	Needs review
	OR19096	PSR 621		5379.4	Power site	BLM	C	Needs review
	OR19100	PSR 625		80	Power site	BLM	C	R
	OR19107	PSR 635		40	Power site	BLM	C	Needs review
	OR19111	PSR 653		127	Power site	BLM	C	R
	OR19121	PSR 686		158.72	Power site	BLM	C	R
	OR19131	PSC 2		6.42	Power site	BLM	C	Needs review
	OR19139	PSC 143		22948.95	Power site	BLM	C	Needs review
	OR19143	PSC 158		71.8	Power site	BLM	C	Needs review
	OR19151	PSC 196		5.94	Power site	BLM	C	R
	OR19154	PSC 218		1482.21	Power site	BLM	C	R

District	Serial Number	Authority	Legal Description	Acres	Purpose/Name	Managing Agency	Segregation Effect	Recommendation (C/R)
	OR19173	PSC 330		1151.73	Power site	BLM	C	Needs review
	OR19174	PSC 340		5207.45	Power site	BLM	C	Needs review
	OR19291	PLO 3530		210.36	Brewer Spr. RNA	BLM	B	C
	OR03664	B.O. of 1-24-1956		875.93	Rogue R. Basin Proj.	Bur. Of Reclamation	B	Needs review
	OR011495	PLO 4289		1132.39	Rogue R. Basin Proj.	Bur. Of Reclamation	C	C
	OR017844	PLO 4037		162.5	Rogue R. Basin Proj.	Bur. Of Reclamation	B	C
	OR20246	S.O. of 1-28-1905		22138.52	Klamath Proj.	Bur. Of Reclamation	B	Maintan 49 ac;revoke 1800 ac.
	OR20519	S.O. of 2-20-1943		84.64	Medford\SV Proj.	Bur. Of Reclamation	B	R
	OR20572	B.O. of 8-18-1950		80	Air Navg. Site	FAA	B	C
	OR03801	PLO 1189		395.5	Recreation area	USFS	B	R
	OR 139	R&PP		3.9	Sanitary lagoon	BLM	B	C
	OR 651	R&PP		200	Sanitary landfill	Jo. County	B	R
	ORE 013905	R&PP		4.2	River access	BLM	B	C
	ORE 010635	R&PP		80	River park	BLM	B	C
	ORE 012309	R&PP		82.69	Jo. Co. park	BLM	B	C
	ORE 013232	R&PP		400	Cathedral Hills Pk.	BLM	B	C
	ORE 013626	R&PP		6.63	Pinehurst Sch.	BLM	B	C
	ORE 015451	R&PP		12.12	Jack. Co. park	BLM	B	C
	ORE 018320	R&PP		41.48	Recreation area	BLM	B	C
	ORE 010368	R&PP		48.56	Jo. Co. park	BLM	B	C

District	Serial Number	Authority	Legal Description	Acres	Purpose/Name	Managing Agency	Segregation Effect	Recommendation (C/R)
	ORE 012765	R&PP		46.76	R&PP Classification	BLM	B	R
	ORE 016993	R&PP		35	Recreation area	BLM	B	C
Coos Bay	OR 50856	PLO 7215	19S 12W 1	40.43	Pacific Coastline	BLM		
			26S 14W 28	40.00				
			27S 14W 29	2.26				
			30S 15W 12	40.00				
			32S 15W 4	71.75				
			33S 14W 31	155.16				
			34S 14W 6	40.70				
			34S 14W 33	162.05				
			34S 14W 34	40.00				
			34S 15W 1	7.92			Loc: all	C - serving original purpose, revoke patented parcel.
			38S 14W 4	40.00				
			38S 14W 5	40.00				
			38S 14W 34	34.00				
			39S 14W 23	40.00				
			41S 13W 6	2.56				
			41S 13W 7	0.32				
	OR 016183C	PLO 3869	20S 9W 31	81.29	Smith River Falls Recreation Site	BLM		
			20S 9W 33	3.50	Vincent Creek Recreation Site	BLM		
			23S 10W 2	78.86	Loon Lake Recreation site	BLM		
			27S 10W 4	60.00	Park Creek Recreation Site	BLM		
			27S 10W 18	20.00	Big Tree Recreation Site	BLM		
			30S 9W 9	80.00	Bear Creek Recreation Site	BLM		

District	Serial Number	Authority	Legal Description	Acres	Purpose/Name	Managing Agency	Segregation Effect	Recommendation (C/R)
			32S 14 W 12	120.00	Sixes River Recreation Site	BLM		
				443.65				
	OR 23558	SO 12-31-1930	23S 10W 1	51.51	East Shore Recreation Site	BLM	Loc:all	C - Developed Site
		Rec Wdl. No. 43					Loc:all	C - Developed Site
							Loc:all	C - Developed Site
	OR 19291A	PLO 3530	27S 10W 17	590.00	Cherry Creek Natural Area	BLM	Loc:all	C - Developed Site
			27S 10W 18				Loc:all	C - Developed Site
			27S 10W 19				Loc:all	C - Developed Site
			27S 10W 20				Loc:all	C - Developed Site
	OR 6398	PL 181 5-5-1926	27S 11W 35	120.00	Lavern County Park	BLM/Coos County		
			27S 12W 35	160.00	Rock Prairie County Park	BLM/Coos County	Sur: all	
			28S 9W 7	87.72	Judge Hamilton County Park	BLM/Coos County		
			28S 11W 5	80.00	Middle Creek County Park	BLM/Coos County		
			28S 11W 11	80.00	Frona County Park	BLM/Coos County	Sur: all	C - Portecting site, providing for research opportunities
				527.72				
	OR 21318	SO 6-12-1907	40S 13W 11	320.75	Potential National Park	BLM		
			40S 13W 14					
							Loc:all	C - Developed County Park
	OR 19231	EO 11-24-1903	22S 13W 14	71.10	Umpqua Jetty Maintenance	COE	Loc:all	C - Potential for County Park Development

District	Serial Number	Authority	Legal Description	Acres	Purpose/Name	Managing Agency	Segregation Effect	Recommendation (C/R)
							Loc:all	C - Potential for County Park Development
	OR 21901	EO 8-23-1895	22S 13W 13	130.00	Umpqua River Light Station	USCG	Loc:all	C - Potential for County Park Development
							Loc:all	C - Developed County Park
	OR 4011	EO 7-14-1884	26S 14W 2	2.43	Bar Watch	USCG		
			26S 14W 2	2.67	Administrative Site	USCG		
				5.10			Sur: all	R - Not developed, no planned development, no public support for establishment of park or monument.
	OR 19227	EO 7-14-1884	26S 14W 2	2.43	Military Facility	US Navy		
			26S 14W 3				Loc:all	R - COE indicated a desire to relinquish
	OR 22094	EO 6-14-1876	26S 14W 4	35.78	Cape Arago Administative Facility	USCG	Loc:all	R - USCG indicated a desire to relinquish
			26S 14W 9					
							Loc:all	C - serving original purpose
	OR 36343	EO 9-11-1843	26S 14W 4	5.00	Cape Arago Lighthouse	USCG	Loc:all	C - serving original purpose
	OR 12693	PLO 5490	All Public Domain lands	50329.00	Multiple use management	BLM	Loc:all	C - serving original purpose
			on district					

District	Serial Number	Authority	Legal Description	Acres	Purpose/Name	Managing Agency	Segregation Effect	Recommendation (C/R)
							Loc:all	R - USCG has submittted an NOI to relinquish
	OR 54142	PLO 7436	25S 13W 4	80.00	North Spit Recreation Area	BLM		
		3-24-2000	25S 13W 5	32.23				
			25S 13W 6	271.60			Loc:all	R - USCG has submittted an NOI to relinquish
			25S 13W 7	212.90				
			25S 13W 8	5.90				
			25S 13W 18	325.49			Sur: agriculture	C - serving original purpose
			25S 13W 19	10.38				
			25S 14W 12	14.85				
			25S 14W 13	232.00				
			25S 14W 23	1.10			Loc:all	C - serving original purpose
			25S 14W 24	398.89				
			25S 14W 25	80.72				
			25S 14W 26	113.21				
				1779.27				
	OR 24294	PL 95-450	26S 14W 5	incl. below	Oregon Islands NWR	USFW		
		10-11-1978	26S 14W 8	incl. below				
			26S 14W 17	incl. below				
			26S 14W 18	incl. below				
			26S 14W 19	15.00				
			27S 14W 19	8.00				
			28S 15W 25	incl. below				

District	Serial Number	Authority	Legal Description	Acres	Purpose/Name	Managing Agency	Segregation Effect	Recommendation (C/R)
			28S 15W 26	3.56				
			28S 15W 35					
			29S 15W 2	4.00				C - serving purpose
			31S 16W 24	7.00				
			31S 16W 25	16.00				
			31S 16W 34	incl. below				
			31S 16W35	7.00				
			32S 16W 2	54.00				
			32S 16W 3					
			32S 16W 10					
			32S 16W 17	incl. below				
			32S 16W 21	incl. below				
			32S 16W 28	incl. below				
			32S 16W 29	incl. below				
			32S 16W 30	incl. below				
			32S 16W 31	54				
			33S 15W 6	2				
			33S 15W 8	3				
			33S 15W 21	incl. below				
			33S 15W 22	15				
			33S 15W 33	18				
			34S 14W 30					
			34S 15W 31	31.83				
			36S 15W 2	incl. below				

District	Serial Number	Authority	Legal Description	Acres	Purpose/Name	Managing Agency	Segregation Effect	Recommendation (C/R)
			36S 15W 11	12				
			36S 15W 15					
			36S 15W 16	incl. below				
			36S 15W 17	20				
			38S 14W 30					
			38S 14W 31	12				
			38S 15W 1	16				
			39S 14W 6	7				
			39S 14W 8	inc.in Sec 17				
			39S 14W 16	3				
			39S 14W 17	20				
			40S 14W 4	25				
			40S 14W 16	2				
			40S 14W 22	9				
			40S 14W 26	2.00				
	OR 711	PLO 4395	28S 15W 25	3.56	Oregon National Wildlife Refuge	USFW		
			31S 16W 24	7.00				
			31S 16W 25	16.00				
			31S 16W 34	7.00				
			31S 15W 35	15.00				
			32S 16W 17	incl. below				
			32S 16W 21	incl. below				
			32S 16W 28	incl. below				
			32S 16W 29	incl. below				
			32S 16W 30	incl. below			Loc:all	C - serving original purpose

District	Serial Number	Authority	Legal Description	Acres	Purpose/Name	Managing Agency	Segregation Effect	Recommendation (C/R)
			32S 16W 31	54.00				
			33S 15W 21	incl. below				
			33S 15W 22	15.00				
			33S 15W 33	incl. below				
			34S 15W 4	18.00				
			36S 15W 2	incl. below				
			36S 15W 11	12.00				
			38S 15W 1	16.00				
			38S 14W 30	incl. below				
			38S 14W 31	12.00				
			39S 14W 6	7.00				
			39S 14W 16	3.00				
			39S 14W 8	incl. below				
			39S 14 17	3.00				
			40S 14W 4	25.00				
			40S 14W 22	9.00				
				222.56				
	OR 50874		29S 15W 35	70.90	Lost Lake	BLM		
			29S 15W 36					
	OR 45401	PLO 6977	30S 15W 2	94.20	New River ACEC	BLM		
		4-29-1993	30S 15W 3	75.58				
			30S 15W 10	209.00				
			30S 15W 11	80.15				
			30S 15W 15	156.80				

District	Serial Number	Authority	Legal Description	Acres	Purpose/Name	Managing Agency	Segregation Effect	Recommendation (C/R)
			30S 15W 21	55.14			Loc:all	C - serving original purpose
			30S 15W 22	109.83				
			30S 15W 28	153.10				
			30S 15W 32	2.18				
			30S 15W 33	27.40			Loc:all	C - serving original purpose
				963.38				
	OR 51194	PLO 7170	31S 15W 7	2.89	Floras Lake	BLM		
			31S 15W 8	108.59				
				111.48				
	OR 51891	PLO 7247	32S 14W 6	44.48	Edson Creek Rec Site	BLM		
		2-20-1997						
	OR 24293	PL 91-504	40S 14W 22	21.00	Oregon Islands NWR	USFW		
	OR 22376	PROC 2416	40S 14W 35	21.00	Oregon Islands NWR	USFW	Loc:all	C - serving original purpose
	OR 25306	PLO 6287,	Unsurveyed Islands		Oregon National Wildlife Refuge	USFW		
	OR 11517	EO 5-6-1935,	and rocks	100.00				
			41S 13W 6					C - serving original purpose
								C - serving original purpose
	OR 19130	PSC 01	28S 10W 6	45.26	Protect water power and reservoir	BLM/FERC		

District	Serial Number	Authority	Legal Description	Acres	Purpose/Name	Managing Agency	Segregation Effect	Recommendation (C/R)
			28S 10W 8	40.00	development potential			C - serving purpose
			28S 10W 12	40.00				
			28S 10W 14	40.00			Loc:all	C - serving original purpose
				165.26				
	OR 19140	PSC 147	27S 10W 31	115.35	Protect water power and reservoir	BLM/FERC		
			27S 11W 35	236.72	development potential			
			28S 10W 5	124.12				
			28S 11W 6	45.14			Sur: all	R - unless there is substantial evidence that the site is viable for the production of hydropower.
			28S 11W 14	240.00				
				761.33				
	OR 19144	PSC 162	22S 8W 7	181.00	Protect water power and reservoir	BLM/FERC		
		PLO 3414	22S 8W 9	11.07	development potential			
			22S 8W 17	46.78			Sur: all	R unless there is substantial evidence that the site is viable for the production of hydropower.
			22S 8W 21	2.42				
			22S 9W 7	56.44				
			22S 9W 9	50.04				
			23S 8W 13	80.00				
				427.75				

District	Serial Number	Authority	Legal Description	Acres	Purpose/Name	Managing Agency	Segregation Effect	Recommendation (C/R)
	OR 19152	PSC 198	22S 9W 7	183.93	Protect water power and reservoir	BLM/FERC	Sur: all	Revoke unless there is substantial evidence that the site is viable for the production of hydropower.
	OR 20365	PSR 273	20S 9W 26	85.27	Protect water power and reservoir	BLM/FERC		
			20S 9W 28	44.31				
			20S 9W 32	75.85				
			20S 9W 34	39.79				
				245.22				
	OR 19101	PSR 629/WPD 11	20S 8W 17	39.65	Protect water power and reservoir	BLM/FERC	Sur: all	Revoke unless there is substantial evidence that the site is viable for the production of hydropower.
			20S 8W 19	623.68				
			20S 8W 21	304.23				
			20S 8W 27	120.00			Sur: all	Revoke unless there is substantial evidence that the site is viable for the production of hydropower.
			20S 8W 33	499.01				
			20S 9W 21	40.00				
			20S 9W 25	499.37				
			20S 9W 27	284.81				
			20S 9W 31	232.49				

District	Serial Number	Authority	Legal Description	Acres	Purpose/Name	Managing Agency	Segregation Effect	Recommendation (C/R)
			20S 9W 33	278.38			Sur: all	Revoke unless there is substantial evidence that the site is viable for the production of hydropower.
			20S 9W 35	173.27				
			21S 8W 1	400.00				
			21S W 11	200.00				
				3694.89				
	OR 19102	PSR 630	22S 8W 24	3.00	Protect water power and reservoir	BLM/FERC		
	OR 19105	PSR 633/WPD 11	22S 7W 19	29.93	Protect water power and reservoir	BLM/FERC		
			22S 8W 5	19.75				
			22S 9W 7	21.32				
			22S 9W 13	149.00				
			22S 9W 17	72.20				
			23S 7W 7	49.10				
			23S 7W 19	151.06				
			23S 7W 21	30.15			Sur: all	Revoke unless there is substantial evidence that the site is viable for the production of hydropower.
			23S 8W 11	29.38				
				551.89			Sur: all	Revoke unless there is substantial evidence that the site is viable for the production of hydropower.

District	Serial Number	Authority	Legal Description	Acres	Purpose/Name	Managing Agency	Segregation Effect	Recommendation (C/R)
	OR 19106	PSR 634/WPD 11	22S 10W 35	239.95	Protect water power and reservoir	BLM/FERC		
			23S 9W 7	41.66				
			23S 9W 17	120.00				
			23S 9W 19	158.55				
			23S 10W 1	171.51				
			23S 10W 13	40.00				
				771.67				
	OR 19109	PSR 645/WPD 12	23S 10W 35	40.00	Protect water power and reservoir	BLM/FERC		
							Sur: all	Revoke unless there is substantial evidence that the site is viable for the production of hydropower.
	OR 19113	PSR 659	30S 9W 9	40.00	Protect water power and reservoir	BLM/FERC		
	OR 19113	PSR 659/WPD 14	26S 9W 17	160.00	Protect water power and reservoir	BLM/FERC		
			26S 9W 19	160.00				
			26S 9W 29	160.00				
			26S 9W 31	360.00				
			27S 9W 7	265.55				
			27S 11W 15	182.80			Sur: all	Revoke unless there is substantial evidence that the site is viable for the production of hydropower.
			30S 9W 17	80.00				

District	Serial Number	Authority	Legal Description	Acres	Purpose/Name	Managing Agency	Segregation Effect	Recommendation (C/R)
			30S 10W 3	120.00			Sur: all	Revoke unless there is substantial evidence that the site is viable for the production of hydropower.
			30S 10W 13	160.00				
				1648.35			Sur: all	Revoke unless there is substantial evidence that the site is viable for the production of hydropower.
	OR 19017	WPD 17	27S 11W 5	610.66	Protect water power and reservoir	BLM/FERC		
			27S 11W 7	40.00				
			27S 11W 17	40.00				
			27S 11W 19	163.04				
			27S 11W 21	440.00				
			27S 11W 29	480.00				
			27S 11W 31	280.14				
			27S 11W 33	240.00				
			27S 12W 11	186.14				
			27S 12W 13	520.00			Sur: all	Revoke unless there is substantial evidence that the site is viable for the production of hydropower.
			27S 12W 23	200.00				
			27S 12W 25	320.00				
			27S 12W 27	240.00				
			27S 12W 35	220.00				
			28S 9W 7	335.20				
			28S 10W 3	366.60				

District	Serial Number	Authority	Legal Description	Acres	Purpose/Name	Managing Agency	Segregation Effect	Recommendation (C/R)
			28S 10W 5	329.68				
			28S 10W 9	280.00				
			28S 10W 11	240.00				
			28S 10W 15	80.00				
			28S 11W 1	152.80				
			28S 11W 3	234.00				
			28S 11W 7	32.28				
			28S 12W 1	254.80				
			28S 12W 13	155.68				
			28S 12W 23	161.76				
				6602.78				
	OR 19142	PSC 157			Protect water power	BLM/FERC		
					and reservoir			
K. Falls	OR 5433	BLM Order	40S 10E 9	80	Air navigation	FAA	A	Modify withdrawal, 80 acres
		6/14/57 ANS 57	40S 10E 10	80				continued, 80 acres returned
				160				to BLM, not all land used by
								withdrawing agency.
	OR 36244	SO of 2/11/47	39S 9E 21	51.12	Kingsley Field	USAF	B	Modify withdrawal. Portion
								not needed by holding agency
								portion continued in withdrawal
	OR19001	PLO 5907	39S 13E 2	78.87	Public Water	BLM	D	Not evaluated
			38S 13E 34	40	Reserve 146			

District	Serial Number	Authority	Legal Description	Acres	Purpose/Name	Managing Agency	Segregation Effect	Recommendation (C/R)
			38S 13E 35	40				
				158.87				
	OR 20219	EO of 1/24/1914	41S 13E 6	52.14	Public Water	BLM	D	Not evaluated
			40S 13E 19	189.55	Reserve 15			
			41S 12E 1	40				
			40S 12E 24	160				
				441.69				
	OR 9041	SO 234	40S 10E 11	80	Public Water	BLM	D	Not evaluated
					Reserve 107			
	OR 9041	SO 214	41S 14.5E 1	640	Public Water	BLM	D	not evaluated
					Reserve No. 107			
	OR 16183E	PLO 3869	39S 13E 2	160	Gerber Reservoir	BLM	B	C -
					recreation site.			BLM's investment still in
								need of protection. Use
								as a developed recreation
								site and campground will
								continue for the duration
								of the plan
			38S 5E 21	80	Surveyor			
					Mountain			
					recreation site	BLM	B	

District	Serial Number	Authority	Legal Description	Acres	Purpose/Name	Managing Agency	Segregation Effect	Recommendation (C/R)
			40S 7E 6	14.35	Topsy recreation			
				254.35	site.	BLM	B	
	OR 12799	PLO 3274	39S 9E 21	10.04	Administrative	FWS	B	Transfer jurisdiction of the
					site	FWS	B	10.04 acre administrative
								site to BLM. Site no
								longer needed by Fish
								and Wildlife Service
	OR 6058	PLO 4876	38S 6E 21	9.69	Protect road use	BLM/FS	B	Not evaluated
	OR 5746	PLO 4878	36S 15E 28, 32	14	Protect road use	BLM/FS	B	Not evaluated
				9				
				23				
	OR 20243	SO of 7/9/1904	39S 14E 5	240.05	Klamath Basin	BR/BLM	B	R -
			39S 14E 6	486.36	Reclamation			Withdrawal relinquished by
			39S 14E 7	209.43	Project			holding agency, no longer
			39S 14E 8	240				needed for project
			39S 14E 17	640				purposes. Suitable for
			39S 14E 18	529.98				return to BLM
			39S 14E 19	400				administration.
			39S 14E 20	360				

District	Serial Number	Authority	Legal Description	Acres	Purpose/Name	Managing Agency	Segregation Effect	Recommendation (C/R)
			39S 14E 21	160				
			39S 14E 22	160				
			38S 14E 31	80				
			38S 14E 32	80				
				3585.82				
		SO of 7/27/1904	38S 13E 35	120	Klamath Basin	BR/BLM	B	R -
			39S 13E 1	80	Reclamation			Withdrawal relinquished
			39S 13E 2	78.87	Project			by holding agency, no
			39S 13E 11	80				longer needed for project
			39S 13E 12	640				purposes. Suitable for
			39S 13E 13	320				return to BLM administration
			39S 13E 14	160				
			39S 13E 23	320				
			39S 13E 26	320				
			39S 13E 27	280				
			39S 13E 33	240				
			39S 13E 34	240				
				2878.87				
	OR 20246	SO of 1/28/1905	37S 8E 17	68.7	Klamath Basin	FWS/BR	B	R -
					Reclamation			Withdrawal relinquished by
					Project/Upper			holding agency, no longer

District	Serial Number	Authority	Legal Description	Acres	Purpose/Name	Managing Agency	Segregation Effect	Recommendation (C/R)
					Klamath National			needed for project purposes.
					Wildlife Refuge			Withdrawal overlaps USFWS
								withdrawal.
	OR 20249	SO of 1/20/1910	34S 6E 2	44.59	Klamath Basin	FS/BR	B	R -
		Lands within	34S 6E 11	438.73	Reclamation			Withdrawal relinquished by
		Winema NF	34S 6E 14	440	Project/Winema			holding agency, no longer
			34S 6E 23	140	National Forest			needed for project purposes.
			34S 6E 26	358.83				Withdrawal overlaps USFWS
			34S 6E 35	242.7				withdrawal.
			36S 6E 10	80				
			36S 6E 11	160				
				1904.85				
	OR 20249	SO of 1/20/1910	34S 6E 25	480	Klamath Basin	FWS/BR	B	R -
		(Continued)	34S 6E 26	120	Reclamation			drawal relinquished by holding
		Same lands	34S 6E 35	200	Project/Upper			agency, no longer needed
		included in	34S 6E 36	640	Wildlife Refuge			for project purposes.
		EO 2416	35S 6E 1	640				Withdrawal overlaps USFWS
			35S 6E 2	280.24				withdrawal.
			35S 6E 12	640				

District	Serial Number	Authority	Legal Description	Acres	Purpose/Name	Managing Agency	Segregation Effect	Recommendation (C/R)
			35S 6E 13	640				
			35S 6E 24	640				
			35S 6E 35	320				
			35S 6E 36	640				
			36S 6E 1	640				
			36S 6E 2	560				
			36S 6E 3	80				
			36S 6E 11	480				
			36S 6E 12	640				
			36S 6E 13	400				
			36S 6E 14	320				
				8361.84				
	OR 20249	SO of 1/20/1910	34S 6E 1	239.23	Klamath Basin	BR	B	R -
		(Continued)	34S 6E 12	640	Reclamation			Withdrawal relinquished by
			36S 6E 13	316.86	Project			holding agency, no longer
			36S 6E 13	1196.09				needed for project purposes.
								Suitable for return to BLM
								administration.
	OR 20253	SO of 6/25/1919	41S 10E 15	159.8	Klamath Basin	FWS/BR	B	C
		Same lands	41S 10E 16	74.1	Reclamation			
		included in	41S 9E 3	405.2	Project/Upper			
			41S 9E 4	648.4	Klamath National			
			41S 9E 5	405.25	Wildlife Refuge			

District	Serial Number	Authority	Legal Description	Acres	Purpose/Name	Managing Agency	Segregation Effect	Recommendation (C/R)
			41S 9E 6	324.16				
			41S 9E 8	567.68				
			41S 9E 9	648.76				
			41S 9E 10	647.92				
			41S 9E 14	396.39				
			41S 9E 15	387.32				
			41S 9E 16	373.92				
			41S 9E 17	359.46				
			41S 9E 18	344.8				
			41S 8E 1	344.32				
			41S 8E 4	72.3				
			41S 8E 9	149.5				
			41S 8E 11	40				
			41S 8E 12	324.44				
			41S 8E 13	167.1				
			41S 8E 14	40				
			41S 8E 15	291.2				
			41S 8E 16	91.8				
			40S 8E 24	40				
				7303.82				
	OR 20254	SO of 7/31/1919	39S 11E 19	80	Klamath Basin	BR/BLM	B	R -
					Reclamation			Withdrawal relinquished by
					Project			holding agency, no longer
								needed for project purposes.
								Right-of-way issued to

District	Serial Number	Authority	Legal Description	Acres	Purpose/Name	Managing Agency	Segregation Effect	Recommendation (C/R)
								protect BR interests. Suitable
								for return to BLM administration
	OR 20240	SO of 6/20/1922	41S 14E 19	29.55	Klamath Basin	BR/BLM	B	C
					Reclamation			
					Project			
	OR 20259	SO of 2/25/1939	39S 12E 22	40	Klamath Basin	BR/BLM	B	R -
			39S 12E 26	80	Reclamation			Withdrawal relinquished by
				120	Project			holding agency, no longer
								needed for project purposes.
								Suitable for return to BLM.
								administration.
	OR 20261	SO of 4/2/1940	40S 14E 5	41.04	Klamath Basin	BR/BLM	B	R -
					Reclamation			Withdrawal relinquished by
					Project			holding agency, no longer
								needed for project purposes.
								Suitable for return to BLM.
								administration.

District	Serial Number	Authority	Legal Description	Acres	Purpose/Name	Managing Agency	Segregation Effect	Recommendation (C/R)
	OR 20239	SO of 2/21/1946	41S 14E 15	80	Klamath Basin	BR/BLM	B	C -
			41S 14E 20	240	Reclamation			Property still needed for
			41S 14E 21	307.06	Project			project purposes.
			41S 14E 22	354.92				
			41S 14E 23	81.82				
				1063.8				
	OR 20264	BO of 2/11/1947	39S 9E 20	13.3	Klamath Basin	BR/BLM	B	Continue
			39S 9E 21	12.06	Reclamation			or revoke portions of the
			39S 9E 21	1.2	Project			withdrawal as requested by
			39S 9E 22	7.5				holding agency. Property
			39S 9E 25	7.7				no longer needed for project
			39S 9E 27	18.4				purposes. Rights-of-way
				60.14				issued to protect BR interests
								on lands to be returned to
								BLM administration.
		FPC	40S 8E 33	1.52	Protect electric	BLM/FERC	B	Not evaluated
		Order 11/17/1930			transmission line			
	OR 19085	PSR 579	41S 6E 2	80	Protect water,	BLM/FERC	C	Not evaluated
		EO 2/1/1917	41S 6E 7	40	power, and			

District	Serial Number	Authority	Legal Description	Acres	Purpose/Name	Managing Agency	Segregation Effect	Recommendation (C/R)
			41S 6E 10	80	reservoir			
			41S 6E 18	113.95	development			
				313.95	potential			
	OR 19087	WPD 3	41S 6E 2	440	Protect water,	BLM/FERC	C	Not evaluated
		Same lands	41S 6E 3	480	power, and			
		included in	41S 6E 5	40	reservoir			
		PSR 582	41S 6E 7	412.58	development			
			40S 6E 1	151.54	potential			
			40S 6E 11	240				
			40S 6E 13	550.15				
			40S 6E 23	578.25				
			40S 6E 27	280				
			40S 6E 35	312.53				
			41S 5E 13	30.54				
				3615.19				
	OR 19054	PSR 258	41S 6E 4	40	Protect water,	BLM/FERC	C	Not evaluated
		EO 4/13/1912	41S 6E 8	360	power, and			
			41S 6E 10	80	reservoir			
			40S 6E 12	294.03	development			
			40S 6E 14	216.09	potential			
			40S 6E 26	288.15				
			40S 6E 34	309.83				
			41S 5E 13	23.24				
				1611.34				
	OR 43211	Power	40S 6E 14	45	Protect water,	BLM/FERC	B	Not evaluated
		project 10199	40S 6E 23	147.15	power, and			

District	Serial Number	Authority	Legal Description	Acres	Purpose/Name	Managing Agency	Segregation Effect	Recommendation (C/R)
		Salt Caves	40S 6E 26	150.32	reservoir			
		proposal	40S 6E 27	13.56	development			
			40S 6E 34	115.7	potential			
			40S 6E 35	76.28				
			41S 6E 3	76.53				
			41S 6E 5	28.08				
			41S 6E 7	146.13				
			41S 6E 8	111.86				
			41S 6E 9	168.92				
			41S 6E 10	8.79				
			41S 5E 1	8.15				
			41S 5E 12	11.89				
			41S 5E 13	13.98				
				1122.34				
	OR 18974	Power	40S 7E 6	14.47	Protect J.C.	BLM/FERC	B	Not evaluated
		project 2082	40S 6E 1	23.41	Boyle power			
			40S 6E 12	67	project.			
			40S 6E 13	40.74				
			40S 6E 14	27.33				
			40S 6E 23	16.68				
			40S 6E 26	7.4				
			40S 6E 27	1.23				
			40S 6E 34	2.8				
			40S 6E 35	11.17				
			41S 6E 3	8.24				
			41S 6E 10	4.89				
				225.36				

District	Serial Number	Authority	Legal Description	Acres	Purpose/Name	Managing Agency	Segregation Effect	Recommendation (C/R)
	OR 19131	PSC 2	41S 5E 12	6.42	Protect water,	BLM/FERC	C	Not evaluated
		SO 5/19/1921			power, and			
					reservoir			
					development			
					potential.			
	OR 43472	Power project	40S 10E 11	200	Protect water,	BLM/FERC	B	Not evaluated
		10518-000	40S 10E 14	240	power, and			
		preliminary	40S 10E 24	120	reservoir			
		permit		560	development			
					potential			
	OR 42356	Power	40S 13E 30	80	Protect water,	BLM/FERC	B	Not evaluated
		project 10233	40S 13E 31	400	power, and			
		preliminary	41S 12E 1	120	reservoir			
		permit	41S 13E 6	640	development			
			41S 13E 7	360	potential			
			41S 13E 8	40				
			41S 13E 17	200				
			41S 13E 18	40				
			41S 13E 19	40				
			41S 13E 20	80				
				2000				
	OR 46064	Power	40S 13E 35	40	Protect water,	BLM/FERC	B	Not evaluated
		project 10897	41S 13E 5		power, and			
		preliminary	41S 13E 6		reservoir			
		permit Russell	41S 13E 7		development			
		Canyon	41S 13E 8		potential			
			41S 13E 9					

District	Serial Number	Authority	Legal Description	Acres	Purpose/Name	Managing Agency	Segregation Effect	Recommendation (C/R)
			41S 13E 17					
			41S 13E 18					
	OR 47193	Power	40S 10E 11	200	Protect water.	BLM/FERC	B	Not evaluated
		project 11136	40S 10E 14	240	power, and			
		preliminary	40S 10E 24	120	reservoir			
		permit Stukel		560	development			
		Mountain			potential			
	OR 49194	Power	40S 10E 11	200	Protect water,	BLM/FERC	B	Not evaluated
		project 11138	40S 10E 14	240	power, and			
		preliminary	40S 10E 24	120	reservoir			
		permit Stukel		560	development			
		Mountain			potential			
	OR 46064	Power	40S 12E 12	640	Protect water,	BLM/FERC	B	Not evaluated
		project 10897			power, and			
		preliminary			reservoir			
		permit Lorella			development			
		pumped storage			potential			
		project.						
	OR 46244	Power	40S 13E 7	497.11	Protect water,	BLM/FERC	B	Not evaluated
		project 10970	40S 13E 8	360	power, and			
		preliminary	40S 13E 17	280	reservoir			
		permit Smith	40S 13E 18	292.05	development			

District	Serial Number	Authority	Legal Description	Acres	Purpose/Name	Managing Agency	Segregation Effect	Recommendation (C/R)
		Reservoir		1429.16	potential			
		pumped storage						
		project						
* PLO: Public Land Order								
PSR: Power Site Reserve								
PSC: Power Site Classification								
R&PP: Recreation and Public Purposes								
WPD: Water Power Designation								
** A: Withdrawn from operation of the general land laws, the Mining law, and the Mineral Leasing Act								
B: Withdrawn from operations of the General Land and Mining Laws								
C: Withdrawn from operation of the General Land Law								
Recommendation Continue-C Revoke-R								

Table 287. Land Tenure Zone 3 Lands.

District	Township	Range	Section	Subdivision	Acres	Status
Medford	34 S	6 W	22	NW¼SE¼;	40	PD
			33	SW¼SW¼; E½SW¼;	120	PD
			35	NW¼NE¼;	40	PD
	35 S	1 W	15	NW¼SE¼;	40	OC
	35 S	5 W	31	SE¼NW¼, SW¼, W½SE¼;	240	PD
			32	SW¼NE¼; W½SE¼, NE¼SE¼;	160	PD
	35 S	6 W	5	S½NE¼, SE¼SW¼, SE¼;	240	
			7	NE¼NE¼, N½NW¼, SW¼NW¼, SE¼NE¼;	200	
			11	E½NE¼, SW¼NE¼, NE¼SE¼;	200	
			14	NW¼SE¼;	40	PD
			17	NE¼NE¼, NW¼NW¼;	80	
			19	NE¼, N½NW¼;	240	
			21	NE¼NE¼;	40	
			29	NW¼NW¼;	40	
			30	S½S¼;	80	PD
			31	SW¼NE¼, W½, NW¼SE¼;	400	
			33	E½NE¼, E½NW¼, NW¼NW¼, SE¼SE¼;	240	
	36 S	3 W	21	NE¼SW¼;	40	
			33	SW¼SW¼, NW¼SE¼SW¼;	50	
			35	NE¼NE¼;	40	
	36 S	4 W	25	SE¼SW¼, S½SW¼SE¼;	60	
			35	Lots 1, 5, W½SW¼;	126.78	
	36 S	5 W	4	E½NW¼, N½SW¼;	160	PD
			5	SE¼NE¼, E¼SE¼;	80	
			9	W½E½, E½W½, E½NW¼SW¼;	340	
			29	S½SW¼;	80	PD
	36 S	6 W	1	Lots 2,3,4, S½NE¼, N½SW¼, SE¼NW¼, W½SE¼, SE¼SE¼;	440.20	
			3	SW¼, S½SE¼	240	
			4	W½W½	160	PD
			5	E½SE¼, SW¼NW¼, W½SW¼;	200	
			8	W½SE¼, SE¼SE¼;	120	PD
			9	N½NW¼, SW¼NW¼, E½SE¼;	200	
			11	NW¼NE¼;	40	
			17	N½N½;	160	
			30	NW¼SW¼;	40	PD
			31	NW¼NW¼;	40	
			33	SE¼NE¼;	40	

District	Township	Range	Section	Subdivision	Acres	Status
	37 S	3 W	1	Lot 8;	13.82	PD
			4	Mineral Survey located NW¼NW¼;	4.28	PD
			5	Lot 1, NE¼NE¼;	40	
	37 S	5 W	5	NE¼NW¼, SW¼NW¼, NW¼SW¼;	120	
			7	W½SW¼;	80	
			18	W½SW¼;	80	PD
	37 S	6 W	3	SE¼NE¼, NE¼SE¼;	80	
			8	NE¼NE¼;	40	PD
			9	NE¼, N½SW¼, SE¼SW¼, W½SE¼, NE¼SE¼;	400	
			11	N½NW¼;	80	
			13	SW¼SE¼, E½SE¼;	120	
			15	NE¼NE¼, SW¼NE¼, SE¼NW¼;	120	
			24	NW¼NE¼;	40	PD
	38 S	1 W	21	Lot 1, NE¼SW¼, S1/2SW¼	147.04	
	38 S	2 W	10	NE¼NW¼;	40	PD
			28	Lot 1	5	PD
	38 S	4 W	17	NE¼NE¼;	40	
			25	Lot 7	9.26	
	39 S	1 W	1	NE¼NE¼;	40	
	39 S	2 W	18	NW¼NE¼SW¼;	10	PD
	40 S	8 W	1	Lots 7, 8;	11.53	
			5	Lots 6, 7;	21.21	
			7	Lots 1,2, E½SW¼, W½SE¼;	202.34	
	32 S	2 E	17	NW¼SW¼SW¼SW¼;	2.5	PD
	33 S	2 E	1	SE¼SW¼;	40	PD
	36 S	1 E	6	SE¼SE¼;	40	PD
	36 S	2 E	34	SE¼SW¼, SW¼SE¼;	80	PD
	37 S	1 E	15	SE¼NW¼;	40	
	38 S	1 E	3	SW¼NW¼;	40	
			5	SE¼NE¼;	40	
	38 S	2 E	34	SW¼NW¼, NW¼SW¼;	80	PD
				TOTAL MEDFORD DISTRICT	7,203.96	
Eugene	14 S	2 W	13	Lots 4-5 (part)[2]	2.001	O&C
	17 S	3 W	15	Lots 6, 9	1.303	O&C

District	Township	Range	Section	Subdivision	Acres	Status
	16 S	5 W	33	Lots 4-8	6.57	O&C
	16 S	6 W	7	Lot 6	3.76	O&C
	16 S	7 W	11	NW¼SE¼ (part)	2.5[1]	O&C
	17 S	1W	3	Lot 6	0	SOLD
	18 S	1 W	5	Lot 8 (part)	0.501	O&C
	18 S	1 W	26	Lot 7	1.68 (reduced from 2.89 acres due to sale of lots 8, 9, and 10)	PD
	18 S	7 W	11	NE¼NE¼ (part)	3.001	O&C
	18 S	10 W	11	Lot 9	6.24	PD
	19 S	3 W	35	Lot3[2]	2.79	O&C
	19 S	4 W	29	NE¼SW¼ (part)	0.361	O&C
	21 S	1 W	31	Lot 13	1.42 (reduced from 3.62 acres due to cadastral survey and sale of a portion)	O&C
	21 S	1 W	35	Lot 2	0	SOLD
				TOTAL EUGENE DISTRICT	22.77	

[1]Acreage is approximate until cadastral survey is completed.
[2]Tract may be sold only to current R&PP lessee so long as case is in effect.
[3]Actual acreage may vary due to erosion and accretion.

Roseburg	30 S	2 W	32	Lot 3	42.00	PD
	30 S	2 W	34	SESW	40.00	PD
	31 S	2 W	4	Lots 1 and 8	84.00	PD
	24 S	3 W	9	W2W2	160.00	O&C
	24 S	3 W	15	E2NE,W2SE,SESE	200.00	O&C
	24 S	3 W	17	Lots 1,2,3, and 4	154.00	O&C
	24 S	3 W	19	Lots 5 to 12 inclusive	217.00	O&C
	24 S	3 W	21	NWSW	40.00	O&C
	24 S	3 W	22	SWNE, NWSW	80.00	PD
	24 S	3 W	23	NWNW	40.00	O&C
	24 S	3 W	31	Lot 1, N2NE, SWNE, E2NW,SESE	281.00	O&C
	25 S	3 W	3	Lot 5,6,7, and 8	98.00	O&C
	25 S	3 W	4	Lot 5	23.00	PD
	25 S	3 W	5	Lots 5 and 6	52.00	O&C
	25 S	3 W	9	Lots 1 to 5 inclusive	223.00	O&C
	27 S	3 W	34	SESW	40.00	PD
	30 S	3 W	5	Lots 1 and 2	19.00	O&C
	21 S	4 W	19	NWSE	40.00	O&C

District	Township	Range	Section	Subdivision	Acres	Status
	21 S	4 W	31	SWSW, S2SE	122.00	O&C
	21 S	4 W	33	S2SW	80.00	O&C
	22 S	4 W	7	NE, NWNW, NESE	250.00	O&C
	23 S	4 W	7	Lot 4, NENE, SESW, W2SE,SESE	240.00	O&C
	23 S	4 W	17	All	640.00	O&C
	23 S	4 W	19	Lots 2,3,4, NE, SENW, E2SW	407.00	O&C
	23 S	4 W	20	SWNE, NWSE	80.00	PD
	23 S	4 W	29	N2NW, SENW, NESW, SWSW	200.00	O&C
	24 S	4 W	5	Lots 3 and 4, W2SE	154.00	O&C
	24 S	4 W	25	N2, NWSW, SE	520.00	O&C
	24 S	4 W	29	NESE	40.00	O&C
	24 S	4 W	33	SE	160.00	O&C
	24 S	4 W	35	W2NE, E2NW, SWNW, N2SW	280.00	O&C
	25 S	4 W	3	NENW, NWSE	82.00	O&C
	25 S	4 W	16	NENW	40.00	PD
	25 S	4 W	17	Lot 5	17.00	O&C
	26 S	4 W	10	Lot 1	7.00	PD
	26 S	4 W	17	Lots 9 and 10	12.00	O&C
	27 S	4 W	7	Lot 2	4.00	O&C
	27 S	4 W	33	NWSW	40.00	PD
	28 S	4 W	29	SENE	40.00	O&C
	30 S	4 W	1	Lot 9	4.00	O&C
	21 S	5 W	13	NESW, W2SE	120.00	O&C
	21 S	5 W	21	NENW	40.00	O&C
	21 S	5 W	25	S2NE, E2NW, NESE	200.00	O&C
	21 S	5 W	27	E2NE, NESW	120.00	O&C
	21 S	5 W	29	NESW	40.00	O&C
	21 S	5 W	33	W2NW	80.00	O&C
	22 S	5 W	1	Lots 1,2,3, and 4, S2N2, S2	634.00	O&C
	22 S	5 W	3	Lots 1,2, SWNE, S2NW	197.00	O&C
	22 S	5 W	5	NWNE, N2NW, SWNW, NWSW	206.00	O&C
	22 S	5 W	11	NE1/4, SWNW, W2SW	280.00	O&C
	22 S	5 W	15	N2NE, SWNE	120.00	O&C
	22 S	5 W	19	SENE	40.00	O&C
	22 S	5 W	23	NESE, S2SE	120.00	O&C
	22 S	5 W	25	SWNE, S2NW, SW, W2SE	360.00	O&C
	22 S	5 W	33	W2NE, NW, NESW	280.00	O&C
	22 S	5 W	35	Lot 1, E2NE, N2NW	180.00	O&C
	23 S	5 W	5	NW, N2SW, SESW	276.00	O&C
	23 S	5 W	7	NWNE, SESE	80.00	O&C
	23 S	5 W	13	E2NE, SE	240.00	O&C
	23 S	5 W	17	S2SW	80.00	O&C

District	Township	Range	Section	Subdivision	Acres	Status
	23 S	5 W	21	NWNW	40.00	O&C
	24 S	5 W	29	Lot 5	28.00	O&C
	25 S	5 W	23	NESW	40.00	O&C
	25 S	5W	27	N2NW	80.00	O&C
	25 S	5W	29	S2NE	80.00	O&C
	28 S	5 W	23	SWNW	40.00	O&C
	28 S	5 W	28	NWNW	40.00	PD
	28 S	5 W	29	E2NE	80.00	O&C
	28 S	5 W	31	NESE	40.00	O&C
	29 S	5 W	29	NENE	40.00	O&C
	30 S	5 W	9	Lots 3 and 4	77.00	O&C
	30 S	5 W	13	Lot 1	21.00	O&C
	30 S	5 W	17	NENE, N2NW, SWNW	160.00	O&C
	30 S	5 W	19	Lot 1	38.00	O&C
	30 S	5 W	29	SESW, S2SE	120.00	O&C
	31 S	5 W	4	Lot 6	33.00	O&C
	22 S	6 W	15	SESW	40.00	O&C
	22 S	6 W	23	W2NW, SW1/4, S2SE	320.00	O&C
	22 S	6 W	35	S2S2	160.00	O&C
	23 S	6 W	1	Lots 5,6, and 7	134.00	O&C
	24 S	6 W	27	W1/2, SWSE	360.00	O&C
	25 S	6 W	3	NWNE, NESW, NESE	122.00	O&C
	25 S	6 W	7	Lots 1,2,3, and 4, E2NW	244.00	O&C
	25 S	6 W	33	SESE	40.00	O&C
	26 S	6 W	3	SENE, NESE	80.00	O&C
	26 S	6 W	17	Lot 2, SENW, SESW, SWSE	126.00	O&C
	29 S	6 W	17	Lots 9,10, and 11, SESE	102.00	O&C
	29 S	6 W	19	NWNE, N2NW, SWSE	164.00	O&C
	30 S	6 W	18	Lots 1 and 2	39.00	PD
	30 S	6 W	20	Lots 1,2, and 3	58.00	PD
	30 S	6 W	21	NWNE, NENW, SE	240.00	O&C
	30 S	6 W	25	SESE	40.00	O&C
	30 S	6 W	29	N2NW	80.00	O&C
	28 S	7 W	11	SWSE	40.00	CBWR
	28 S	7 W	14	Lot 1, N2NE	99.00	PD
	28 S	7 W	15	Lots 7 to 13 inclusive	197.00	CBWR
	28 S	7 W	21	N2, N2S2, SWSW	520.00	CBWR
	28 S	7 W	22	SENE, S2NW	120.00	PD
	28 S	7 W	27	Lots 3 and 4	85.00	CBWR
	29 S	7 W	5	NWSW	40.00	O&C
				TOTAL ROSEBURG DISTRICT	13352.00	

District	Township	Range	Section	Subdivision	Acres	Status
Salem	3 N	1 W	9	Lot 8	1.24	Ot
	3 N	8 W	10	NWNE	40.00	PD
	3 N	8 W	11	Lot 2	0.01	PD
	3 N	8 W	18	Lot 2	21.44	PD
	5 N	6 W	6	Lot 9	2.12	PD
	5 N	7 W	10	SWNE	40.00	PD
	7 N	4 W	6	Lot 7	0.03	PD
	9 N	7 W	32	Lot 8	0.72	PD
	1 S	3 W	7	Lot 1	0.18	OC
	1 S	3 W	8	Lot 1	0.05	PD
	1 S	4 W	15	SWNE, S/2NW	120.00	OC
	2 S	2 E	4	Lot 2	0.04	PD
	2 S	2E	9	Lot7	0.11	Ot
	2 S	3 E	23	Lots 8, 12	6.25	OC
	2 S	3 E	25	Lots 7, 8	1.69	OC
	2 S	3 W	23	N/2NE, NENW	120.00	OC
	2 S	4 W	31	Lot 1	1.30	OC
	2 S	9 W	4	M&B	5.30	Ot
	2 S	9 W	7	UN Lot	0.19	PD
	3 S	2 E	7	Lot 1	0.87	OC
	3 S	3 E	1	Lots 11, 14	54.51	OC
	3 S	3 E	7	NESW	40.00	OC
	3 S	3 E	9	Lot 3, NW, W/2SE	270.40	OC
	3 S	3 E	15	Lot 6, 10-12	45.93	OC
	3 S	3 E	19	NWNE, NENW	80.00	OC
	3 S	3 E	25	Lots 9-11	24.17	OC
	3 S	3 E	27	Lot 7, SENE, SWSE	103.32	OC
	3 S	3 E	29	Lot 4, SESW, W/2SE	146.65	OC
	3 S	3 E	33	NW	160.00	OC
	3 S	3 E	35	NE, NW	320.00	OC
	3 S	4 E	31	UN Lot, Lot 5	57.66	OC
	3 S	4 W	33	Lot 4	0.11	OC
	3 S	9 W	19	NENW	40.00	PD
	3 S	9 W	20	NWNE	40.00	PD
	3 S	9 W	21	SWSW	40.00	PD
	3 S	9 W	28	SWSE	40.00	PD
	3 S	9 W	31	S/2SE	80.00	PD
	3 S	9 W	33	NWNE	40.00	PD
	3 S	10 W	30	Lot 15	0.45	PD
	4 S	1 E	21	Lot 1	0.49	OC
	4 S	2 E	11	NENE, SWNE, E/2SW, NWSE	200.00	OC
	4 S	2 E	15	NWSE, SESE	80.00	OC

District	Township	Range	Section	Subdivision	Acres	Status
	4 S	2 E	23	SWNW	40.00	OC
	4 S	2 E	33	Lots 1, 2	1.80	OC
	4 S	3 E	9	SWNE, NWSE	80.00	OC
	4 S	3 E	19	UN Lot	47.31	OC
	4 S	3 E	21	E/2NE, SWNW, N/2SW	200.00	OC
	4 S	3 E	29	E/2NE	80.00	OC
	4 S	3 E	31	S/2NE, NWSE	120.00	OC
	4 S	1 W	22	UN Lot	0.50	PD
	4 S	3 W	2	Lot 1	0.25	PD
	4 3	3 W	26	Lot 14	6.75	PD
	4 S	3 W	34	Lots 1, 2	4.40	PD
	4 S	3 W	35	Lot 13	8.34	OC
	4 S	10 W	19	Lot 1, 15	77.75	PD
	4 S	10 W	28	Lot 3	0.53	PD
	5 S	3 W	4	Lot 1	1.16	PD
	5 S	3 W	11	Lot 1	15.06	OC
	5 S	4 W	27	Lot 1	13.00	OC
	5 S	5 W	13	Lot 3	0.05	OC
	5 S	5 W	31	Lot 1	3.57	OC
	5 S	5 W	34	Lot 1	0.93	PD
	5 S	5 W	35	Lot 1	8.00	OC
	5 S	10 W	5	UN Lots	2.07	PD
	5 S	10 W	20	SENE	40.00	PD
	5 S	10 W	34	N/2NE, NENW	120.00	PD
	6 S	3 W	2	Lot 2	0.20	PD
	6 S	3 W	5	Lot 1	2.00	OC
	6 S	1 E	13	E/2NW, SWNW	120.00	OC
	6 S	1 E	25	NWNE, SENW	80.00	OC
	6 S	6 W	35	Lot 1	28.40	OC
	6 S	10 W	20	NESW, NWSE	80.00	PD
	6 S	10 W	26	NWNW	40.00	PD
	6 S	10 W	35	SENE	40.00	PD
	7 S	1 E	1	SESW	40.00	OC
	7 S	1 E	23	SESE	40.00	OC
	7 S	3 W	29	Lot 3	5.42	OC
	7 S	6 W	34	SWSE	40.00	OC
	7 S	10 W	20	NE	160.00	PD
	7 S	10 W	30	W/2NE, SENE, E/2SE	200.00	PD
	8 S	1 E	3	SWNW, SW	200.00	OC
	8 S	1 E	27	NESW	40.00	OC
	8 S	1 E	35	Lots 1,2, NWNW, S/2	400.22	OC
	8 S	4 W	24	M&B	1.54	Ot

District	Township	Range	Section	Subdivision	Acres	Status
	8 S	4 W	25	M&B	8.00	Ot
	8 S	10 W	20	WNWNW	20.00	PD
	8 S	11 W	3	Lot 8	4.73	PD
	9 S	1 W	21	Lot 7, NWNE	84.21	OC
	9 S	3 W	21	Lot 3	0.08	Ot
	9 S	3 W	24	UN Lot	1.40	PD
	9 S	3 W	32	Lot 2	4.60	PD
	9 S	4 W	9	Lot 5	1.16	OC
	9 S	4 W	14	Lot 9	0.17	PD
	9 S	5 W	32	Lots 1, 2	2.90	PD
	9 S	9 W	19	Por Lot 29	10.00	PD
	9 S	9 W	33	Lot 17	20.00	PD
	9 S	9 W	34	W/2NWSW	20.00	PD
	9 S	:10 W	26	SWNW	40.00	PD
	9 S	10 W	36	POR Lots 5, 6	10.00	PD
	9 S	11 W	1	Lot 6	1.46	PD
	9 S	11 W	4	SWSW	40.00	PD
	10 S	2 W	8	Lot 1	6.13	PD
	10 S	3 W	24	Lot 6	0.90	PD
	10 S	4 W	11	Lot 5	1.52	OC
	10 S	5 W	19	Lots 1-4, NE, E/2NW, E/2SW	480.00	OC
	10 S	5 W	23	Lot 4	0.79	OC
	10 S	5 W	29	NENE, N/2SW, NSE	145.00	OC
	10 S	6 W	22	Lots 2, 3	15.70	PD
	10 3	7 W	18	SWNE, SESW, W/2SE	160.00	PD
	10 S	10 W	2	Lot 20	20.00	PD
	11 S	3 W	1	Lot 11	0.15	Ot
	11 S	7 W	14	Lot 5	0.14	PD
	11 S	7 W	23	Lots 1, 2	1.39	Ot
	11 S	8 W	6	NESW, NWSE, SESE	120.00	PD
	11 S	9 W	31	Lot 2	43.25	PD
	11 S	10 W	12	N/2NE, NWSW, NESE	160.00	PD
	11 S	10 W	14	Lot 1	2.87	PD
	11 S	10 W	15	Lot 13	3.85	PD
	11 S	10 W	23	NESE	40.00	PD
	11 S	10 W	24	SWSW	40.00	PD
	11 S	10 W	25	Lot 1	37.22	PD
	11 S	10 W	36	SESE	40.00	PD
	12 S	3 E	23	SESW, SWSE	80.00	PD
	12 S	4 E	30	SESW	40.00	PD
	12 S	4 E	31	Lot 1, NENW	84.81	PD
	12 S	1 W	34	Lot 10	11.45	PD

District	Township	Range	Section	Subdivision	Acres	Status
	12 S	2 W	13	Lot 6	7.04	Ot
	12 S	4 W	1	Lot 3	0.23	OC
	12 S	6 W	35	Lot 3	0.20	Ot
	12 S	8 W	6	Lot 7	40.18	PD
	12 S	8 W	7	Lots 1, 2	79.04	PD
	12 S	9 W	29	E/2NE, SESE	120.00	PD
	12 S	9 W	32	E/2NE, SWNE	120.00	PD
	12 S	9 W	34	NENW	40.00	PD
	12 S	9 W	35	NENW, S/2SW	120.00	PD
	12 S	10 W	6	SWSE	40.00	PD
	12 S	10 W	14	NENE	40.00	PD
	12 S	10 W	25	SW, SE	320.00	PD
	12 S	10 W	35	NESE	320.00	PD
	12 S	11 W	9	Lots 5-8, SWNW	201.76	PD
	12 S	11 W	10	Lots 3, 4	76.16	PD
	12 S	11 W	17	Lot 5	38.84	PD
	13 S	3 E	9	NENE	40.00	PD
	13 S	3 E	24	N/2NE, SENE	120.00	PD
	13 S	2 W	21	NWNE	40.00	OC
	13 S	4 W	30	Lot 5	8.49	PD
	13 S	5 W	29	Lot 1	0.84	OC
	13 S	9 W	5	SW	160.00	PD
	13 S	9 W	10	E/2NE, NESE	120.00	PD
	13S	9 W	13	NWNW	40.00	PD
	13 S	9 W	20	S/2SW, SWSE	120.00	PD
	13 S	11 W	3	SWSE	40.00	PD
	13 S	11 W	22	Lots 19, 20	78.23	PD
	13 S	11 W	23	Lot 3	39.15	PD
	13 S	11 W	26	E/2SE	80.00	PD
	13 S	11 W	28	Lot 9	7.60	PD
	13 S	11 W	33	NESE	40.00	PD
	14 S	5 W	25	Lot 1	0.26	OC
	14 S	11 W	3	Lots 1, 2, 25	111.50	PD
	14 S	11 W	4	Lots 29, 30	84.30	PD
	14 S	11 W	5	Lot 10	40.62	PD
	14 S	11 W	6	Lot 16	40.00	PD
	14 S	11 W	10	Lots 1, 11-13, 17	210.21	PD
	14 S	11 W	15	NESE	40.00	PD
	14 S	12 W	35	SENE	40.00	PD
	15 S	5 W	6	Lot 5	1.46	PD
	15 S	9 W	1	Lot 3, SENW, NESE	20.94	OC
				TOTAL SALEM DISTRICT	9505.41	

District	Township	Range	Section	Subdivision	Acres	Status
Klamath Falls	40S	6E	1	Metes and Bounds	(1.62) 1.01	SOLD
	41S	7E	13	NENE	40.00	
				LOT 4	24.69	
	38	8	31	LOT 4	10.30	
	39	8	6	LOT6	27.20	
			7	LOT5	16.90	
			33	LOT 1 (unpatented portion)	4.42	
	40	8	17	SWSE	40.00	
			21	SWSE	40.00	
			22	LOT 4	38.00	
			28	SENE,W1/2NE,NWSE	160.00	
			32	S1/2NE	80.00	
	41	8	8	NWNW,S1/2N1/2, E1/2SW,SE	440.00	
			17	NENE	40.00	
	37	9	4	SWSW	40.00	SOLD
			6	SENW	40.00	
			7	NENE	40.00	
			8	E1/2SW	80.00	
			9	NWNW,NESW	80.00	SOLD
			17	W1/2E1/2, NENW	200.00	
			20	N1/2NE, SENE	120.00	
			21	SWNW,NWSW,SESW	120.00	
			28	W1/2NW,SWNE,NWSE,SESE	200.00	
			35	SENE,W1/2NE,NWSE	40.00	SOLD
	38	9	3	SENE,SESE	80.00	
			5	SWSE	40.00	
			8	NENE	80.00	
			9	NWNW,SESW	80.00	
			15	SWSW	40.00	
	40	9	23	SWNW,NWSW,SESW	40.00	
			35	N1/2NE, SENE	120.00	
	37	10	12	S1/2SE	80.00	
			13	NENW	40.00	
	38	10	6	LOT 5	39.80	
				LOT 6	39.96	
				LOT 7	40.12	
			6	SWNW, N1/2SW	120.00	SOLD
				NESW	40.00	
			7	NENE, NENW	80.00	
			27	NESW, S1/2SW	120.00	
			28	W1/2E1/2, SESE	200.00	

District	Township	Range	Section	Subdivision	Acres	Status
			30	LOT2	39.80	
				LOT 3	39.72	
				LOT 4	39.66	
			31	LOT 1	39.65	
				LOT 2	39.75	
				LOT 3	39.85	
				E1/2E1/2, SWNE, E1/2SW	280.00	
			32	N1/2NE, SWNE,SWNW,W1/2SW, SE	400.00	
			33	W1/2NE, N1/2SW, SESW,W1/2SE	280.00	
			34	N1/2NW	80.00	
			35	NESW	40.00	
	39	10	4	LOT 1	41.40	
				LOT 2	41.40	
				LOT 3	41.50	
				S1/2NE,SENW,N1/2SW,SWSW	240.00	
			5	LOT 2	41.03	
				LOT 3	41.68	
				LOT 4	40.34	
				S1/2NE, SESE	120.00	
	37	11	15	NWNW	40.00	
			23	NWNW	40.00	
			26	SW	160.00	
			27	E1/2SW, SE	240.00	
			29	N1/2SW, SESW	120.00	SOLD
			30	N1/2SE	80.00	SOLD
			33	SENW, W1/2SE	120.00	
			34	E1/2., NENW,N1/2SW, SESW	480.00	
			35	W12, S1/2NE, SE	560.00	
	38	11	1	W1/2SW, SESW	120.00	
			2	LOT 4	41.43	
			3	LOT 1	41.46	
				LOT 2	41.35	
				LOT 3	41.24	
				S1/2NE, SENW,SE	280.00	
			10	E1/2, E1/2NW, NESW	440.00	
			11	SWSW, S1/2SE	120.00	
			12	SWNE, W1/2NW, SENW, N1/2SW, SESW, E1/2SE	360.00	
			13	W1/2NE, NW, E1/2SW, W1/2SE	400.00	
			14	W1/2NE, N1/2NW, SENW, E1/2SE, SESE	320.00	
			17	NWNE, E1/2SE	120.00	
			22	S1/2NE, N1/12SE, SESE	200.00	

District	Township	Range	Section	Subdivision	Acres	Status
			23	E1/2, S1/2SW	400.00	
			26	N1/2NE, SENE, W1/2	440.00	
			32	NESW, NWSE	80.00	
			35	W1/2, E1/2NE, SWNE	440.00	
	39	11	2	LOT 1	40.24	
				LOT 3	39.60	
				LOT 4	80.00	
			33	E1/2NE	80.00	
	41	11	34	NESW	40.00	SOLD
			34	SWNW, W1/2SW	120.00	
	37	111/2	13	E1/2NW	80.00	SOLD
			14	SENE	40.00	SOLD
			17	SESW	40.00	SOLD
			20	NESE	40.00	SOLD
			21	NWNE, S1/2NE, N1/2NW, N1/2SE, SESE	320.00	SOLD
			22	W1/2SW, SESW	80.00	SOLD
			26	NENW	40.00	SOLD
			27	NWSW	40.00	SOLD
			28	W1/2NW, SENW, NWSW, SWNE	200.00	SOLD
			29	E1/2SW, SENE, E1/2SW	200.00	SOLD
	38	12	5	W1/2SW, SESW	803.00	
			6	NESE	40.00	
	39	12	21	NENE	40.00	
			26	NWSE, SESE	80.00	
			27	E1/2SE	80.00	
			28	NESW	40.00	
			34	NENE	40.00	
	40	12	10	NENE, SENW, W1/2SE	160.00	
			11	LOT 1	41.20	
			14	SENW, N1/2SW, SWSW, NWSE	200.00	
			15	N1/2NE, SESW, N1/2SW	200.00	
			19	N1/2NE, SENE	120.00	
			20	N1/2N1/2, SENE, NESE	240.00	
			21	SWNE, E1/2, NESE	400.00	
			22	SWNE, SENW, SWSW	120.00	
			26	W1/2SE, SESE	120.00	
			27	W1/2NE, SENE, W1/2NW, SENW	240.00	
			28	E1/2NW	80.00	
			35	NENE	40.00	
	37	13	1	LOT 5	9.88	
				LOT 7	9.88	

District	Township	Range	Section	Subdivision	Acres	Status
			11	NWSE, SESE	40.00	
	40	13	35	SWNE	40.00	
	41	13	14	NENW	40.00	SOLD
	37	14	10	NWNE, N1/2SWNE, N1/2S1/2SWNE	70.00	
	41	14	5	NESE	40.00	
	36	15	30	Lot 1	40.25	
				Lot 2	40.18	
				Lot 3	40.11	
				Lot 4	40.04	
				E12W1/2, E1/2	480.00	
			32	ALL	640.00	
	37	15	4	LOT 1	40.73	
				LOT 2	41.03	
				LOT 3	40.91	
				LOT 4	40.64	
				LOT 5	40.11	
				LOT 6	40.21	
				LOT 7	40.54	
				LOT 8	40.64	
				LOT 11	40.02	
				LOT 12	39.96	
				LOT 13	40.13	
				LOT 14	40.19	
				TOTAL KLAMATH FALLS	17432.14	
Coos Bay	19S	12W	1	Lots 1, 2	40.48	PD
	20S	9W	33	Lot 7	3.98	O&C
	20S	10W	31	Por. Lot 10	5.98	Acq.
	21S	11W	36	Por. Lot 9		
	21S	11W	31	Lot 11	40	PD
	21S	11W	32	Lots 16, 23	59.01	PD
	22S	8W	15	Lot 9, 10	25.3	O&C
			21	Lots 7, 14	2.42	O&C
			24	Por. Lot 7	3	PD
	22S	9W	7	Por. Lot 6	10.64	O&C
	22S	13W	14	Lots 1, 2	71.1	PD
	25S	11W	30	Lot 5	39.92	PD
	25S	13W	4	N1/2NW1/4	80	PD
	25S	13W	7	Lots 6, 8, 13, 14, 15 (zoned future industrial)	92.78	PD
	25S	13W	18	Lot 7, E1/2NW1/4 (zoned future industrial	96.15	PD
	26S	8W	10	SE1/4NE1/4	40	PD

District	Township	Range	Section	Subdivision	Acres	Status
	26S	11W	8	NW1/4NE1/4	40	PD
	26S	12W	9	Por. SE1/4SW1/4	4	Acq.
	26S	14W	3	Pors. Lots 1, 2, SE1/4NW1/4	62.18	PD
	26S	14W	28	NW1/4NE1/4	40	PD
	28S	12W	19	SE1/4SE1/4	40	CBWR
	30S	12W	5	Lot 6	1.8	O&C
	30S	12W	6	Lots 3, 4	1.14	PD
	30S	13W	21	N1/2NE1/4NW1/4	20	PD
	32S	14W	7	N1/2SWNENW	5	PD
	32S	15W	4	NE1/4SE1/4NE1/4,		
				S1/2NE1/4NE1/4,		
				W1/2SE1/4NE1/4,		
				Lots 1, 2, 3, 4	71.75	PD
	39S	12W	8	W1/2NW1/4	80	PD
				TOTAL COOS BAY DISTRICT	976.63	

Inventory of Communication Sites

The following Table contains information on existing communication sites. Chapter 2 of the Draft EIS contains management actions related to management of communication sites.

Table 288. Inventory of Communication Sites.

District	Site Name	Serial No.	Twn.	Range	Section	Quarter Sec.	Lat	Long.
Coos Bay	Roman nose	OR 8652	19 S	9 W	23	NWNE, NENW	43-54-50N	122-44-00W
Coos Bay	Johns's Peak	OR 53660	23 S.	9 W	27	SESW	43-31-56N	123-45-41W
Coos Bay	Blue Ridge	OR 36189	26 S	12 W	35	SESW	43-16-34.7N	124-5-24.5W
Coos Bay	Signal Tree	OR 8651	29 S	9 W	33	NWSW	43-00-07N	123-46-28W
Coos Bay	Sugar Loaf	None	29 S	12 W	23	NE	43-02-48N	124-05-14W
Coos Bay	Bennett Butte	OR	30 S	13 W	20	NENW	43-57-38N	124-16-27W
Coos Bay	Edson Butte	OR 46648	31 S	14 W	23	SWNW	43-52-20N	124-20-03W
Coos Bay	Grizzly Mountain		37 S	14 W	4	Lot 15	42-23-50N	124-21-55W
Coos Bay	Bosley Butte	OR 16304	39 S	13 W	10	SWSE	42-12-33N	124-13-25W
Coos Bay	Palmer Butte		40 S	13 W	10	Lot 10	42-7-36N	124-12-34W
Coos Bay	Black Mound	OR 60391	40 S	13 W	20	NWNWSW	42-5-17N	124-18-52.83W

District	Site Name	Serial No.	Twn.	Range	Section	Quarter Sec.	Lat	Long.
Eugene	Badger Mountain	OR 55473, OR 48253, ORE 02880, OR 59637, OR 34510	17 S.	7 W.	35	Lot 7	44.05073 N	123,5015 W
Eugene	Brickerville	Vacant	18 S.	10 W.	3	Lot 5	44.03375 N	123.886 W
Eugene	Vaughn Hill	Vacant	18 S.	6 W.	5	SE, SW4NE4	44.03641 N	123.4373 W
Eugene	Amy Road	OR 15674	16 S.	7 W.	1	NW, SW	44.20898 N	123.4823 W
Eugene	Hawley Butte	OR 56656, OR 43048	21 S.	1 W.	29	Lot 7	43.71797 N	122.8375 W
Eugene	Huckleberry Mountain	OR 51261,	24 S.	1 W.	6	Lot 21	43.51053 N	122.8571 W
Eugene	Horse Rock	OR 53355, OR 02743	15 S.	2 W.	1	Lot 4	44.30092 N	122.8831 W
Eugene	Buck Mountain	ORE 017963, OR28799	16 S.	2 W.	7	Lot 1	44.19825 N	122.9851 W
Eugene			16 S.	3 W.	1	S2SE		
Eugene	Mt. Tom	Vacant	15 S.	2 W.	31	SW	44.21592 N	122.9784 W
Eugene	South McGowan	Vacant	16 S.	2 W.	31	NW	44.13768 N	122.9786 W
Eugene	Windy Peak	Vacant	16 S.	8 W.	27	SW	44.14644 N	123.6521 W
Eugene	Elk Mountain	Vacant	16 S.	8 W.	26	NE	44.15383 N	123.622 W
Eugene	Black Canyon	Vacant	17 S.	2 W.	7	SW	44.10226 N	122.9794 W
Eugene	Camp Creek Ridge	Vacant	17 S.	2 W.	15	NE	44.09592 N	122.9066 W
Eugene	High Point	Vacant	19. S	6 W.	23	NW	43.9065 N	123.3783 W
Eugene	Eagle's Rest	Vacant	20 S.	1 W.	12	NE	43.8471 N	122.7465 W
Eugene	Cougar Mountain	Vacant	20 S.	3 W.	1	NE	43.86457 N	122.9869 W
Eugene	Laurel Butte	Vacant	22 S.	3 W.	23	SE	43.64147 N	123.0066 W
Eugene	Hobart Butte	Vacant	22 S.	3 W.	1	NW	43.61182 N	123.0993 W
Salem	Bald Mountain	OR049380	3S	6W	29	NW¼SW¼	45° 17' 00"	123° 25' 50"
Salem	Brightwood	OR 044996, OR 054285, OR 054287, OR 060816	2S	6E	14	SE¼NW¼	45° 24' 50"	122° 02' 15"
Salem	Dixie Mountain	OR005491	2N	2W	27	NW¼NE¼	45° 42' 00"	122° 55' 00"
Salem	Goat Mountain	OR034944	5S	4E	14	SW¼SW¼	45° 07' 52"	122° 17' 16"
Salem	High Heaven	OR018080	3S	5W	33	NW¼SE¼	45° 15' 53"	123° 18' 33"
Salem		ORE000172	3S	5W	33	NW¼SE¼	45° 15' 53"	123° 18' 33"
Salem	Mt. Horeb	OR002086	9S	4E	17	NE¼NE¼	44° 47' 35"	122° 20' 21"
Salem	Prairie Mtn.	ORE005555	15S	7W	7	LOT 11	44° 16' 48"	123° 35' 05"
Salem	Prairie Mtn. East	OR042998	15S	7W	4	SE¼SE¼	44° 16' 37"	123° 36' 31"
Salem	Prairie Mtn. West	OR039808	15S	7W	7	LOT 12	44° 16' 47"	123° 35' 22"

District	Site Name	Serial No.	Twn.	Range	Section	Quarter Sec.	Lat	Long.
Salem	Prospect Hill	OR046839	8S	4W	25	LOT 2	44° 51’ 14”	123° 07’ 19”
Salem	Snow Peak	OR047462	11S	2E	5	LOT 12	44° 39’ 30”	122° 36’ 15”
Salem	Tater Hill	OR016808	4N	3W	27	SW¼SW¼	45° 47’ 45”	123° 03’ 00”
Salem	Trask Mountain	OR047588	2S	6W	29	NE¼NW¼	45° 22’ 17”	123° 27’ 18”
Salem	Yellowstone Mountain	OR013666	11S	3E	32	SW¼NW¼	44° 34’ 04”	122° 28’ 57”
Medford	Mt. Bluie						42.2256N	123.1629W
Medford	Beacon Hill						42.2706N	123.1750W
Medford	Mt. Sexton						42.3700N	123.2200W
Medford	Mt. Baldy						42.1944N	123.1117W
Medford	Gilbert Peak						42.2932N	123.1842W
Medford								
Medford	Chestnut Mt.						42.1397N	122.4408W
Medford	Mt. Isabelle						42.3034N	123.1036W
Medford	Soda Mtn.						42.0648N	122.4780W
Medford	Squires Peak						42.2190N	123.0330W
Medford	Tallowbox						42.1966N	123.1504W
Medford								
Medford	King Mountain						42.6920N	123.2294W
Medford								
Medford	Flounce Rock						42.4360N	122.3650W
Medford	Wolf Ridge						42.4582N	122.5113W
Medford	Fielder Mountain						42.2688N	123.1273W
Medford	Tin Pan Peak						42.2558N	123.0899W
Medford	Elk Mountain						42.3240N	123.1498W
Medford	Nuggett Butte						42.2700N	123.0333W
Roseburg	Kenyon Mountain		30S.	9W.	3	NW	42.5944N	123.4531W
Roseburg	Canyon Mountain		31S.	5W.	3	SW	42.5436N	123.1706W
Roseburg	West of Tiller		30S.	2W.	31	SW		
Roseburg	Yellow Butte		23S.	6W.	27	NW	43.3207N	123.2413W
Roseburg	Lane Mountain		27S.	4W.	25	NE	43.1144N	1230710W
K Falls	Stukel	OR 48956					42.1010N	121.6342W
K Falls		OR 35373						
K Falls		OR 46312						
K Falls		OR 52152						
K Falls	Hamaker	OR 15231					42.0679N	121.9699W
K Falls		OR 36377						
K Falls		OR 36541						
K Falls		OR 36562						
K Falls		OR 37192						

District	Site Name	Serial No.	Twn.	Range	Section	Quarter Sec.	Lat	Long.
K Falls		OR 45051						
K Falls		OR 46180						
K Falls		OR 56655						
K Falls		OR 56235						
K Falls		ORE 09843						
K Falls		ORE 10866						
K Falls		ORE 05614						
K Falls		ORE 10317						
K Falls		ORE 15790						
K Falls	Yaniax	OR 39227					42.3264N	121.2684W
K Falls	Buck Butte	OR 55670					42.0921N	121.4432W
K Falls		OR 2231						
K Falls	Brady Butte	OR 2087					42.0166N	121.0340W

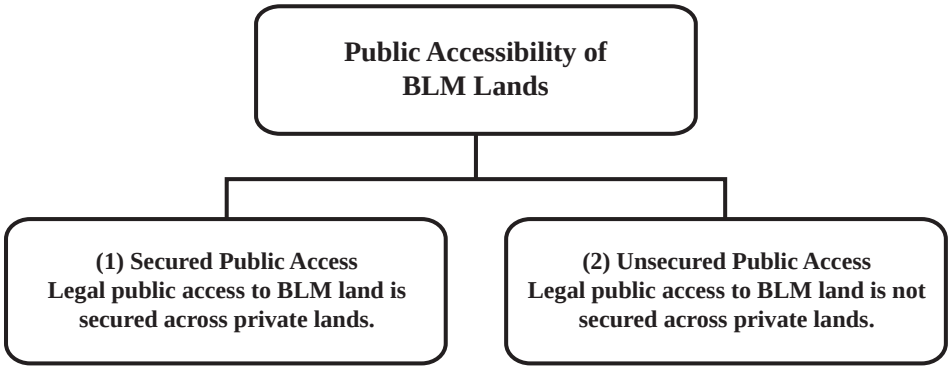
Analytical Methods to Determine Legal Public Accessibility of BLM Lands in the Planning Area

Purpose

Since a majority of BLM lands in western Oregon are intermingled with private lands, public access opportunities can vary greatly. Reciprocal right-of-way agreements, easements, and unsecured access rights across adjacent private lands all have a determining affect on the availability of legal public access to BLM lands.

This analysis is not designed to distinguish between motorized and non-motorized use areas, seasonal use restrictions, or consider other resource management constraints associated with public use. Nor does this analysis consider natural barriers that may affect public access (e.g. steep topography, dense vegetation, impassible rivers, etc.). Only the legal accessibility of BLM lands for the public will be determined primarily using existing agency transportation database information. A small percentage of BLM lands are legally accessible to the public other than via the road network (i.e. navigable waterways, coastal beaches, trail systems, etc.). These other access options will be considered as part of the analysis either in the actual calculations or in the narrative for each BLM district.

Public access categories described in the flowchart below will be assigned to all distinct management units of BLM land throughout western Oregon. A distinct management unit is defined by a contiguous block of BLM land, not including BLM lands that are joined by corners. Each access category is further defined on the next page.



It is important to note that this analysis will only determine if the public can legally access a distinct management unit, not if a particular management unit provides roaded access throughout it. In some cases, a road may only access a small portion of a management unit; where as the remainder of the unit would require cross-country travel to reach. In this instance, the entire management unit is considered legally accessible to the public.

(1) Secured public access: Public access rights to a distinct management unit of BLM land have been secured by the United States. Physical access must be present and available via the general transportation road network, a navigable waterway, coastal beach, or trail systems. Public access rights are generally included in the acquisition of exclusive or access road easements where the U.S. has acquired control of the right-of-way. However, individual access documents should be reviewed and used as the determining factor where necessary.

(2) Unsecured public access: Public access rights to a distinct management unit of BLM land have not been secured by the United States. Administrative access is legally and/or physically available to the BLM via the general transportation road network; however, associated reciprocal right-of-way agreements or non-exclusive easements do not include legal access rights for the public. Individual access documents should be reviewed and used as the determining factor where necessary.

Legal public access may not be secured to certain distinct management units; however, the public may currently be allowed to access these BLM lands at the consent of the adjacent private landowner. In fact, a number of BLM recreation sites do not have secured legal public access to them. Due to the difficulty and sensitivity of mapping private lands that provide unsecured public access to BLM lands, this analysis is not designed to map these occurrences. BLM districts may decide to conduct a follow-up analyzes to determine the extent of this type of unsecured public access in order to improve management of these areas.

Methods

Part I. Geographic Information System Mapping

Step 1.

Develop a digital layer of distinct management units of BLM land for each district – using the ‘dissolve’ tool.

Step 2.

Identify which access routes (line segments) on the BLM’s transportation system have secured legal public access rights using the selected ‘access rights’ attribute from the BLM’s ground transportation road network database described below. Legal public access is available to a distinct management unit where a management unit boundary intersects with an access route from a public road in which all of the line segments contain one of the following designation in the “*acc_rgt*” attribute field.

- BP = BLM Public Access
- FP = USFS Public Access
- OF = Other Federal Agency
- CO = County
- ST = State

Step 4.

Determine which distinct management units do not have secured legal public access using the remaining 'access rights' attributes of the ground transportation road network (flowchart box 2): *Located in field acc_rgt.* (The remainder of the BLM lands should be captured with this step.)

- BA = BLM Administrative Access
- BR = BLM Reciprocal Right-of-Way Agreement
- FA = USFS Administrative Access
- NO = No Legal Access
- PV = Private only
- UK = Unknown (also shown as "NKN")
- Blank (This will capture all roadless blocks of BLM land surrounded by private lands.)

Step 5.

Map the location and calculate total acreage for all distinct management units having either secured or unsecured legal public access for each district by land status (O&C lands, Coos Bay Wagon Road lands, Public Domain lands, and Acquired lands) (Flowchart boxes 1 and 2).

The scale of these maps must be large enough for the Realty, Roads, and Recreation Specialists to analyze the data. It may take 10 or more maps to cover the entire land base for most districts. Develop a template for each map that displays the following information:

(1) District boundary lines

(2) Distinct management units of BLM land (using a distinct boundary type). Distinct management units will be identified using a reproducible color code or symbol based on one of the following attributes:

- Secured legal public access (see Step 2 above)
- Unsecured legal public access (see Step 3 above)

(3) Road line segments (using distinct colors and thicknesses), based on the following attributes:

- Secured public access (based on the attributes in Step 3 above)
- Unsecured legal public access (based on the attributes in Step 4 above)
- A thicker line for BLM roads with maintenance levels 3 or higher. (This will help the Road Specialists orient the transportation system for their analysis.)
- BLM Road numbers (e.g. 18-5-12)
- US, State, and County Highways/Roads
- County and State roads and highways labeled accordingly

(4) Township, range, and section numbers

Step 6.

The District Geographic Information System Specialists will then print out the maps provided to them by the Geographic Information System Project Coordinators. Once the maps have been printed, they will then be passed on to the Realty and/or Road Specialists.

Part II. Analysis of Maps

Step 1.

The District Realty and/or Road Specialists verify the Geographic Information System outputs and quality control the maps. The maps must be reviewed for accuracy of attribute data that may affect public access to each distinct management unit of BLM land. This quality control process should answer that all the distinct management units correctly color-coded as "Secured Public Access" or "Unsecured Public Access?" All errors should be corrected by marking up the maps using the following two rules:

- If a block is incorrectly color-coded as "Secured Public Access," circle the letters "UPA" in the center of the block, meaning the block should changed to "Unsecured Public Access."
- If a block is incorrectly color-coded as "Unsecured Public Access," circle the letters "SPA" in the center of the block, meaning the block should changed to "Secured Public Access."

This quality control check may be used in the future to correct errors in FAMS database and the Ground Transportation Road Network "access rights." However, for purposes of this analysis, it is only necessary to mark up the paper copies of the maps.

Step 2.

After the district maps have been analyzed by the realty and/or road specialists, they will then coordinate with the district recreation planners for a final evaluation. This is necessary so that the recreation planners can consider other public access options other than via the road network (i.e. navigable waterways, coastal beaches, trail systems, etc.). Once all changes have been incorporated, the maps will then be mailed to the Geographic Information System staff in the State Office who will arrange for a contractor to incorporate all the necessary changes to produce final maps.

Part III. Development of Final Results

Update digital coverages for each district in western Oregon based on the marked-up maps provided by each BLM District in western Oregon. The final product will include:

(1) BLM district maps of public accessibility routes and distinct management units of BLM land identified by one of the following attributes:

1. Secured legal public access
2. Unsecured legal public access

(2) Spreadsheets that calculate the total number of acres per attribute and a percentage of the total land base for each district by land status (O&C, CBWR, PD and Acquired).

Appendix P. Energy and Minerals

This appendix provides detailed background on mineral and energy developments.

In this appendix:

Reasonably Foreseeable Mineral and Energy Developments 1437

Proposed Restrictions and Requirements on Mineral and Energy Exploration and Development Activity 1478

Reasonably Foreseeable Mineral and Energy Developments

SUMMARY

Table 289. Fluid Mineral Development Potential

	Salem	Eugene	Roseburg	Coos Bay	Medford	Klamath Falls
Conventional O/G	68 wells associated with the Mist Gas Field	N/A	N/A	3 exploration wells	N/A	N/A
Seismic Notices of intent	Expected to be confined to existing road systems; negligible effects			Expected to be confined to existing road systems; negligible effects		
Road construction	¼ mile per well@ 40 ft = 82 acres disturbance			¼ mile per well@ 40 ft = 4 acres disturbance		
Well pad	2 acres per well= 136 acres			2 acres per well = 6 acres		
Collection pipe:	assume 25% well success; 2 miles per well; 30 ft wide= 124 acres			No discoveries; no pipe; no disturbance		
Plug & abandon wells	No additional effect			No additional effect		
Coal Bed Natural Gas	Exploration only	N/A	N/A	37 to 77 wells	N/A	N/A
Seismic Notices of intent	Expected to be confined to existing road systems; negligible effects			Expected to be confined to existing road systems; negligible effects		
Road construction				¼ mile per well@ 40 ft = 45- 90 acres disturbance		
Well pad				Assume 4 wells per pad; 2 acres per pad =19 -38 acres disturbance		
Collection pipe:				Assume 50% well success; Assume most collection pipe along existing transportation system; new disturbance = 5-10 linear miles at 30 ft wide = 18-36 acres		
Plug & abandon wells				No additional effect		

	Salem	Eugene	Roseburg	Coos Bay	Medford	Klamath Falls
Geothermal	N/A	N/A	N/A	N/A	N/A	See below

For Klamath Falls Resource Area:

Geophysical Exploration (includes seismic reflection and gravity/magnetic field surveys):
- Notices of Intent: 2; Very small acres disturbed
- Exploratory Wells: 1-2: 0.1 acre per site; .25 acre per well for roads. 0.35-0.7 acres total disturbance

Geothermal Operations:

-Notices of Intent:
Surface Geophysical Surveys: 6: very limited surface disturbance

Temperature Gradient Holes: 5: 0.1 acre per site; .25 acre per well for roads. 2.25 acres total disturbance

Exploration wells: 5 wells; One acre per well pad; 40 ft. wide ROW @ 0.5 mile per well = 17 acres total disturbance

Geothermal Power Plant Development:
1 possible in the life of the plan; if proposed, evaluate separately in cooperation with the State.

Direct Use of Geothermal Energy for space heat:
2 possible; evaluate separately if proposed

Table 290. Saleable Mineral Development Scenario Summary for 2008-2018.

	Roseburg	Salem	Eugene	Coos Bay	Medford	Klamath Falls
New quarries	1	5	2	5	3	1-2 new
Acres disturbed	2 acres per + ½ acre for access	2 acres per + ½ acre for access	2 acres per, + ½ acre for access	2 acres per, + ½ acre for access	2 acres per + ½ acre for access	2-3 acres per + ½ acre for access
Existing quarries	60; 6 expanded @ 2 acres per	38 existing, 8 expanded less than 2 acres per	71 existing, 4 expanded at approximately 1 acre each	32 existing; 6 expanded @ less than 2 acres each	188 existing quarries; 10% expanded @ less than 1 acre per + 1/10 acre per for new access	18 quarry & cinder sites used intermittently;
depletions	10 quarries	2 quarries	2 quarries	One quarry	5 quarries depleted	Up to 4
Decorative stone		3 to 6 sales per year	1 to 2 sales per year		750 sales over the 10 year period	1-2 sales per year.

Table 291. Locatable Mineral Development Scenario.

	Roseburg	Salem	Eugene	Coos Bay	Medford	Klamath Falls
Instream suction dredging notices		2	2		50	2
Bench Placer notices	2	10	6	6	80	0
Roads	0.3 acres per	0.3 acres per	0.3 acres per	0.3 acres per	Of 80 estimated, 10 would have roads at ½ acre per notice	

	Roseburg	Salem	Eugene	Coos Bay	Medford	Klamath Falls
Test pits, support facility	1 acre per notice	1 acre per notice	1 acre per notice	1 acre per notice	1 acre per notice on average	
Notice to plan	1	1	?	1	0	0
Vein notices	2	4	4	one	100 notices; surface disturbance 1-5 acres per notice	4
Roads	3 per notice 40x200= ½ acre per notice	3 per notice 40X200=1/2 acre per notice	3 per notice 40x200= ½ acre per notice	3 per notice 40x200= ½ acre per notice	Mostly existing roads; minimal temporary roads; estimate ½ acre for ½ of the notices zero acre for the other half of the notices	Mostly existing roads; minimal temporary roads
Support facilities	1 acre per notice	1 acre per notice	1 acre per notice	1 acre per notice	1 acre for ½ of the notices (many current notices take ore off site for processing)	
Sample sites	½ acre per notice	½ acre per notice	½ acre per notice	½ acre per notice	Ten holes per notice; 0.1 acre per hole; estimate 1/5 of the notices will drill hole	Ten holes per notice; 0.1 acre per hole;
Plans of operation	one	One	one	one	15 (lode & placer)	0
Exploratory holes	5; 0.1 acre per hole; roads 40x300= 0.75 acre	Ten; 0.1 acre per hole; roads 40x300= 0.75 acre	Ten; 0.1 acre per hole; roads 40x300= 0.75 acre	Ten; 0.1 acre per hole; roads 40x300= 0.75 acre	Ten; 0.1 acre per hole; roads 40x300= 0.75 acre. Estimate ½ of the plans will be lodes and have exp holes	
Support facility	1 acre	1 acre	1 acre	1 acre	1 acre per plan	
2nd phase exploration						
Roads	5 (standard as above)= 2.5 acres	10 (standard as above)= 2.5 acres	10 (standard as above)= 2.5 acres	10 (standard as above)= 2.5 acres	Mostly existing roads; minimal temporary roads; estimate ½ acre for ½ of the plans; zero acre for the other half of the plans	
Drill pads	5 holes, 0.1 acre per hole	10 holes, 0.1 acre per hole	10 holes, 0.1 acre per hole	10 holes, 0.1 acre per hole	10 holes, 0.1 acre per hole; on ¼ of the plans	
Mine development						
Bench placer	one; 1 acre	One, 7.5 acres	one; 7.5 acres		Eight of the plans are estimated to be bench placers at five acres per plan	

	Roseburg	Salem	Eugene	Coos Bay	Medford	Klamath Falls
Lode	one	one	none		Seven of the plans are estimated to be lodes with one requiring a 25 acre heap leach	
Surface excavation	1 acre	10 acres			5 acres per plan	
Stockpile topsoil	1 acre	2acres			1 acre per plan	
Support facility	1 acre	2acres			1 acre per plan	
Roads	1 acre	2 acres			Less than 1 acre per plan	
Mineral processing	Done elsewhere	Done elsewhere			One acre for ½ of the plans	
Silica sand deposit		One	*	one		0
Mine site		21 acres		20 acres		
Stockpile heavy minerals		One acre		2 acres		
vegetation stockpile		One acre		½ acre		
Office & magnetic separation		One acre		One acre		
Laterite placer plan of operation				One plan		0
Exploratory Holes drilled				10 @ 0.1 acre per hole		
New temporary Roads				0.75 acres total		
Support facility				One acre		
2nd phase exp:						
Temporary roads				2.5 acres total		
Ten additional drill holes				One acre total		
Recreational mining	5 notices; 2 acres total	30 notices; 7.5 acres total	30 notices; 7.5 acres total	30 notices; 7.5 acres total	800 Estimate 300 acres, this is disturbance only under the water level	See suction dredging above

* Eugene footnote: Locatable minerals with silica sand potential withdrawn from mineral entry in the Florence area. However, sand is excavated and removed from BLM property near Florence, Oregon, on an easement granted to the adjacent landowner

Salem District

The District is located in northwest Oregon, bound by the Pacific Ocean to the west, the Columbia River to the North, the crest of the Cascade Mountain Range to the East, and the Salem District/Eugene District boundary to the south. It encompasses lands in thirteen different counties that include Clatsop, Columbia, Multnomah, Tillamook, Washington, Clackamas, Yamhill, Marion, Polk, Lincoln, Benton, Linn and Lane Counties. It is expected that most District public domain and O & C Railroad lands will be available for leasing, subject to guiding stipulations.

Estimating how much oil and gas exploration and development will occur on federal lands managed by the Salem District during the next ten years is based on an existing gas field designation within the District boundary and historical Oil and Gas investigations.

The first exploration well was drilled near Newberg, Oregon in 1902. Conventional petroleum in the District has been the focus of numerous studies. Two periods of intense search for petroleum occurred from 1920 to 1940 and 1940 to 1960. These investigations have resulted in one developed field, the Mist Gas Field, with a discovery well in 1979. However, small amounts of gas have been found throughout the District boundaries, with sedimentary basins projected.

Review of Oil and Gas Occurrence Potential, Oil and Gas System and Play Analysis, Oil and Gas Production Activities, Potential for Resource Occurrence and Development, and Leasing was needed to understand the oil and gas potential. This information was used to project activity through 2018. Given the current incipient nature of petroleum development in Oregon (current Coalbed Natural Gas (CBNG) development, new exploration of the Mist Gas Field) in 2007, completely new assumptions and information that impact many Reasonably Foreseeable Development scenarios may be available during the course of the next 10 years, or, at the least, effecting projections beyond the next 10 years.

Identified potential petroleum source sedimentary basins within the District include the Astoria Basin, the Nehalem Basin (or Arch), the Tualatin Basin, the Willamette Valley, the Yaquina Basin and the Tillamook Basin. Both the Yaquina Basin and the Tillamook Basin are part of the off-shore Newport Basin. BLM manages approximately 19,400 acres of surface estate within these identified basins. The amount of subsurface estate is unknown. These basins exist within the Western Tertiary Basins Province. The Mist Gas Field lies within the Nehalem Basin/Arch.

As of 1985, the estimated in-place gas reserves for the Mist Gas Field were 28.4 billion cubic feet (bcf), with total production through 1984 being 19.2 bcf. This is a total estimated resource in 1985 of 47.6 bcf. As of 2007, DOGAMI reported that approximately 65 bcf of gas had been produced from the Mist Gas Field, with 2.7 bcf produced between 2002 and 2006. This exceeds the 1985 estimate by 17.4 bcf, indicating continued discoveries of resource.

Current non-federal lease holdings within the District are focused within the Mist Gas Field. There are currently no BLM-managed surface holdings within the Mist Gas Field. However, there appears to be one BLM-managed subsurface estate within the gas field. BLM-managed surface estate is located to the southeast of the current field description. Previous Mist Gas Field boundaries include approximately 980 acres of BLM-managed surface estate. Similar geology and structure exists under at least 9,000 acres of BLM-managed surface estate southeast of the Mist Gas Field indicating that foreseeable development expansion of the identified High Potential area could result in approximately 10,800 acres of BLM-managed lease offerings.

The spacing plan for the Mist Gas Field is 160 acres, to access reservoir pools. The size of the pools ranges from 40 acres to 160 acres. Extension of the Mist Field onto the adjacent BLM land as defined by wells and mapped geology, could result in approximately 68 wells on BLM-managed estate. Additional conventional and non-conventional development may occur within other sedimentary basins located within the district. CBNG development is occurring within Coos County. Exploration companies are mapping coal seams throughout Oregon for other potential areas. Coal has been historically mapped and mined throughout the District. However, CBNG development is not expected above exploration within the next 10 years.

Coos Bay District

The District is located on the western edge of Southwest Oregon and encompasses lands in Douglas, Coos, Curry, Lane and Josephine Counties. Conventional petroleum in the District has been the focus of numerous studies (Diller 1901, as found in Newton 1980); Niem and Niem 1990; and Ryu *et al* 1996) with the projection of numerous plays and petroleum structures. The District has also been the focus of numerous industry explorations and investigations. Two speculative conventional petroleum systems have been identified within the District (Ryu *et al*, 1996). One CBNG play has also been identified within the District, and is currently being developed on private and Coos County lands. It is expected that most District public domain, O & C lands and Coos Wagon Road lands will be available for leasing, subject to guiding stipulations.

Estimating how much oil and gas exploration and development will occur on federal lands managed by the Coos Bay District during the next ten years is at best difficult. Review of Oil and Gas Occurrence Potential, Oil and Gas System and Play Analysis, Leasing, and Oil and Gas Production Activities was needed to understand the oil and gas potential. This information was used to project activity through 2018. Where appropriate, the CBNG resource is discussed separately from conventional oil and gas.

The speculative conventional petroleum systems include the Umpqua-Dothan-White Tail Ridge hybrid petroleum system and the Umpqua-lower Tyee Mountain petroleum system. Both areas are contained in the southern Tyee sedimentary basin (Ryu *et al*, 1996) (Figure 317). The Umpqua-Dothan-White Tail Ridge hybrid petroleum system is located in the mid-central portion of the District and encompasses an estimated 350 square miles, approximately 26% of which is managed by the District. The District contains approximately 200 square miles of the Umpqua-lower Tyee Mountain petroleum system, located in the northern portion of the District. BLM-managed lands comprise about 20% of the area. The CBNG play is focused mainly on the Coaledo Formations of the onshore portion of the Coos Basin (Figure 318), an area of approximately 250 square miles located on the western edge of the District.

While oil and gas exploration has been historically associated with these systems (Ryu *et al*, 1996; Newton, 1980) and conventional oil and gas potential exists as identified speculative petroleum systems (Ryu *et al*, 1990), there is currently no known interest in exploration or development of these systems. There are presently no conventional production wells or Federal oil and gas leases. It is anticipated the District could issue competitive and over-the-counter leases and authorize geophysical surveys. It is also estimated that up to three exploratory wells for conventional petroleum may be drilled during the estimated life of this plan. Conventional exploration, coupled with CBNG exploration within coal seams beyond the Coos Basin, could potentially increase the number of wells actually drilled.

Current non-federal lease holdings within the District are focused within the Coos Basin area, with the intention of CBNG development. Approximately 115,000 of the 160,000 acres within the Coos Basin are privately held. Federally-managed mineral estate represents approximately 12.3 percent of the basin, with BLM-managed mineral estate representing roughly 7.6 percent.

Figure 317. Southern Tyee sedimentary basin, from Ryu *et al.* (1996)

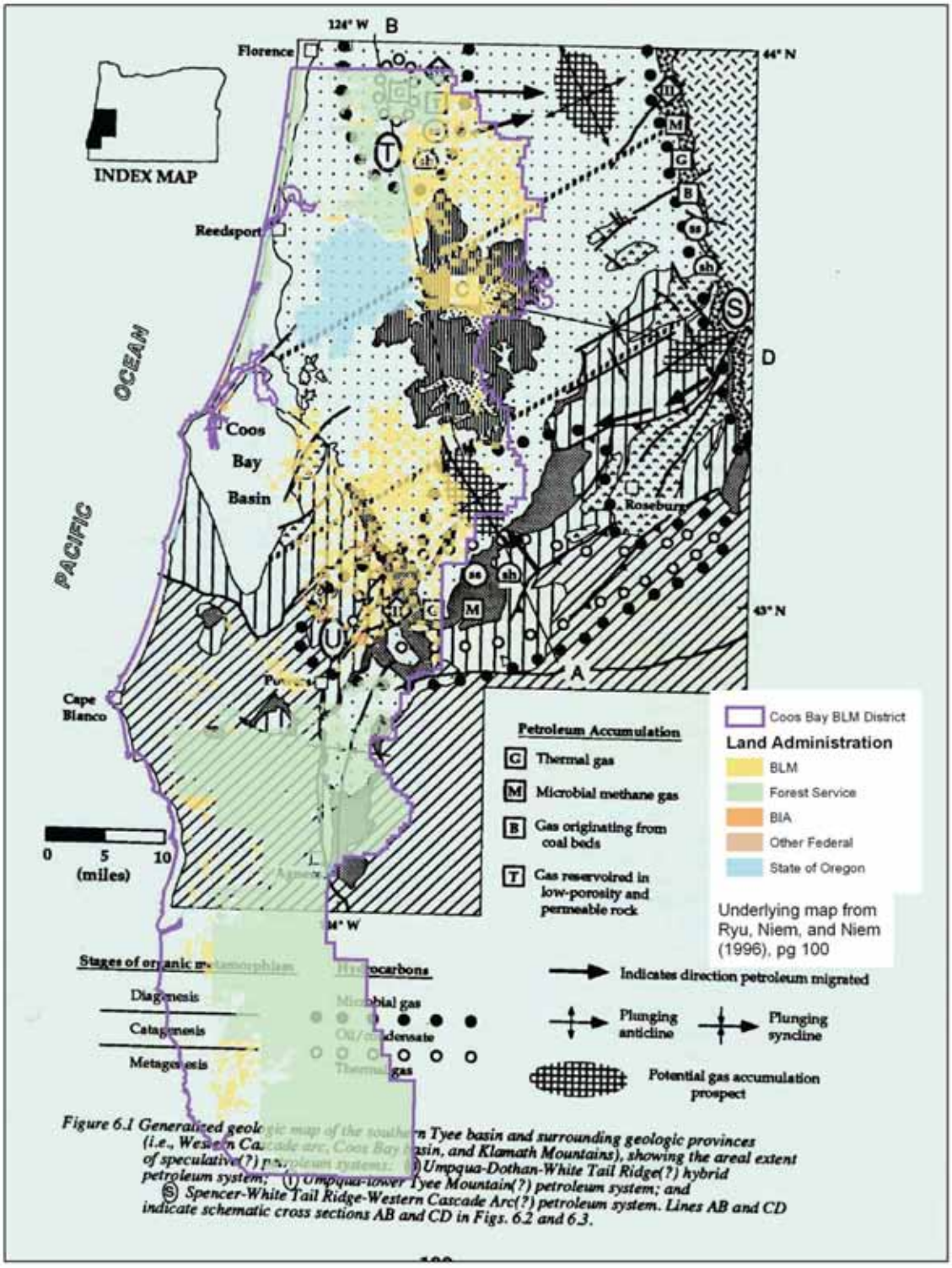
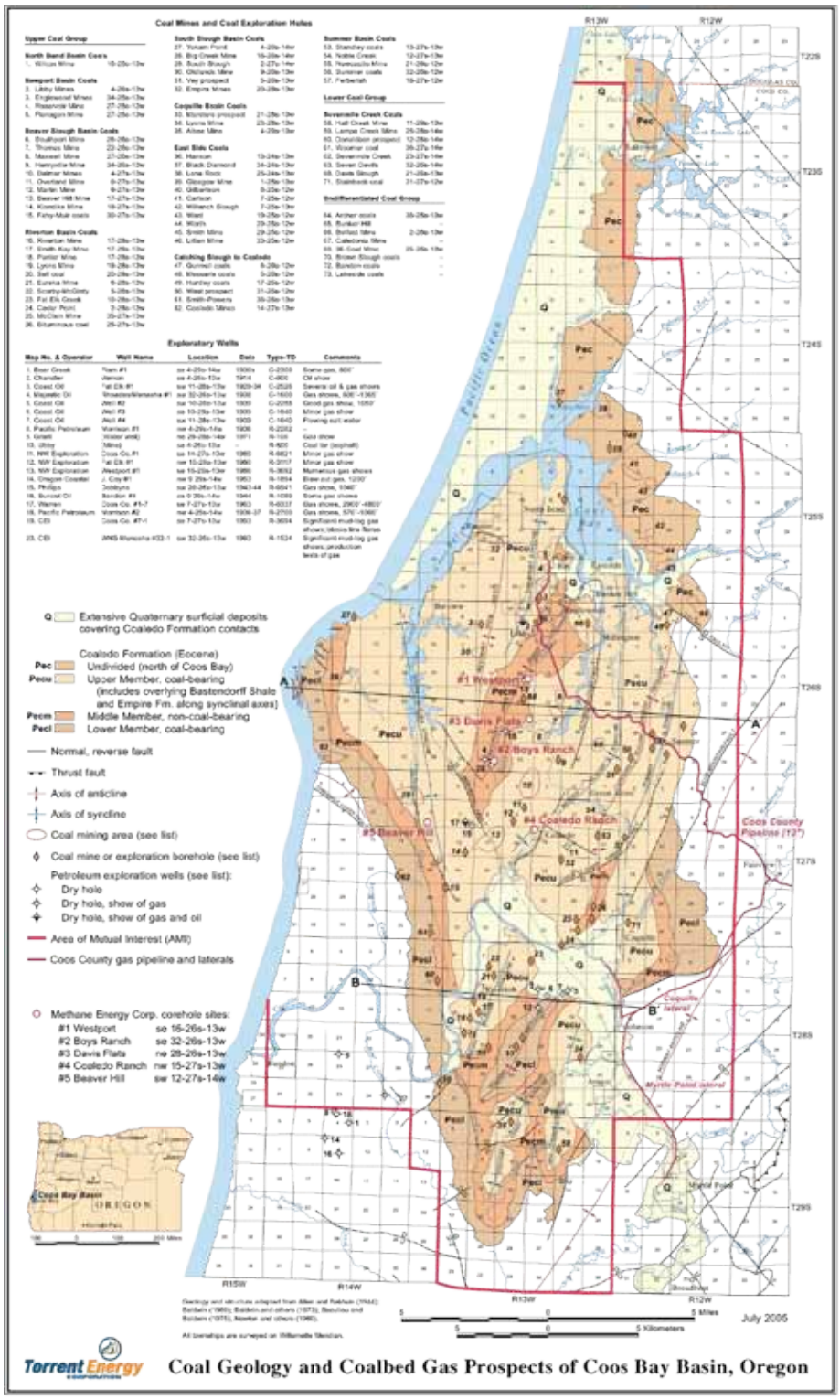


Figure 6.1 Generalized geol n Tyee basin and surrounding geologic provinces (i.e., Wes n Ca asin, and Klamath Mountains), showing the areal extent of speculative(?) p Umpqua-Dothan-White Tail Ridge(?) hybrid petroleum system; (T) Umpqua-lower Tyee Mountain(?) petroleum system; and (S) Spencer-White Tail Ridge-Western Cascade Arc(?) petroleum system. Lines AB and CD indicate schematic cross sections AB and CD in Figs. 6.2 and 6.3.

Figure 318. Coaledo Formations of the onshore portion of the Coos Basin, from Torrent Energy Inc. (2005)



Industry has estimated an in-place gas reserve for their lease holdings at 1,166 billion cubic feet (bcf) (1.2 trillion cubic feet (tcf)) for the privately held 115,000 acres (Sproule, 2006). To develop this resource on the 115,000 acres, Industry estimates a total build out of wells ranging between 300 and 719, with 300 wells being the most likely within the next 10 years (Halferty, 2007). Based on this estimate compared to proportional acreage, the Coos Bay District estimates a total well development on BLM lands to be between 37 and 77. Total Coos Basin development could range between 436 wells and 1,001 wells. To date, industry has placed approximately 18 single and multiple well pads consisting of both exploration and production wells. Foreseeable development of the CBNG play could result in an additional 25,000 acres of BLM-managed lease offerings.

TEN-YEAR REASONABLY FORESEEABLE DEVELOPMENT OF OIL AND GAS RESOURCES SCENARIO FOR THE SALEM AND COOS BAY DISTRICTS

Common to All Alternatives

Introduction

Reasonably Foreseeable Developments describe scenarios for leasable oil and gas mineral commodities. The purpose of a Reasonably Foreseeable Development scenario is to provide models that anticipate the level and type of future petroleum development activity in the planning area, and to serve as a basis for cumulative impacts analysis. The Reasonably Foreseeable Development first describes the Historic and Current Development. Future Trends and Assumptions of hypothetical exploration and mining operations are then described. These projections are estimates which are based on the available information within the Historic and Current Development section.

Scope

Reasonably Foreseeable Developments are based on known and inferred mineral resource capability of the lands involved and applies to conditions and assumptions discussed under Historic and Current Development, as well as Future Trends and Assumptions. Changes in geologic data, interpretation, and/or economic conditions that alter the RFD would result in deviation over time.

Impacts caused by oil and gas development, and impacts to oil and gas development, cannot be assessed without estimating future oil and gas activity.

Estimates of future activity on the Salem District would need to take into account:

- Oil and Gas Occurrence Potential, as documented by historic research and papers;
- Oil and Gas System and Play Analysis (including looking at existing plays such as the Mist Gas Field and the potential development of new plays such as identified sediment basins and Coalbed Natural Gas (CBNG);
- Oil and Gas Production, including economics and technology;
- Potential for Resource Occurrence and Development;
- Leasing and development, including Federal and Non-Federal activities.

Estimates of future activity on the Coos Bay District would need to take into account:

- Oil and Gas Occurrence Potential, as documented by historic research and papers;
- Oil and Gas System and Play Analysis (including looking at the potential development of new plays such as the identified petroleum systems and Coos Basin Coalbed Natural Gas (CBNG) or interest in unknown discoveries;
- Leasing, including Federal and Non-Federal activities;
- Oil and Gas Production, including economics and technology.

The above factors cannot be predicted with certainty, but some generalizations are possible. The estimates presented here are based on past and present activities and trends, as well as future price deviations. Those estimates may be lower than what actually happens if price and play developments are more positive than anticipated. Likewise, if exploration in existing plays, such as the Coos Basin, is not successful, new plays are not developed, and/or commodity prices are less than anticipated, these estimates may be exaggerated.

Potential for Resource Occurrence and Development

Potentials for resource occurrence and resource development (Haerter 2007-personal communications) have been estimated for the District. Definitions for potential for resource occurrence include:

- Low Potential-hydrocarbon occurrence is unlikely;
- Moderate Potential-conditions exist for hydrocarbons to occur; and
- High Potential-hydrocarbon shows have been documented or production has been established.

Definitions for potential for resource development include:

- Low Potential-economic or other conditions would likely preclude development;
- Moderate Potential-it is reasonable to conclude that development could occur; and
- High Potential-development is likely to occur within the life of the plan.

Leasing

After initial field work, research, and subsurface mapping, which may include seismic testing and data collection, leasing is often the next step in oil and gas development. Leasing may be based on speculation, with the riskiest leases usually purchased for the lowest prices.

Geophysical Exploration

Geophysical exploration is conducted in an attempt to determine the subsurface structure of an area. The three geophysical survey techniques generally used to define subsurface characteristics are measurements of the gravitational field, magnetic field, and seismic reflections.

Gravity and magnetic field surveys involve small portable measuring units which are easily transported via light-weight off-highway vehicles, such as four-wheel drive vehicles, or aircraft. Both off-highway and on-highway travel may be necessary in these two types of surveys. Usually a three-man crew transported by one or two vehicles is required. These two survey methods can make measurements along defined lines, but it is more common to use a grid with discrete measurement stations.

Seismic reflection surveys, which are the most common of the geophysical methods, produce the most detailed subsurface information. Seismic surveys are accomplished by sending shock waves, generally by a small explosion or mechanically beating of the ground surface, through the earth's surface, reflecting off some layers, thus depicting the underlying structure of the rock. The thumper and vibrator methods pound or vibrate the ground surface to create a shock wave. Usually four large trucks are used, each equipped with pads about four-feet square. The pads are lowered to the ground, and the vibrators are electronically triggered from the recording truck. Once information is recorded the trucks move forward a short distance and the process is repeated. Less than 50 square feet of surface area is required to operate the equipment at each recording site.

The small explosive method requires that charges be detonated on the surface or in a drill hole. Holes for the charges are drilled utilizing truck-mounted portable drills to create small-diameter (two or six-inch) holes to depths of 100 to 200 feet. Generally 4 to 12 holes are drilled per mile of line and a 5 to 50-pound

charge of explosives is placed in the hole, covered, and detonated. The created shock wave is recorded by geophones placed in a linear fashion on the surface. In rugged terrain, a portable drill carried by helicopter can sometimes be used. A typical drilling seismic operation may utilize 10 to 15 men operating five to seven trucks. Under normal conditions, three to five miles of line can be surveyed daily using this method. A drilling program may include the use of heavy truck-mounted drill rigs, track-mounted air rigs, water trucks, a computer recording truck, and several light pickups to transport people conducting the survey.

Public and private roads and trails are used where possible. However, off-highway cross-country travel is also necessary in some cases. Graders and dozers may be required to provide access to remote areas. Several trips a day are made along a seismograph line, usually resulting in a well-defined two-track trail. Drilling water, when needed, is usually obtained from private landowners, but may be acquired from sources used for fire suppression, such as pump chances and ponds.

The surface charge method utilizes charges of between one and five pounds attached to wooden laths three to eight feet above the ground. Placing the charges lower than six feet usually results in the destruction of the vegetation, while placing the charges higher, or on the surface of deep snow, results in little visible surface disturbance.

Advanced Three Dimensional Survey analyzes five to six miles using lines with 1,700 shot holes at 70-foot spacing. The lines are spaced at 400 feet apart. The lines are hand brushed for survey. The survey crews utilize an Inertial Survey System that allows for accurate surveying without the need to maintain a line of sight. This allows flexibility in brushing paths. The shot hole pad is three feet by four feet in size and cleared to mineral soil with hand tools. The drill rig is then placed on the pad. If existing access to the pad is limited, the drill rig may be placed and removed by helicopter. The holes are drilled to 15-foot depths and the charges exploded subsurface, leaving no surface expression. Where there is surface expression, the damaged is mitigated with hand tools. In open valleys and areas with access, thumper rigs are used, as they disturb even less ground.

Drilling and Production Phase

Notices of Staking are anticipated during the plan period. It is anticipated that the company would then submit an Application for Permit to Drill after the Notice of Staking is accepted. Private surface owner input, if split estates are involved, would be actively solicited during this stage. Once an Application for Permit to Drill is approved, the operator initiates construction activities in accordance with stipulations and Conditions of Approval. Access road lengths vary, but usually the shortest feasible route is selected to reduce the haul distance and construction costs. In some cases, environmental factors or landowner's wishes may dictate a longer route. Drilling activity in the planning area is predicted to be done using

existing roads and constructing short roads to access each drill site location. The District will utilize currently developed and utilized forest management Best Management Practices (BMP), in addition to the BLM's "Gold Book" (USDI/USDA 2006), for surface disturbance in road construction and pad development similar to landings.

Surface Impacts of Drilling and Production

During the first drilling phase, the operator would move construction equipment over existing maintained roads to the point where the new access road begins.

In the second part of the drilling phase, the operator would construct the drilling pad or platform, anticipated to involve approximately two acres per well site. Support facilities are anticipated to disturb about two acres per well site. The likely duration of well development, testing, and abandonment is predicted to be approximately six months to one year for each drill site.

Plugging and Abandonment

Wells that are completed as dry holes are plugged according to a plan designed specifically for the down-hole conditions of each well. Plugging is accomplished by placing cement plugs at strategic locations from the bottom of the well to the surface. Drilling mud is used as a spacer between plugs to prevent communication between fluid-bearing zones. The casing is cut off at least three feet below ground level and capped by welding a steel plate on the casing stub. Wells will be plugged and abandoned at the end of their production life, with the pad, support facilities, and road reclaimed.

Surface Impacts of Plugging and Abandonment

After plugging, all equipment and debris would be removed and the drill site would be restored as near as reasonably possible to its original condition. If new roads constructed for drilling are not needed for future access to the area, they would be reclaimed using Best Management Practices, with the road prism revegetated as required by the Authorized Officer. Pipelines will be plugged and abandoned in place to minimize new surface disturbance.

District Specific

Historic and Current Development

Oil and Gas Occurrence Potential

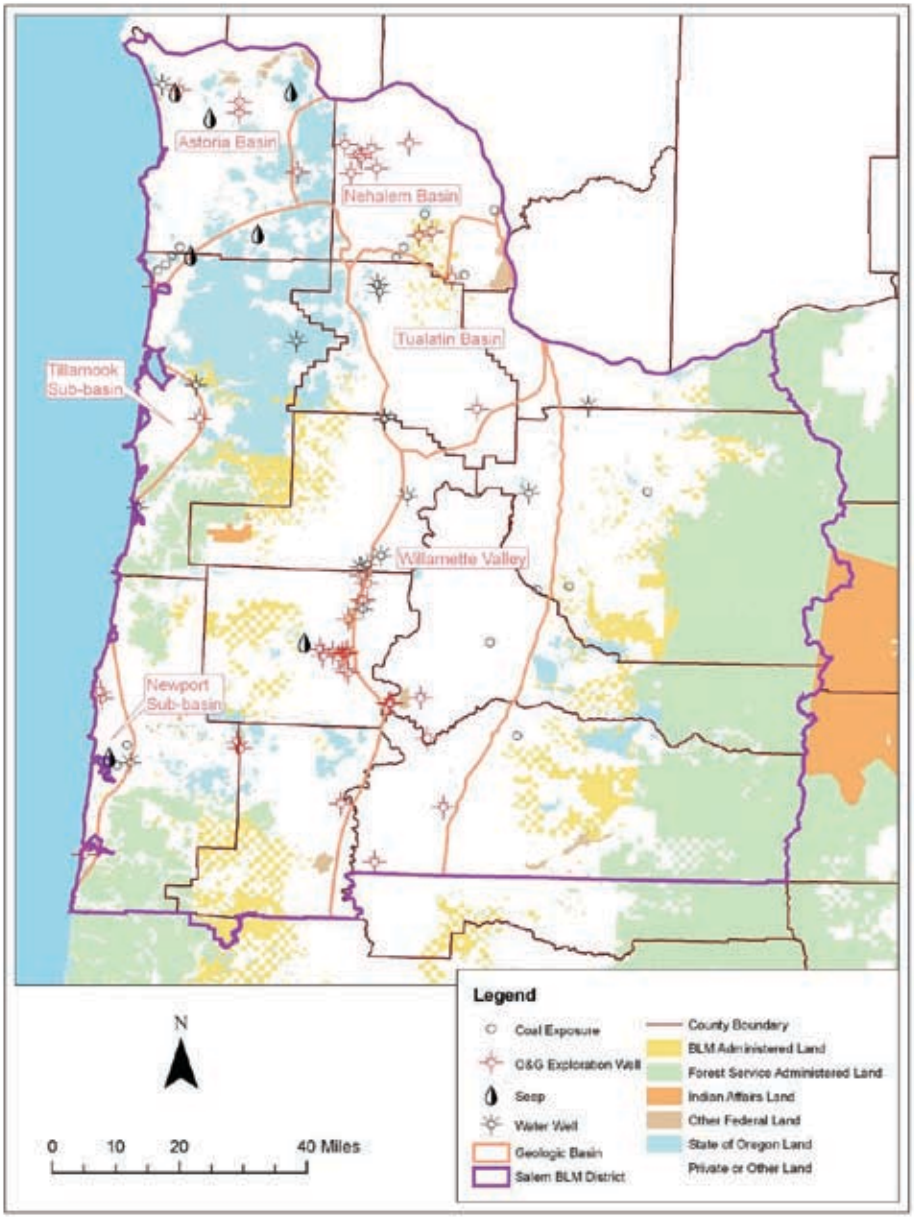
Salem District

The District is part of a structural sedimentary basin system that extends onshore and offshore from the Klamath Terrains boundary north to the Columbia River (extending into Washington) from the continental shelf east to the Cascade Mountain/Willamette Valley interface. This is known as the Western Tertiary Basin Province (Olmstead *et al.* 1989). It has been of interest for petroleum exploration since the 1880s (Newton, 1969; Orr and Orr, 2000) with oil and gas drilling exploration beginning in 1902 with the drilling of an exploration well near Newberg (Newton, 1965, Olmstead *et al*, 1989). Two major peaks of petroleum exploration have occurred. The first occurred between 1920 and 1940 and was very wide-spread, as there was little geologic information guiding the exploration. The second peak occurred between 1940 and 1960, investigating the deeper Oligocene and Eocene marine sediments. These explorations cumulated in the discovery of the Mist Gas Field in 1979 (Olmstead *et al*, 1989; Olmstead and Alger, 1985; Houston, 1997).

Petroleum development on the District has been the focus of numerous studies (Washburne 1914, in Olmstead *et al.* 1989; Stewart 1954 in Newton *et al.* 1965); Newton 1969; Olmstead *et al.* 1989; Niem *et al.* 1990; Houston 1997; and Meyer 2007 Personal Communication). The District has also been the focus of industry explorations and investigations by companies such as Northwest Natural (Oregon Natural Gas Development), RH Exploration, Diamond Shamrock Corporation, Quintana Petroleum Corporation, Standard Oil Company of California, American Quasar Petroleum Company, ARCO Oil and Gas Company, Exxon Corporation, The Texas Company (Texaco), and others (Olmstead *et al*, 1989).

At least 42 exploration wells, 16 water wells and 7 seeps within the District boundary and outside the 1985 Mist Gas Field boundary (Figure 319) have had gas shows (Olmstead *et al.* 1989). As of 1989, a total of at least 108 wells drilled outside of Columbia County (which holds the Mist Gas Field) and within the District (Olmstead *et al.* 1989), have defined specific sedimentary basins of the Western Tertiary Basin Province that exist within the District (Newton, 1969; Olmstead *et al.* 1989). These basins have been the focus of historic investigation and contain potential conventional petroleum development (Newton, 1969; Niem *et al.* 1985; Meyer, 2007-personal communications).

Figure 319. BLM Oregon Salem District, Surface. Based on Newton (1969), Ferns and Huber (1984), Olmstead ***et al.*** (1989), and BLM (2007)



Non-conventional systems such as CBNG may be a possibility and is being researched where coal is present (Wiley 2006-personal communications; Pappajohn 2007-personal communications; Meyer 2007-personal communications).

Coos Bay District

The District is part of a structural sedimentary basin system that extends onshore and offshore from the Klamath Terrains boundary (Middle Fork of the Coquille River) north to the Columbia River (extending into Washington), from the continental shelf east to the Willamette Valley. These basins have been the focus of petroleum exploration since the 1880s (Newton, 1980; Orr and Orr, 2000), with oil and gas drilling exploration of the District beginning in 1913 (Newton, 1980). Conventional petroleum in the District has been the focus of numerous studies (Diller 1901, in Newton; Niem and Niem 1990; Ryu *et al.*1996) with the projection of numerous plays and petroleum structures. The District has also been the focus of industry explorations and investigations by companies such as AMOCO Production Company, Union Oil Company, Phillips Petroleum Company, Northwest Natural Gas Company (Newton 1980) and Methane Energy Corporation (Pappajohn 2002).

The most recent play and petroleum structure projections provide three possibilities within the District. These include portions of two potential conventional petroleum structures (Ryu *et al.* 1996) and a non-conventional CBNG play identified by Methane Energy Corporation (Pappajohn, 2002).

Oil and Gas Structures and Plays

A speculative petroleum system presumes a direct relationship between a particular source rock and a resulting potential petroleum (or natural gas) accumulation (Ryu *et al*, 1996). An oil and/or gas play is an area, geologic formation, or geologic trend which has good potential for oil and/or gas development**, or** is generating a large amount of interest in leasing and drilling (BLM, 2001).

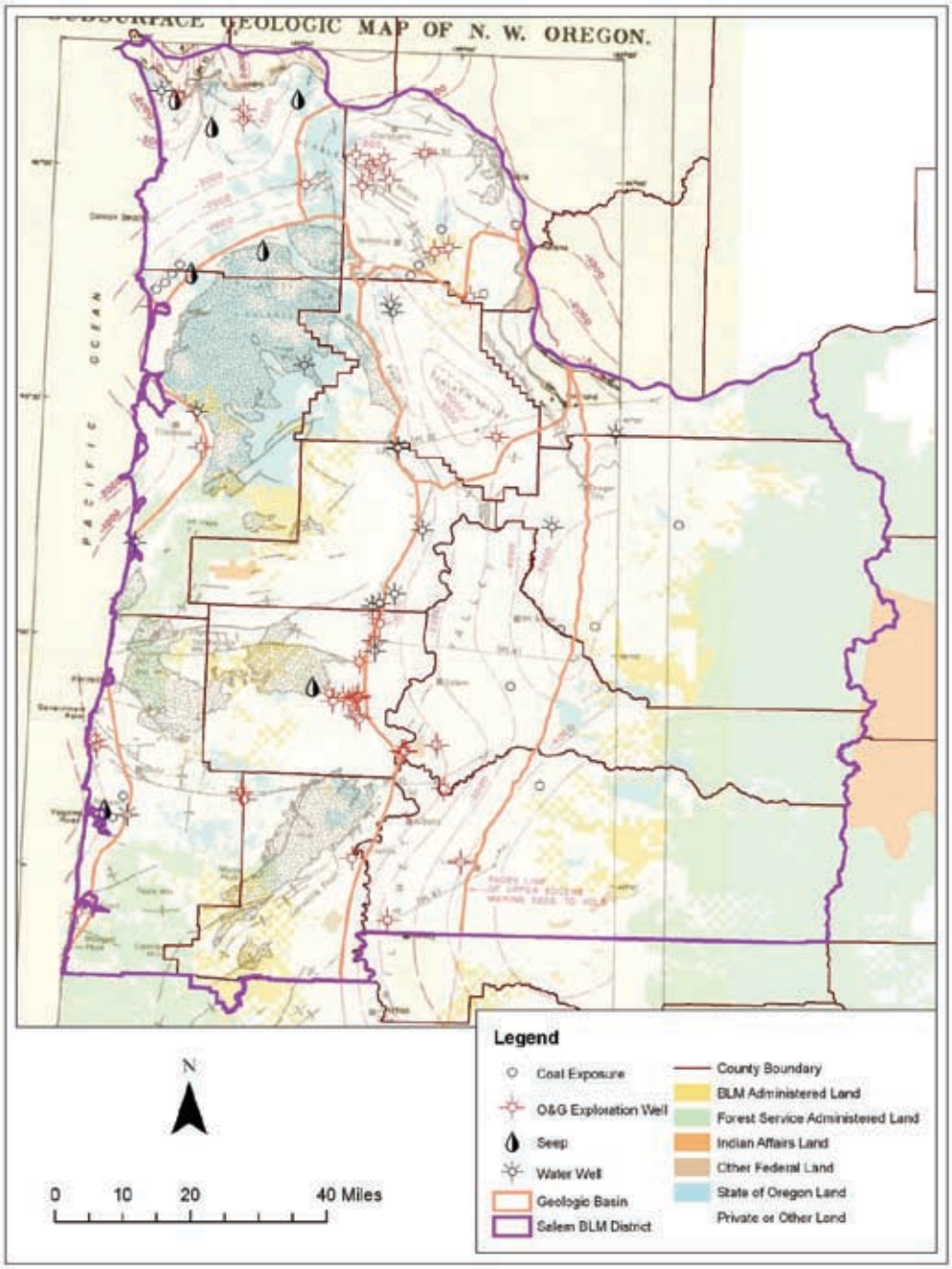
Salem District

The Western Tertiary Basin Province contained within the District possesses at least six identified basins or sub-basins (Newton, 1969; Orr and Orr, 2000; Olmstead *et al.* 1989). These include: the Tualatin Basin ,a sub-basin of the Willamette Valley; the Willamette Valley; the Newport Basin, a sub-basin of the larger off-shore Newport Basin; the Tillamook Basin, a sub-basin of the larger off-shore Newport Basin; the Astoria Basin; and the Nehalem Basin or arch (Orr and Orr, 2000; Olmstead *et al*, 1989; Newton, 1969) (Figures 319 and 320).

The basins structures are controlled by compression force of the sub-ducting easterly movement of the Juan de Fuca plate in relation to the overriding westerly movement of the North American Plate. The fold axes are oriented north-south (Orr and Orr, 2000), and are defined by the contact between the Miocene or Oligocene rock and Eocene rock. This is a point of erosion of the Eocene rock, which was covered by Miocene or Oligocene rock, defined as a nonconformity

(unconformity if covered by Miocene or Oligocene sedimentary rock). This break in the geologic column is considered the Eocene nonconformity and a focus of petroleum exploration. The Eocene rocks consist of marine sediments, with latter sedimentation creating coal beds in many areas (Newton, 1969) (Figure 320). The District manages a total of approximately 19,375 acres of surface estate within these basins (BLM, 2007).

Figure 320. Salem District BLM, Subsurface. Based on Newton (1969), Ferns and Huber (1984), Olmstead *et al* (1989), and BLM (2007)



Tualatin Sub-Basin: The BLM manages approximately 8,858 acres of surface estate in the Tualatin Sub-Basin (BLM, 2007) which is considered part of the Willamette Valley. The lower rock is Eocene shale and sandstone intermixed with basalt. Miocene Columbia River Basalts rest unconformably on top of the sedimentary rock and are covered by gravels and silts. The Eocene rock and sands have excellent reservoir characteristics as the faulting and overlying basalts provides trap structures (Newton, 1969). The Eocene Nonconformity is at a maximum mapped depth of 4,000 feet below sea level (Newton, 1969) (Figure 318). It is thought that the Tualatin Sub-Basin is a source of petroleum for the Mist Gas Field (Olmstead and Alger, 1985; Houston, 1997).

Willamette Valley: The BLM manages approximately 644 acres of surface estate in the Willamette Valley, excluding the Tualatin Sub-Basin (BLM, 2007). The lower rock, or basement rock, is the Eocene Siletz River Volcanics or Kings Valley Siltstone. Overlying these are sandstones and siltstones of the Eocene Nonconformity, then covered by volcanics, and overlain by sandstone, limestone, and coal beds. This is capped by the Columbia River Basalts and then covered by tuff and silt. The petroleum potential Eocene rock boundary is defined to the east by the change from marine sediment to volcanic sediment (facies change) (Newton, 1969) (Figure 320). Numerous wells with gas shows have been drilled within the valley. The eastern valley edge provides numerous possibilities for structural traps, with the marine beds providing source rock. Even though numerous holes have been drilled and source and structure is present, true potential has not been clearly defined. The Eocene Nonconformity (marine facies) is at maximum mapped depth mapped of 5,000 feet below sea level (Newton, 1969).

Newport Sub-Basin: The BLM manages approximately 443 acres of surface estate in the Newport Sub-Basin (BLM, 2007) which is part of the off-shore Newport Basin (Orr and Orr, 2000). As most of the basin lays off-shore, little was found to be published about on-shore portions of the specific Newport Sub-Basin. Generally, the off-shore basins consist of thicknesses up to 15,000 feet of marine sediments, predominately siltstones and shales, with some sand shows. Oil and gas shows occurred in at least three of the off-shore wells (Orr and Orr, 2000). Two exploratory gas wells with shows, one seep and one gas show in a water-well have been reported within the Newport Sub-Basin (Olmstead *et al.* 1989). There are also occurrences of coal (Ferns and Huber, 1984) (Figure 319 and 320). The Eocene Nonconformity is at a maximum on-shore mapped depth of 2,000 feet below sea level (Newton, 1969) (Figure 320).

Tillamook Sub-Basin: The BLM manages approximately 25 acres of surface estate within the Tillamook Sub-Basin (BLM, 2007) which is also a part of the off-shore Newport Basin (Orr and Orr, 2000), described above. Gas show has been associated with one exploratory well and two water wells in the Tillamook Sub-Basin (Olmstead *et al.* 1989). The Eocene Nonconformity is at a maximum on-shore mapped depth of 2,000 feet below sea level (Newton, 1969) (Figure 320).

Astoria Basin: The BLM manages approximately 39 acres of surface estate within the Astoria Basin (BLM, 2007). The lowest sequence of rock, considered the basement rock, is the upper Eocene Volcanics. There are a few thin beds of sandstone and mudstone that are inter-fingered with the Tillamook Volcanics. A few of these sedimentary layers have gas shows. The volcanics are overlain with the mudstone-dominated rock, with sandstone and conglomerate members. The mudstone is overlain by sandstone and siltstones. These sandstones, the Cowlitz Formation, contain the Clark and Wilson Sandstone which is the gas reservoir in the Mist Gas Field. Late Eocene mudstone and sandstone sequences then overlie the Clark and Wilson Sandstones (Niem *et al.* 1985; Houston, 1997). A total of 49 noncommercial gas shows were recorded in eight wells developed within the basin. Gas shows, with the majority of hydrocarbon chains being methane, were recorded in all units except the Roy Creek conglomerate and sandstone, the Pittsburg Bluff Formation and the Wickiup Mountain and Youngs Bay members of the Astoria Formation (Niem *et al.* 1985). The Eocene Nonconformity is at a maximum mapped depth of 5,000 feet below sea level (Newton 1969) (Figure 320). It is thought that the Astoria Basin is a source of petroleum for the Mist Gas Field (Olmstead and Alger, 1985).

Nehalem Basin: The BLM manages approximately 9,366 acres of surface estate in the Nehalem Basin (BLM, 2007). It is in this basin that the Mist Gas Field exists (Figure 321) the only official State of Oregon Designated Gas Field. This basin that has the most potential for further gas development that may impact BLM-managed lands (Houston 1997; Houston 2007-personal communications; Meyer 2007-personal communications). While the Nehalem structure is defined as a Tertiary Basin by most researchers (Olmstead *et al.* 1989; Olmstead and Alger 1985; Newton 1969; Houston 1997), it has also been identified as an arch in comparison to the surrounding structures of the Astoria Basin to the west and the Tualatin Sub-Basin to the east (Armentrout and Suek in Niem *et al.* 1985; Orr and Orr 2000). The description of the structure as an arch provides mechanism for petroleum migration from the adjoining Astoria Basin and Tualatin Sub-Basin to the collection traps of the Nehalem Arch (Niem *et al.* 1985). However, the structure does have a down-warp, creating a closed structural basin (Newton 1969) (Figure 320). A great deal of geologic work has occurred within the Mist Gas Field and surrounding areas of the Nehalem Basin (Niem *et al.* 1985 and 1990; Olmstead *et al.* 1985), including Three Dimensional Survey (Meyer 2007-personal communication). Specific geologic interpretation was conducted on the Bacona Quadrangle containing BLM-managed lands located ten miles southeast of the Mist Gas Field (Houston, 1997) (Figure 320).

The Nehalem Basin consists of deltaic to shallow-marine and deep marine depositional environments, depositing thousands of feet of mud and sand. There was also intermittent volcanism (Houston 1997; Olmstead and Alger 1985). This lithified material creates the basin's stratigraphy. The oldest rock, considered the economic basement rock, is the Middle to Upper Eocene Tillamook Basalts. However, other localities show that deep-water depositions of the Yamhill

Formation may underlie the Tillamook Basalts (Olmstead and Alger 1985). Houston (1997) has defined, at least in part, the Yamhill Formation as the Hamlet Formation. The mudstone of the Hamlet Formation is mature at depth and could be a source of petroleum within the Mist Gas Field. It is overlain by the Cowlitz Formation, separated by unconformity (Houston 1997; Olmstead and Alger 1985). The lowest member of the Cowlitz Formation is the Clark and Wilson Sandstone that serves as the major reservoir rock for the Mist Gas Field (Olmstead and Alger, 1985) and reservoir potential outside the Mist Gas Field (Houston 1997). Coal also occurs within the sandstone (Olmstead and Alger 1985). The sandstone in the Mist Gas Field has flow rates of 10,000 to 20,000 cubic feet per day (Niem *et al.* 1985 *in* Houston 1997). However, the reservoir quality deteriorates southeast of the Mist Gas Field (Houston, 1997) and BTU rates may also decline southeast of the Mist Gas Field (Meyer 2007-personal communications).

Overlying Clark and Wilson Sandstone is a mudstone member of the Cowlitz Formation. This formation is a deep oceanic mudstone that acts as a seal to the Clark and Wilson Sandstone, helping form the petroleum trap (Houston, 1997). After deposition of the Cowlitz Formation, the region was faulted, creating horst and graben environment, possibly forming structural traps. These fault patterns are not transferred to the younger overlying formations and, therefore, more recent faulting may not have compromised these traps. The faults truncate at the Keasey Formation-Goble Volcanics (Houston, 1997; Houston, 2007-personal communications; Olmstead and Alger, 1985).

Covering at least a portion of the Cowlitz Formation, and intermixed with the Keasey Formation, is the Goble Volcanics, shown as a 2,000 meter thick sequence in the exploration hole located on BLM-managed lands (Figure 322). The Keasey Formation unconformably overlies the Cowlitz Formation where the Goble Volcanics are not present, and consists of silty mudstone (Houston 1997). It is in turn covered by the sandstones, mudstones, siltstones, and volcanics of the Oligocene Pittsburg Bluff Formation (Houston 1997; Olmstead and Alger 1985). Coal seams are also found in the Pittsburg Bluff Formation (Houston 1997). The Scappoose Formation unconformably overlies the sandstone Pittsburg Bluff Formation (Houston 1997) with flows from the Miocene Columbia River Basalts as an unconformable cap rock. The Eocene Nonconformity is at a maximum mapped depth of 500 feet below sea level (Newton, 1969) (Figure 320).

Figure 321. Mist Gas Field, 1999 Boundary (DOGAMI 2003)

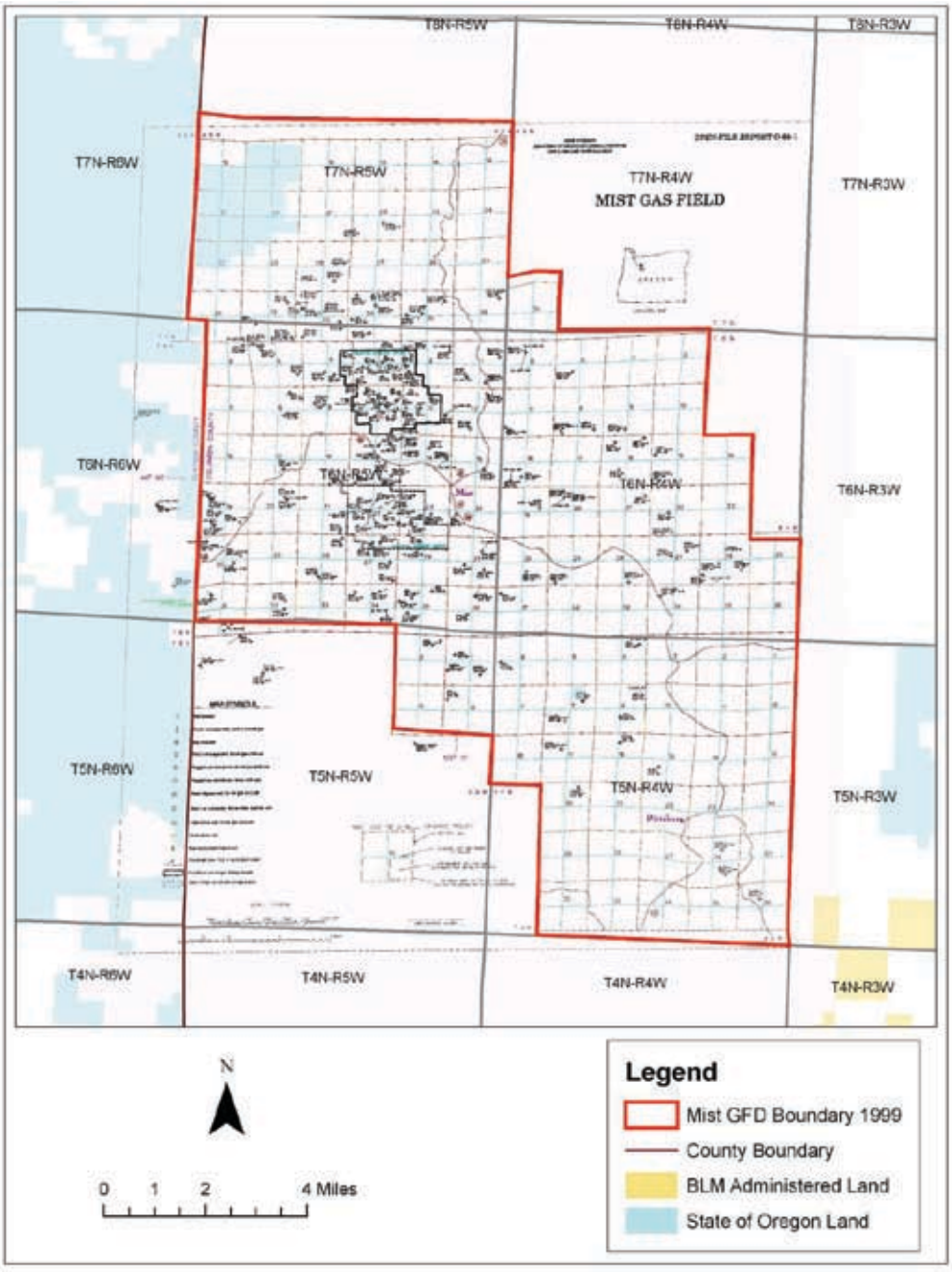
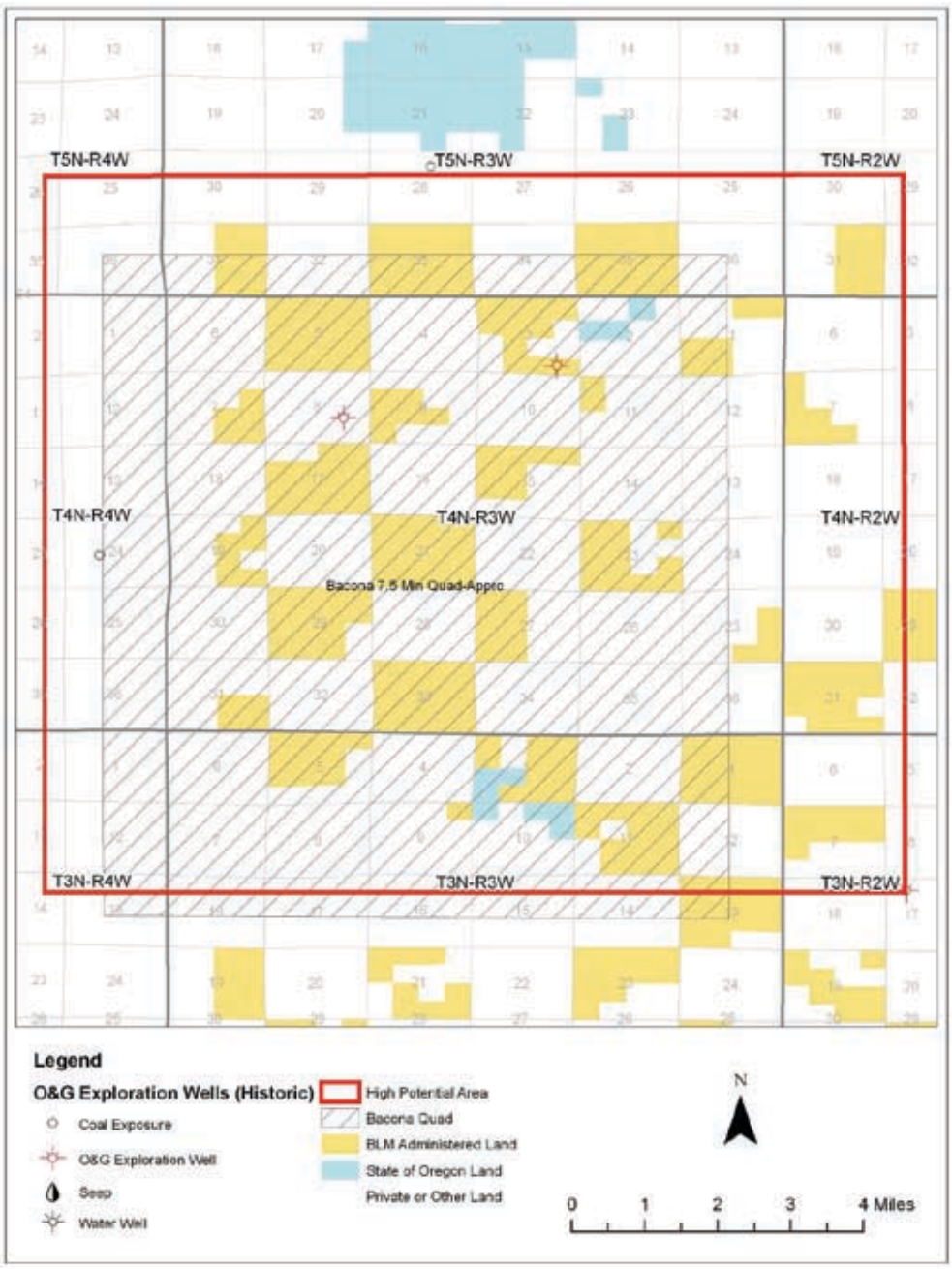


Figure 322. Identified High Potential Area (this report) and Bacona Geologic Quadrangle (Houston 1997)



The Mist Gas Field Designation was initiated with the discovery of natural gas in 1979. The official boundaries as of 1985 consisted of 89,575 acres, approximately 140 square miles (State of Oregon 1985; Olmstead *et al.* 1985), including approximately 978 acres of BLM-managed surface estate. By 1999, the boundaries were reconfigured to a total acreage of 81,850 acres, approximately 128 square miles, with no BLM-managed surface estate (State of Oregon 1999; Houston 2007-personal communications) (Figure 323).

The main target zone is the reservoir rock of the Clark and Wilson Sandstone (Olmstead and Alger 1985). To date, there have been over 45 separate pools identified (Meyer 2007-personal communications) with two gas storage reservoirs (DOGAMI 2003). Locations of additional pools are expected with the use of Three Dimensional Survey (Meyer 2007-personal communications). Current exploration is focused to the northwest of the Mist Gas Field (Houston 2007-personal communications). However, this is due to economics as opposed to existence of resource. Exploration to the southeast, in the direction of BLM-managed lands, has been restricted to lower BTUs and depth of resource, not lack of product. All areas north of Vernonia, Oregon could be considered a viable extension of the Mist Gas Field (Meyer 2007-personal communications).

Natural Gas production at the Mist Gas Field has been consistent since its discovery in 1979. As of 2006, two companies maintained production wells, Enerfin Resources with eight producing wells and Northwest Natural with four producing wells. Other production wells of the companies were shut in for 2006. An annual production history of the past 10 years is as follows (DOGAMI 2007; DOGAMI 2003):

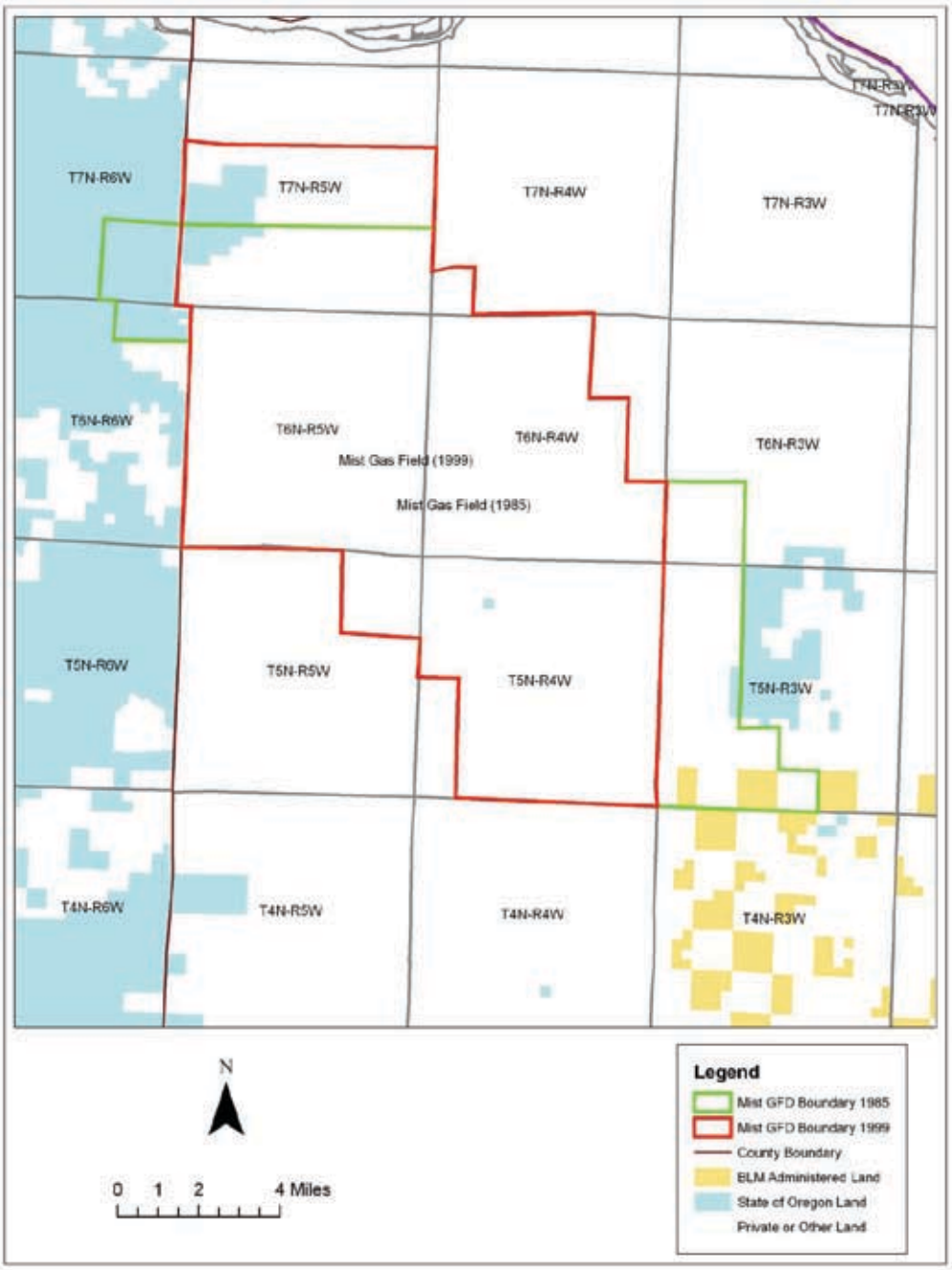
Table 292. Mist Gas Field 10-year Production

Year	Cumulative Cubic Feet-All Wells	Cumulative Therms-All Wells
2006[1]	402,713 Mcf	2,482,713
2005	305,433 Mcf	2,744,415
2004	466,756 Mcf	4,180,445
2003	733,537 Mcf	6,500,818
2002	837,067 Mcf	6,926,533
2001	2,674,673 Mcf	10,037,413
2000	1,596,159 Mcf	14,426,257
1999	1,554, 717 Mcf	13,534,088
1998	1,262,550 Mcf	11,009,121
1997	1,380,509 Mcf	12,023,109
10-Year Total:	9,659,397 Mcf (9.7 bcf)	83,864,912

[1] Update on March 20, 2007 of DOGAMI Database (DAGAMI, 2007)

Gas production has decreased from its discovery in 1979 to present (2006), depleting known pools. However, with the advancement of Three Dimensional Survey it is probable that additional pools within and outside of the Gas Field Designation Boundary will be discovered and developed.

Figure 323. Mist Gas Field Boundaries-1985 and 1999



Oil and Gas Production

Salem District

Annual production for 2005 for the Mist Gas Field was 305,000 thousand cubic feet (mcf) (305 million cubic feet (mmcf) with a total life production to date of 70 mmcf (DOGAMI 2007). As of 2006, the field had produced approximately 68 bcf with a value of about $140 million (DOGAMI 2007). The State of Oregon applies a severance tax of 6% on the production designated to the common school fund. In total, over 500 oil and gas wells had been permitted in the field by 2003 (DOGAMI 2003). There are currently 18 producing wells, one water disposal well, 21 observation wells, and 20 gas injection/withdrawal wells operating on the site (DOGAMI 2007). Eight new Applications for Permit to Drill are being submitted to DOGAMI for additional exploration and production wells (Houston 2007-personal communications).

In addition to production, the Mist Gas Field also contains two underground natural gas storage projects defined as the Flora/Bruer EFSC and the Calvin Creek EFSC (DOGAMI 2003). These storage facilities consist of six drained gas structures with a storage capacity of 12.5 bcf. As additional pools become depleted they may be converted to additional storage facilities. This is dependent upon market supply and demand (DOGAMI 2006).

Water management for the Mist Gas Field is currently by deep well injection. In Oregon, discharge of produced water from onshore oil and gas activities into navigable waters is addressed in the 40 CFR, Part 435, Subparts C and E. With exceptions, produced water can be used for agriculture and wildlife propagation. Produced water discharges to streams or other surface water bodies must be authorized by a National Pollutant Discharge Elimination System (NPDES) permit issued by the Oregon Department of Environmental Quality (DEQ). Consistent with the Energy Policy Act of 2005, storm water discharges from oil and gas-related construction activities are exempt from NPDES permit coverage, except in limited instances. Injection wells used for the disposal of produced water are regulated by the Oregon DEQ Underground Injection Control program.

Coos Bay District

There is currently no CBNG production in Oregon. However, the Coos Basin is being developed as a production resource. Sproule (2004, 2005, 2006) has estimated base, high, and low isotherm projections for the industry's 115,000 acre lease holdings within the Coos Basin, with a base (average) isotherm projected in-place gas volume of 1,166 bcf. The low isotherm projects in-place gas volume of 725 bcf, with a high isotherm projection of 1,617 bcf.

The target coal groupings are split into the Lower Coaledo, Isthmus Slough and South Slough groups. Sproule's (2005, 2006) average estimates for gas in-

place for the Lower Coaledo Group is 854 mmcf per 80 acres. Estimates for the Isthmus Slough and South Slough groups are 268 mmcf per 80 acres and 186 mmcf per 80 acres, respectively.

Site-specific calculations for volumetric in-place gas content calculated from average in-situ-isotherms were completed by Sproule (2005). Some of these estimates were conducted for sections including or adjacent to Federally-managed mineral rights. The estimates are as follows:

Table 293. Isthmus Slough Group near Federal Mineral Rights

Location	Gas Content, scf[2]/ton	Total Gas, mmcf/ Acreage sampled	Average Gas per Acre, mmcf/acre[3]
T. 27S, R. 13W., Sec. 11	71.4	828.521/300	2.76
T 27S., R. 13W., Sec 14	54.1	168.327/70	2.40
T 27S., R. 13W., Sec 15	90.4	2342.751/480	4.88
T. 27S., R. 13W., Sec 24	80.1	3115.784/640	4.87

Table 294. South Slough Group near Federal Mineral Rights.

Location	Gas Content scf/ton	Total Gas, mmcf/ Acreage sampled	Average gas per Acre, mmcf/acre
T. 26S., R. 13W., Sec. 6	148.4	665.871/308	2.16
T. 26S., R. 14W., Sec. 1	154.7	150.968/100	1.51
T. 26S., R. 14W., Sec. 3	147.6	15.254/15	1.02
T. 26S., R. 14W., Sec. 4	68.2	0.0/0.0	0.0
T. 26S., R. 14W., Sec. 28	110.6	280.005/160	1.75

Table 295. Lower Coaledo Group[1] near Federal Mineral Rights.

Location	Gas Content scf/ton	Total Gas, mmcf/Acreage sampled	Acreage gas per Acre, mmcf/acre
T. 27S., R. 13W., Sec. 11	158.4	2174.382/360.8	6.03
T. 27S., R. 13W., Sec 12	147.6	590.400/285.9	2.07
T. 27S., R. 13W., Sec. 13	146.0	0.0/0.0	0.0
T. 27S., R. 13W., Sec. 14	149.1	2981.251/580	5.14
T. 27S., R. 13W., Sec. 24	158.4	1140.074/640	1.78

[1] Most of the Lower Coaledo Isotherm Data in Sproule (2005) did not specify section location within a township. Therefore, position of Federal managed rights could not be determined in relation to the MEC cited acreage. These Townships were not included in this report, but, it should be noted, that Federal holdings may be located near Sproule's (2005) projections.

While, based on limited analysis (Sproule 2005), Federally-managed mineral rights may contain less in-place gas volume than the average of industry's holdings, in-place gas is present in measurable volumes.

The analysis of CBNG potential is limited to the Coos Basin coals to a depth of 4,244 feet. Other coal seams occur at deeper intervals, with areas in the South Slough containing coals at depths greater than 10,000 feet. These deeper seams have not been included in the analysis (Sproule 2005). Gas content in the overlying coals may also imply migration of gas from deeper thermogenic sources as well as biogenic development in the target seams (Sproule 2004).

Methane Energy Corporation is utilizing directional drilling of multiple wells from single pad locations. Engineering analysis (Sproule 2004) estimated a 160 acre well spacing on a 50,000 acre lease development. This would yield a maximum potential number of wells for 115,000 acres of development to approximately 719 wells.

Methane Energy Corporation's pilot production program includes the Radio Hill, Beaver Hill, and Westport sites located in the center of the Coos Basin. Collection systems are currently being engineered for the Westport site which will deliver production gas from the well to the Coos County Natural Gas Pipeline.

Initial results from the Radio Hill and Beaver Hill sites indicated that the CBNG was a dry gas, with little production water. This type of system is similar to Horseshoe Canyon coals of Alberta, the Hartshorne coals of the Arkoma basin, and the Fruitland coals of the south San Juan basin (Sproule 2006). However, future production of CBNG could encounter a wet gas system similar to the Powder River basin type. This could create substantial amounts of production water that will need to be managed. Initial results indicate brackish salinity in the production waters. Industry is currently reviewing injection potentials.

Examples of water management issues exist within current CBNG producing areas outside of Oregon and may be used for possible guidance of CBNG development in the District. Powder River Basin CBNG development has produced nearly four billion barrels (bbl) of water through 2006, equating to two bbl of water for every 1,000 cubic feet of gas. Operators discharge 61 percent of the water into ephemeral and perennial surface drainages, 31 percent into off-channel pits, and 5.7 percent for irrigation. Of the remainder, 1.4 percent is re-injected into the wells, and 1.2 percent is treated by ionic exchange. Only 25 percent of the shallow injection wells have been successful (Petzet 2007).

Potential for Resource Occurrence and Development

Salem District

Six distinct sedimentary basins or sub-basins have been the focus of petroleum explorations, the Eocene Unconformity being the primary target of exploration. In areas outside these basins, the target is above surface and eroded, creating the highlands. There has been little exploration of these areas, as any plays that might exist would be below the basement rock of Tillamook or Siletz River Basalts with low potential for occurrence and low potential for development. It is within these areas that the majority of the District's managed lands exist. It should be noted that private timber companies have been marketing the potential of all their lands in Oregon and Washington for the exploration and development of petroleum resources (Meyer 2007-personal communications). Exploration has demonstrated the presence of petroleum in all six basins, although commercial development has been limited to one. While the potential for resource occurrence in all six basins is Moderate to High, the potential for resource development for five of the basins would be Moderate, with little expectation for development within the ten year life span of this scenario. The basins that would have High Potential for Resource Occurrence and Moderate Potential for Resource Development include:

- The Newport Sub-Basin,
- The Tillamook Sub-Basin,
- The Astoria Basin (although, given the location of the Mist Gas field, development potential should be considered higher),
- The Tualatin Sub-Basin (as with the Astoria Basin, development potential could be higher). However, a small portion of the Tualatin Sub-Basin may be included in the identified High Potential Area described below, and
- The Willamette Basin.

The Nehalem Basin, or Arch, has been the most extensively explored structure, resulting in the development of a commercially viable gas field. The basin maintains a High Potential for Resource Occurrence and a High Potential fro Resource Development.

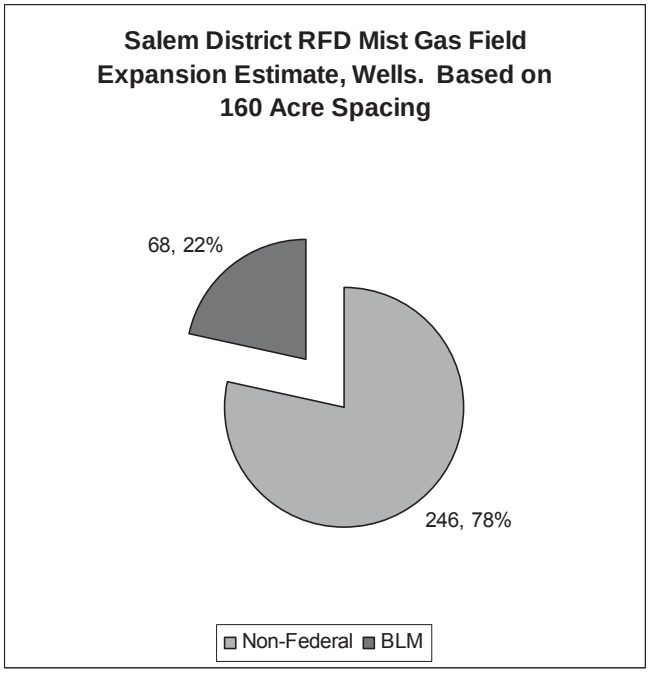
Based on geologic mapping showing similarities to the geology of the Mist Gas Field (Houston 1997), drilled exploration wells with petroleum shows (Olmstead *et al.* 1989) and discussions with DOGAMI and industry (Houston 2007-personal communications; Meyer 2007-personal communications), it is estimated that up to 50,200 acres containing both BLM-managed surface estate and non-federal estate could be explored and developed for petroleum in the 10-year life of this

scenario. Of this acreage, the District maintains approximately 10,800 acres of BLM-managed surface estate. The remaining 39,400 acres appears to be non-federal lands.

The lands are associated with the geologically mapped Bacona Quadrangle (Houston 1997), bound to the southeast by Leaseholding Syndicate's 1925-1927 exploration hole named Dutch Canyon. The well was located at the NW¼ of Section 17 in Township 3 North, Range 2 West. The well encountered gas at a depth of 1,850 feet. The pressure of the gas blew water and mud 20 feet above the casing. However, analysis of the gas determined that only 7.9% was methane while 91.8% was Nitrogen. The identified High Potential area is located southeast of the existing field (Figure 322). Additional petroleum development could likely occur to the northwest of the current Mist Gas Field, an area of current focus of exploration. However, there is no known BLM-managed estate in that area (BLM 2007).

It is assumed that if this area containing both federal and non-federal lands were developed, it would be as an extension of the current Mist Gas Field. Therefore, the current spacing plan of one well per 160 acres would likely apply (DOGAMI 2003; State of Oregon 1999), allowing for a total of approximately 314 wells within the identified High Potential Area, approximately 68 of which could be on BLM-managed surface estate. The District could foresee approximately 22 percent of the expansion development, with non-federal lands carrying approximately 78 percent of the expansion development.

Figure 324. Salem District Mist gas Field Expansion Estimate, 160 acre spacing.



Coos Bay District

Three areas within the District have been identified as having petroleum potential. The two conventional petroleum structures described by Ryu *et al.* (1996) have a moderate to high potential for occurrence. The structures have been identified and historic exploration has had both oil and gas shows. However, resource development potential is low to moderate. While hydrocarbons may exist, it has not been historically economic to produce these resources. This is due to lack of infrastructure, low price, and limited investigations.

The Coos Basin has a high potential for occurrence of CBNG. The structure has been identified and hydrocarbon shows have been documented. While actual economic production from this play has not occurred, initial steps with the placement of infrastructure and wells as well as the Gas Field Designation process has been implemented. The potential for resource development is also high. It is likely that development will occur within the life of this plan, with private development already occurring.

Leasing

Salem District

Foreseeable development of the Mist Gas Field could result in potentially an additional 10,800 acres of BLM-managed lease offerings. If these offerings were sold for the 2006 average of $17.71 per acre, the net receipts would be nearly $191,268.

Coos Bay District

After lands are nominated and reviewed by BLM, leases on lands where the Federal government manages the oil and gas rights are offered via oral auction on a quarterly basis. The maximum lease size is 2,560 acres at a minimum bid of $2.00 per acre. An administrative fee of $75.00 per parcel is charged and each successful bidder must meet citizenship and legal requirements. Lands not leased at auction are then available for over-the-counter leasing for a period of two years. Leases are issued for a ten year term and charged a 12.5 percent royalty on production. In the first five years of a lease, annual rental is $1.50 per acre and $2.00 per acre thereafter. Leases which become productive are “held by production” and do not terminate until all wells on the lease have ceased production.

Foreseeable development of the Coos Basin CBNG play could potentially result in an additional 25,000 acres of BLM-managed lease offerings. If these offerings were sold for the 2006 average price of $17.71 per acre, based on Federal proceeds from leasing in eastern Washington, the net receipts would approach $500,000.

II. Future Trends and Assumptions

Introduction

Salem District

Based on history of past exploration; historic, current, and projected development of the Mist Gas Field; mapped geology; and foreseeable development potential in the planning area, activity over the next decade may be stable to increasing. Current development within the Mist Gas Field as well as petroleum developments and interest in other BLM Districts in Oregon, and the increasing value of petroleum products, indicates continued interest within the District. Oil and gas activity on BLM-managed mineral rights within the District is expected to consist of competitive and over-the-counter leases, geophysical surveys, and processing of Applications for Permit to Drill for approximately 68 wells.

Some exploration for CBNG in the form of coal seam investigation and mapping is predicted, but development of CBNG is not expected within the next 10 years. The supply of natural gas in the region may be augmented by one or more proposed Liquefied Natural Gas terminals. Natural gas prices are expected to rise 0.3% (2004 purchase power) by 2034 with a 0.7% increase in demand over the same period (Energy Information Administration 2007). Consequently, while the petroleum industry does experience economic and production cycles, demand and price are projected to continue to increase.

Coos Bay District

Based on history of past drilling, current development of CBNG and foreseeable development potential in the planning area indicate activity over the next decade may be stable to increasing. Current development within the Coos Basin and the increasing value of petroleum products indicates continued interest within the District. Oil and gas activity on BLM-managed mineral rights within the District is expected to consist of competitive and over-the-counter leases, geophysical surveys, and processing of Applications for Permit to Drill for 50 to 80 wells.

Continued exploration and development for CBNG is expected. Some exploration for conventional natural gas is also predicted. The supply of natural gas in the region has been augmented by the Coos County Natural Gas Pipeline. A Liquefied Natural Gas terminal is being proposed and an associated second natural gas pipeline. These systems provide export opportunities for natural gas produced in the District. Natural gas prices are expected to rise 0.3% (2004 purchase power) by 2034, with a 0.7% increase in demand over the same period (Energy Information Administration 2007). Therefore, while the petroleum industry does experience fluctuations in economic and production cycles, demand and price are projected to continue to increase.

The speculative conventional petroleum systems are the Umpqua-Dothan-White Tail Ridge hybrid petroleum system and the Umpqua-lower Tyee Mountain petroleum system, located in the northern portion of the District are contained in the southern Tyee sedimentary basin (Ryu *et al.* 1996) (Figure 317).

System 1: The Umpqua-lower Tyee Mountain petroleum system is located in the center of the Smith River subbasin. The system may include a tight-gas sandstone reservoir. According to Ryu *et al.* (1996), gas could migrate along faults, forming small accumulations in the lower Tyee Mountain sandstones. Mudstones within the member would serve as additional seals within the traps. An unconventional overpressured tight-gas mudstone reservoir is possible in the Umpqua Group of the Smith River area. Deep wells within the system have encountered overpressured zones at approximately 7,000-foot depth. Characteristics of the zone are sufficient to generate thermogenic wet-gas (Ryu *et al.* 1996). The approximate area of this system within the District is 200 square miles. BLM-surface management consists of approximately 20 percent of that area.

System 2: The Umpqua-Dothan-White Tail Ridge Hybrid Petroleum System is located in the southern portion of the Tyee Basin, with a southern boundary defined by the Tyee Basin-Klamath Mountain contact. According to Ryu *et al.* (1996), the system may contain dry gas from both biogenic methane (similar to CBNG) and deeply buried conventional petroleum sources. It is possible the created gas migrates to accumulation zones which are located east of the District, extending into the BLM Roseburg District. It is also possible that the entire structure projects under the Klamath Mountains (Ryu *et al.* 1996). The approximate area of this system within the District is 350 square miles. BLM-surface management consists of approximately 26 percent of that area.

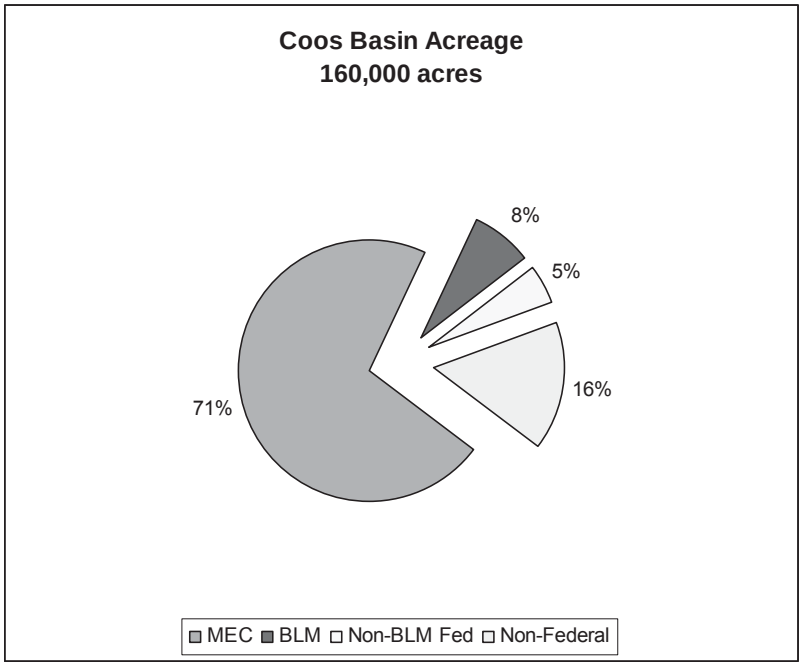
System 3: The third opportunity is the CBNG play located within the Coos Basin. This is the play which is currently producing the most interest and activity. The focus of production is within the Coaledo Formations mapped by Newton (1980). During deposition and compaction of the organic material which ultimately becomes coal, large quantities of methane are generated. Methane gas produced from coal may have lower energy content than conventional natural gas (BLM, 2001).

The approximate area of the CBNG play is 250 square miles, with producing Lower Coaledo Formation coals currently being sought at depths up to 4,500 feet. The Coos Basin is a folded structural basin, one of a series of onshore and offshore basins along the northwest coast, ranging from the Klamath Mountains north to the Columbia River in Oregon, and from the Columbia River north to the Puget Sound in Washington. The basins are located from the continental shelf offshore, east to the Willamette Valley. Sedimentary deposits including coals, sandstones, siltstones, and shales are located within these structural basins (Orr and Orr 2000).

The Coos Basin structure is controlled by compression force of the subducting easterly moving Gordia subplate and Juan de Fuca plate in relation to the overriding westerly moving North American Plate. The fold axes are oriented north-south, plunging northward. The Coaledo Formation-Flournoy Formation contact generally defines the basin boundaries to the north, east, and south. The basin is thought to extend offshore to the west. The basin's rock sequence consists of sedimentary layers of sandstone, siltstone, and shales, with coal seams (Newton 1980). Surface exposures of the basin's coal seams have been economically mined since the 1800s (Orr and Orr 2000).

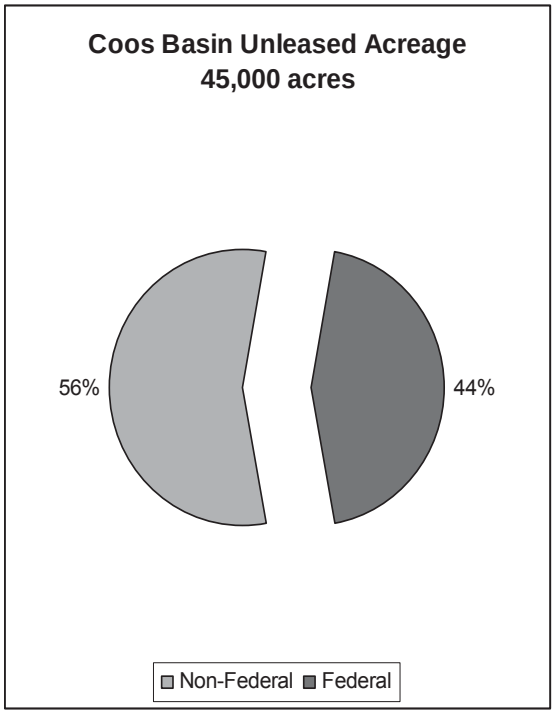
Current development of the CBNG resource is being conducted by Methane Energy Corporation which has completed numerous exploratory and production wells in the Coos Basin. The company has projected an "Area of Mutual Interest" incorporating the Coos Basin, an area of approximately 160,000 acres.

Figure 325. Coos Basin Acreage in Area of Mutual Interest.



Methane Energy Corporation maintains approximately 115,000 acres of non-federal mineral lease rights, with an estimated in-place volume of 1.2 trillion cubic feef (Sproule, 2006). Of the estimated 45,000 acres not yet controlled by lease agreements, the Federal Government manages approximately 19,694 acres or approximately 44 percent (Figure 326). Federal mineral rights account for approximately 19,694 acres of the basin area, and BLM-managed subsurface mineral rights (split and non-split estate) account for approximately 12,228 acres of the basin area. The remaining lands consist of non-federal and non-leased estate in private, City, County, and State ownership.

Figure 326. Coos Basin Unleased Acreage.



The State of Oregon Department of Geology and Mineral Industries (DOGAMI) initiated a public meeting process to establish a Gas Field Designation for the Coos Basin. The first public meeting was conducted January 29, 2007. There is only one other Gas Field Designation in Oregon, that being the Mist Gas Field, located in Northwest Oregon. The Gas Field Designation is required to fulfill state requirements to establish well spacing designations and control drainage. It may also increase competition, as more development companies may be interested in the resource after such a designation. The proposed Gas Field Designation is likely to incorporate the boundaries defined in Methane Energy Corporation's "Area of Mutual Interest". The boundary of the Gas Field Designation is simple to alter, needing only evidence of gas potential (additional formation mapping or shows of gas within a well). The designation will incorporate BLM and Forest Service lands, as well as other federal jurisdictions. (Houston, 2005)

All coal seams in western Oregon could produce CBM. However, the potential is completely unknown, as these resources have not been investigated. Potential could exist within the coal seams of the Umpqua Group, as well as their correlating formations north through the coast range. If CBM is producible in the Coos Basin, exploration could occur within these other speculative formations (May 2005).

Geophysical Exploration

Salem District

Advanced Three Dimensional Survey is utilized within the Mist Gas Field. These requirements are in place because the Mist Gas Field is located in commercial forest land and is required by the land manager to minimize disturbance to near non-existent levels (Meyer 2007-personal communications).

Surface Impacts of Geophysical Explorations

Salem District

It is anticipated that the foreseeable geophysical activity in the identified High Potential area would consist of the currently used the Three Dimensional Survey. The total area of the identified potential expansion is 81 square miles, or approximately 50,200 acres. Using the Three Dimensional Survey spacing of shots, it is anticipated that complete investigation of the area could utilize 22,950 shots. With pad ground disturbance of 12 square feet, the total disturbance area could be up to 6.3 acres. The District manages approximately 22% of the area of interest, so potential surface impacts to BLM-managed lands by Geophysical Explorations are expected to be approximately 1.4 acres. This disturbance is created exclusively with hand tools and based on experience in the Mist Gas Field, is completely reclaimed in five years or less (Meyer, 2007-personal communications). Disturbance will be less where pre-existing roads and/or landings can be used.

Coos Bay District

Geophysical exploration techniques are not commonly utilized in CBNG production, but may be utilized in developing conventional petroleum plays within the District. It is anticipated that the foreseeable geophysical activity in the planning area will consist of seismic reflection surveys, utilizing existing roads. Surface impacts would involve temporary blockage of the roads by the large trucks used to gather the data, but this type of equipment is not expected to damage the roads.

The small explosive method is also anticipated to be used on approximately 20 miles of line. Surface disturbance is expected to consist of drilling four to twelve holes per mile of line. Each drill hole would impact about 200 square feet, but 90 percent of these holes would be drilled on existing landings, spur roads, or timber haul roads. Altogether, 7,200 square feet (approximately 0.2 acre) of existing road surface would temporarily be impacted by drilling activities and low power blasting.

Blasting would not be powerful enough to impact any surface resources or improvements. It is anticipated that four drill holes would be made on currently undeveloped areas. Drill holes would impact about 200 square feet each, and short spur roads 100 feet by 25 feet wide constructed to each drilling location another 2,500 square feet each. Total surface disturbance for the anticipated four drill holes would be approximately 0.25 acre. Total surface disturbance for blasting and drilling combined is expected to total approximately 0.5 acre. An increase in conventional petroleum development would increase these estimates.

Drilling and Production Phase

Salem District

Based on past oil and gas drilling in Oregon, it is projected that three conventional petroleum exploratory "wildcat" wells would be drilled within the District. The estimated success rate of finding hydrocarbons is predicted to be no greater than 10 percent, based on the average U.S. wildcat well success rate. Future identification of additional structures would increase this estimate. Development within the identified High Potential area would be directed by Three Dimensional Survey as opposed to wildcatting (Meyer 2007-personal communications).

Coos Bay District

MEC estimates of development for CBNG for their current leases range from 300 to 719 wells. Based on well spacing assumptions (Sproule 2004) of 160 acres per well, Coos Basin development could eventually involve 436 to 1001 wells. As previously described, spacing rules will be developed during the DOGAMI Gas Field Designation process. If all remaining Federal and non-federal leasable land was open for surface occupancy, well development on federally-managed lands (BLM, USFS, and BIA) could range between 59 and 124 wells. Both highs and lows are extremes.

Figure 327. Coos Basin wells based on 338 acre spacing.

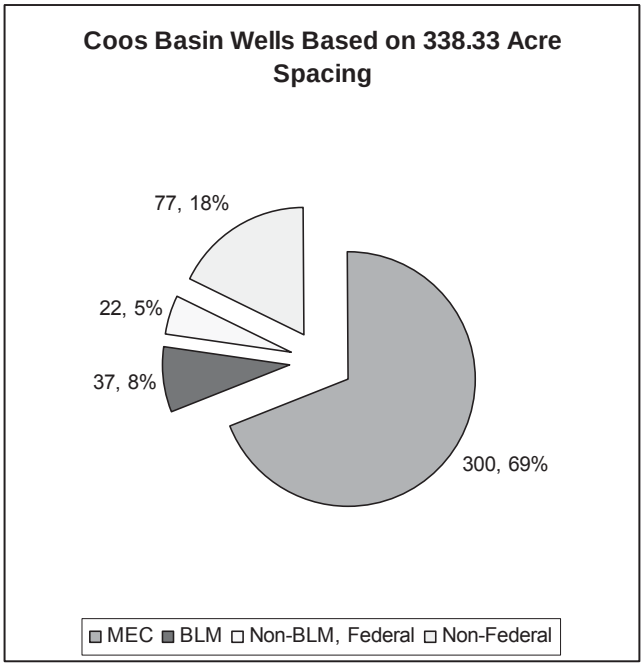
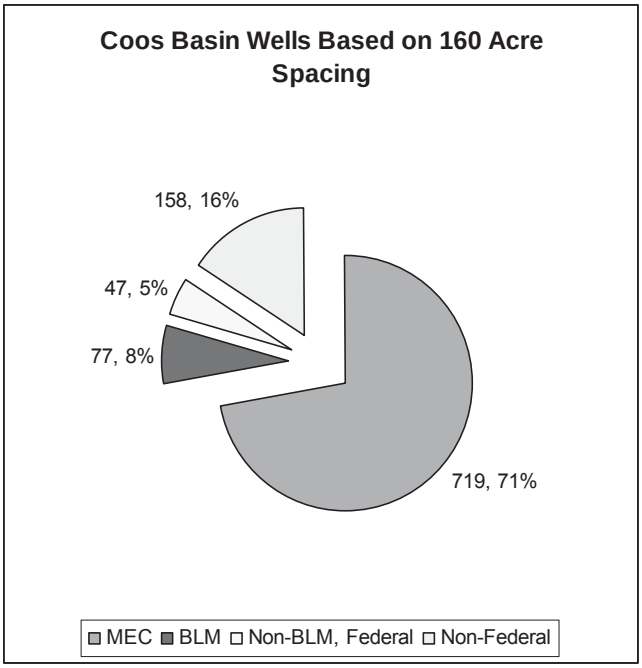


Figure 328. Coos Basin wells based on 160 acre spacing.



Surface Impacts of Drilling and Production

Salem District

The Mist Gas Field has maintained production since 1979. Over 500 wells have been permitted, although 60 wells are currently in operation. Abandoned well sites have been reclaimed and surface disturbance mitigated. Consequently, the current surface disturbance is limited to 60 wells. Development of the identified High Potential area or development of an unknown field could add an additional 314 wells, with 68 wells on BLM-managed lands. It is anticipated that all gas production would be transported by pipelines, most of which would be located within road rights-of-way. It is estimated that up to 20 miles of pipelines could be sited outside road rights-of-way. All well service requirements would be provided by established companies.

Pipelines totaling 20 miles in length within a 30-foot wide right-of-way would disturb about 72.5 acres. Due to the checkerboard public land ownership in this area, it is estimated that only 22 percent or 16 acres would be on lands administered by the BLM.

Given the existing infrastructure of the Mist Gas Field, timber management of other lands within the District, the amount of existing roads within the identified High Potential Area, use of Three Dimensional Survey to optimize directional drilling, the ability to place multiple wells on a single pad (Meyer 2007-personal communications), and development scenarios of other BLM Oregon Districts, it is anticipated that most well development will utilize existing road infrastructure to develop the resource. However, it may be necessary to construct up to ¼-mile of access road for each pad to remove the facilities from active roadways. Based on the ability to cluster wells, an assumption for calculation of four wells per pad was used. Therefore, it is estimated that no more than 20 miles of new road construction would be needed in full development. This would be moderate duty access road with a surface 18 to 20 feet wide, anticipated to be constructed on both private and BLM-managed lands. The clearing width would average 40 feet including ditches, utilities, pipelines, cuts, and fills. The total acreage impacted would total approximately 97 acres for all lands within the District, approximately 22 acres of which would involve BLM-managed lands. Roads not retained for other resource management purposes would be reclaimed at the end of the project.

Total disturbance of both BLM-managed lands and other lands for wells, support services, pipeline and new road construction is expected to be approximately 1,426 acres or 2.8% of the total High Potential acreage. Surface disturbance would be restricted, as much as possible, to previously disturbed areas such as logging roads and landings. Industry is currently utilizing a multi-well to single pad approach which minimizes impact. Interim reclamation will also reduce initial disturbance. After initial construction, well sites pad areas will be

reclaimed while the wells are in production. Disturbance will be limited to areas within overwork foundation structures and necessary infrastructure, such as well heads, pipelines, and access roads.

Coos Bay District

It is estimated that the productive life span of a single well within the CBNG could range to greater than 14 years. Total lifespan of the field would be determined on the type of phased development and exploration of the previously untested deeper resources greater than 4,000 feet. All gas production would be carried by pipelines. Most, if not all, pipeline will be contained within road rights-of-way. It is estimated that up to 40 miles of pipeline could occur outside a road right-of-way. Additional conventional petroleum structures totaling 550 square miles have also been identified within the District.

Based on potential for resource development (described above) and utilizing access road built for well accessed timber development (most likely for the BLM-managed parcels within the Coos Basin), it was estimated that between five to no more than 10 miles of moderate duty access road with a surface 18 to 20 feet wide is anticipated to be constructed. The surface disturbance width would average 40 feet including ditches, utilities, pipelines, cuts, and fills. The acreage impacted by new road building would total between approximately 24.25 acres and 48.5 acres for the District. Roads not incorporated into other resource management would be reclaimed at the end of the project.

Altogether, the total disturbance for the wells, support services, and new road construction on BLM-managed mineral estate is expected to range between 194.25 acres (1.6% of BLM-managed area: 37 wells) to 404.25 acres (3.3% of BLM-managed area: 77 wells). Surface disturbance would be restricted, as much as possible, to previously disturbed areas such as logging roads and landings. Industry is currently utilizing a multi-well to single pad approach which minimizes impact.

A pipeline 40 miles in length with a right-of-way width of 30 feet would disturb about 145 acres. Due to the checkerboard public land ownership in this area, it is estimated that only 50 percent of that acreage would be on public lands administered by the BLM. Altogether, it is estimated that about 73 acres of BLM-administered land would be impacted from pipeline construction. The total surface disturbance of field development and production on BLM-managed land would range between 291.5 acres and 525.75 acres.

Total field development disturbance within the District, both Federal and non-Federal, could range between 2,289 acres (338.33 acre well spacing) and 5,255.25 acres (160 acre well spacing). Communitization and Unitization agreements (both State and Federal) can drastically reduce surface disturbance

for both Federal and Non-Federal lands. These cooperative agreements allow the sharing of wells, pads, and infrastructure, combining uses and minimizing the need for new development.

Limitations

Salem District

The acreage estimates used for BLM-managed surface estate are based upon current GIS layers. The accuracy of this information has not been verified by Master Title Plat Maps. The GIS coverage for subsurface estate within the District is incomplete. Therefore, the existence and location of BLM-managed subsurface estate on the District is unknown.

A brief review of the Master Title Plat Maps was completed within and near the 1985 Mist Gas Field boundaries. Federal subsurface estate identified on the Master Title Plat Maps was not recorded on the GIS layers. Most of the Master Title Plat Maps identified federal subsurface parcels outside the Mist Gas Field boundaries. Due to the incompleteness of the GIS layers, especially within subsurface estate, the potential of BLM-managed subsurface estate was not addressed in this report.

Proposed Restrictions and Requirements on Mineral and Energy Exploration and Development Activity

Introduction

This appendix discusses the leasing stipulations as they will be applied to BLM managed lands in the planning area under each alternative. Operating standards pertinent to the locatable and salable minerals program are also described. Mineral exploration and development on Federal lands must also comply with laws and regulations administered by several agencies of the State of Oregon; however, these requirements are not discussed in this document.

Leasable Mineral Resources

Oil and Gas Leasing

The Mineral Leasing Act of 1920 (as amended) provides that all publicly owned oil and gas resources be open to leasing, unless a specific land order has been issued to close the area. Through the land use planning process, the availability of these resources for leasing is analyzed, taking into consideration development potential and surface resources. Constraints on oil and gas operations are identified and placed in the leases as notices and stipulations. Oil and gas leases are then issued from the BLM Oregon State Office in Portland. Specific proposed notices and stipulations are listed by alternative later in this appendix.

The issuance of a lease conveys to the lessee an authorization to actively explore and/or develop the lease, in accordance with the attached stipulations and the standard terms outlined in the Federal Onshore Oil and Gas Leasing Reform Act (FOOGLRA). Restrictions on oil and gas activities in the planning area will take the form of timing limitations, controlled surface use, or no surface occupancy stipulations used at the discretion of the Authorized Officer to protect identified surface resources of special concern.

The field office which reviews the lease tract will attach stipulations to each lease before it is offered for bid. The review will be conducted by consulting the direction given in this Resource Management Plan. In addition, all lands administered by BLM within the planning area will be subject to the lease notices as shown on the following pages. All Federal lessees or operators are required to follow procedures set forth by: Onshore Oil and Gas Orders, Notices to Lessee (NTL), The Federal Oil and Gas Royalty Management Act (as amended), The

Federal Onshore Oil and Gas Leasing Reform Act, and Title 43 Code of Federal Regulations, Part 3100.

Oil and Gas Operations

Geophysical Exploration

Geophysical operations may be conducted regardless of whether the land is leased or not. Notices to conduct geophysical operations on BLM surface are received by the Resource Area. Administration and surface protection are accomplished through close cooperation of the operator and the BLM. Seasonal restrictions may be imposed to reduce fire hazards, conflicts with wildlife, watershed damage, etc. An operator is required to file a "Notice of Intent to Conduct Oil and Gas Exploration Operations" for all geophysical activities on public land administered by BLM. The notice should adequately show the location and access routes, anticipated surface damages, and time frame. The operator is required to comply with written instructions and orders given by the Authorized Officer, and must be bonded. Signing of the Notice of Intent by the operator signifies agreement to comply with the terms and conditions of the notice, regulations, and other requirements prescribed by the Authorized Officer. A pre-work conference and/or site inspection may be required. Periodic checks during and upon completion of the operations will be conducted to ensure compliance with the terms of Notice of Intent, including reclamation.

Drilling Permit Process

The federal lessee or operating company selects a drill site based on spacing requirements, subsurface and surface geology, geophysics, topography, and economic considerations. Well spacing is determined by topography, reservoir characteristics, protection of correlative rights, potential for well interference, interference with multiple-use of lands, and protection of the surface and subsurface environments. Close coordination with the State would take place. Written field spacing orders are issued for each field. Exceptions to spacing requirements involving Federal lands may be granted after joint State and BLM review.

Notice of Staking

Once the company makes the decision to drill, it must decide whether to submit a Notice of Staking or apply directly for a permit to drill. The Notice of Staking is an outline of what the company intends to do, including a location map and sketched site plan. The Notice of Staking is used to review any conflicts with known critical resource values and to identify the need for associated rights-of-

way and special use permits. The BLM utilizes information contained in the Notice of Staking and obtained from the on-site inspection to develop conditions of approval to be incorporated into the application for permit to drill. Upon receipt of the Notice of Staking, the BLM posts the document and pertinent information about the proposed well in the District Office for a minimum of 30 days prior to approval, for review and comment by the public.

Application for Permit to Drill (APD)

The operator mayor may not choose to submit a Notice of Staking; in either case, an Application for Permit to Drill must be submitted prior to drilling. An Application for Permit to Drill consists of two main parts: a 12-point surface plan that describes any surface disturbances and is reviewed by resource specialists for adequacy with regard to lease stipulations designed to mitigate impacts to identified resource conflicts with the specific proposal, and an 8-point subsurface plan that details the drilling program and is reviewed by the staff petroleum engineer and geologist. This plan includes provisions for casing, cementing, well control, and other safety requirements. For the Application for Permit to Drill option, the on-site inspection is used to assess possible impacts and develop provisions to minimize these impacts.

Geothermal Leasing

The Geothermal Steam Act of 1970 (as amended) provides for the issuance of leases for the development and utilization of geothermal steam and associated geothermal resources. Geothermal leasing and operational regulations are contained in Title 43 Code of Federal Regulations, Part 3200. Through the land use planning process the availability of the geothermal resources for leasing is analyzed, taking into consideration development potential and surface and subsurface resources. Constraints on geothermal operations are identified and placed in the leases as stipulations. Geothermal leases are then issued by the BLM Oregon State Office in Portland.

Geothermal resources are first offered by competitive sale. Prior to a competitive lease sale, or the issuance of a noncompetitive lease, each tract will be reviewed, and appropriate lease stipulations will be included. The review will be conducted by consulting the direction given in this resource management plan. The issuance of a lease conveys to the lessee authorization to actively explore and/or develop the lease in accordance with regulations and lease terms and attached stipulations. Subsequent lease operations must be conducted in accordance with the regulations, Geothermal Resources Operational Orders, and any Conditions of Approval developed as a result of site-specific NEPA analysis. In the planning area, restrictions in some areas will include timing limitations, controlled surface use, or no surface occupancy stipulations used at the discretion of the Authorized Officer to protect identified surface resources of special concern.

In addition to restrictions related to the protection of surface resources, the various stipulations and conditions could contain requirements related to protection of subsurface resources. These may involve drainage protection of geothermal zones, protection of aquifers from contamination, or assumption of responsibility for any unplugged wells on the lease. Development of geothermal resources can be done only on approved leases. Orderly development of a geothermal resource, from exploration to production, involves several major phases that must be approved separately. Each phase must undergo the appropriate level of NEPA compliance before it is approved and subsequent authorization(s) is (are) issued.

Leasing Notice and Stipulation Summary

On the following pages, the mineral leasing notices and stipulations are shown as common for all alternatives are considered to be the minimum necessary in order to issue leases in the operating area. Under all alternatives, the standard and the special status species leasing stipulations will be utilized on most lands. The powersite stipulation (Form 3730-1) would be utilized on lands within powersite reservations.

Stipulations also include waiver, exception, and modification criteria defined below. If the Authorized Officer determines that a stipulation involves an issue of major concern, waivers, exceptions, or modifications of the stipulation will be subject to at least a 30-day advance public review. Waiver, exception, and modification are defined as follows:

Waiver - The lifting of a stipulation from a lease that constitutes a permanent revocation of the stipulation from that time forward. The stipulation no longer applies anywhere within the leasehold.

Exception - This is a one time lifting of the stipulation to allow an activity for a specific proposal. This is a case-by-case exemption. The stipulation continues to apply to all other sites within the leasehold to which the restrictive criteria apply. It has no permanent effect on the lease stipulation.

Modification - This is a change to a stipulation that either temporarily suspends the stipulation requirement or permanently lifts the application of the stipulation on a given portion of the lease. Depending on the specific modification, the stipulation mayor may not apply to all other sites within the leasehold to which the restrictive criteria apply.

Whenever a special stipulation, such as No Surface Occupancy (NSO), Timing, or Controlled Surface Use (CSU) is used, the need for the special stipulation is described in the “Objective” that follows the stipulation. By imposing these special stipulations, it has been concluded that less restrictive stipulations would not be adequate to meet the stated objective.

Leasing Notices

The following Notices are to be included in each lease for all lands administered by BLM within the planning area where the pertinent resource potential exists. Lease notices are attached to leases in the same manner as stipulations; however, there is an important distinction between lease notices and stipulations: lease notices do not involve new restrictions or requirements. Any requirements contained in a lease notice must be fully supported by either laws, regulations, policy, onshore oil and gas orders, or geothermal resources operational orders.

Leasing Notices Common to All Alternatives

Notice

Special Status Species Stipulation

Resources: Botany and Wildlife

Stipulation: (All the)/(Certain) lands within this lease are within the suitable habitat of the (identify all Federal Threatened (FT), Endangered (FE) or Proposed Threatened (PT) & Proposed Endangered (PE) species, including scientific names), (an officially listed)/(a proposed for listing) Threatened or Endangered species. The Authorized Officer, through an environmental review process, has determined that because of the habitat characteristics of this species, all future post-lease operations must be analyzed and subjected to a U.S. Fish and Wildlife Service (FWS) Section 7 consultation or conference to ensure the action is not likely to jeopardize the continued existence of the species or result in the destruction or adverse modification of critical habitat.

(All the)/(Certain) lands within this lease are known to bear the species listed (Insert list of species) which has (have) protected status as (State Threatened (ST); State Endangered (SE); Federal Candidate (FC); Bureau Sensitive (BS)); or are within the suitable habitat of (identify all State Threatened, State Endangered, Federal Candidate, or Bureau Sensitive species, including scientific names). These species are protected by BLM policy as described in Manual 6840. All future post-lease operations must be analyzed, utilizing recent field data collected at the proper time of year, to identify the presence of such species. If the field examination indicates that the proposed activity may adversely impact FC species, technical assistance will be obtained from FWS to insure that actions will not contribute to the need to list a federal candidate as a federal threatened or endangered species. Technical assistance may be obtained from FWS to insure that actions will not contribute to the need to list a ST, SE, or BS species as a federal threatened or endangered species.

Therefore, prior to any surface disturbing activities or the use of vehicles off existing roads on (this lease)/(the lands legally described as: _____), BLM approval is required. This restriction also applies to geophysical activities for which a permit is required. The approval is contingent upon the results of site specific inventories for any of the above mentioned species. The timing of these inventories is critical. They must be conducted at a time of year appropriate to determine the presence of the species or its habitat. The lessee is hereby notified that the process will take longer than the normal 30 days and that surface activity approval will be delayed.

If no FT, FE, PT, or PE species, or suitable habitat, are found during the inventories, then no formal Section 7 consultation with the FWS will be necessary and the action will be processed using the procedures found in the applicable oil and gas Onshore Orders or geothermal resources operational orders. However, the lessee is hereby notified that, if any FT, FE, PT, PE, ST, SE, FC, or BS species are found during the inventories, or if the actions are proposed in designated or proposed critical habitat, then surface disturbing activities may be prohibited on portions of, or even all of the lease, unless an alternative is available that meets all of the following criteria: (a) The proposed action is not likely to jeopardize the continued existence of a threatened or endangered species; (b) the proposed action is not likely to destroy or adversely modify critical habitat for a threatened or endangered species; (c) the proposed action is consistent with the recovery needs in approved Fish and Wildlife Service recovery plans or BLM Habitat Management Plans for the threatened or endangered species; and (d) the proposed action will not contribute to the need to list species as federal threatened or endangered.

Objective: To protect officially listed or proposed threatened or endangered plant or wildlife species; and to insure that post leasing oil and gas or geothermal operations will not likely contribute to the need to list other special status species as threatened or endangered.

Exception: An exception may be granted by the Authorized Officer, if review of the proposed plan submitted by the operator indicates that the proposed action will have no effect on the (common name of species).

Modification: The boundaries of the stipulated area may be modified, by the Authorized Officer, if it is determined that portions of the area do no have any officially listed or proposed threatened or endangered species, federal candidate, state threatened or endangered species, or Bureau sensitive species, or their habitat.

Waiver: This stipulation may be waived if the (common name) is declared recovered and is no longer protected under the Endangered

Species Act, or if other species found within the lease are no longer considered to be in the federal candidate, state threatened or endangered, or Bureau sensitive categories.

Notice

Cultural Resources: An inventory of the leased lands may be required prior to surface disturbance to determine if cultural resources are present and to identify needed mitigation measures. Prior to undertaking any surface-disturbing activities on the lands covered by this lease, the lessee or operator shall:

1. Contact the Bureau of Land Management (BLM) to determine if a cultural resource inventory is required. If an inventory is required, then;
2. The BLM will complete the required inventory; or the lessee or operator, at their option, may engage the services of a cultural resource consultant acceptable to the BLM to conduct a cultural resource inventory of the area of proposed surface disturbance. The operator may elect to inventory an area larger than the standard ten-acre minimum to cover possible site relocation, which may result from environmental or other considerations. An acceptable inventory report is to be submitted to the BLM for review and approval no later than that time when an otherwise complete application for approval of drilling or subsequent surface-disturbing operation is submitted.
3. Implement mitigation measures required by the BLM. Mitigation may include the relocation of proposed lease-related activities or other protective measures such as data recovery and extensive recordation. Where impacts to cultural resources cannot be mitigated to the satisfaction of the BLM, surface occupancy on that area must be prohibited. The lessee or operator shall immediately bring to the attention of the BLM any cultural resources discovered as a result of approved operations under this lease, and shall not disturb such discoveries until directed to proceed by the BLM.

Authorities: Compliance with Section 106 of the National Historic Preservation Act is required for all actions which may affect cultural properties eligible to the National Register of Historic Places. Section 6 of the Oil and Gas Lease Terms (Form 3100-11) requires that operations be conducted in a manner that minimizes adverse impacts to cultural and other resources.

Special Leasing Stipulations

The following special stipulations are to be utilized on specifically designated tracts of land as described under the various alternatives.

Leasing Stipulations Common To All Alternatives

No Surface Occupancy

Resource: Land Use Authorizations

Stipulation: Surface occupancy and use is prohibited on Recreation and Public Purposes (R&PP) and FLPMA leases.

Objective: To protect uses on existing R&PP and FLPMA leases.

Exception: An exception to this stipulation may be granted by the Authorized Officer, if the operator submits a plan demonstrating that impacts from the proposed action are acceptable or can be adequately mitigated.

Modification: The area affected by this stipulation may be modified by the Authorized Officer, if the land use authorization boundaries are modified.

Waiver: This stipulation may be waived by the Authorized Officer, if all land use authorizations within the leasehold have been terminated, canceled, or relinquished.

No Surface Occupancy

Resource: Recreation Sites

Stipulation: Surface occupancy and use are prohibited within developed recreation areas.

Objective: To protect developed recreation areas.

Exception: An exception to this stipulation may be granted by the Authorized Officer, if the operator submits a plan demonstrating that impacts from the proposed action are acceptable or can be adequately mitigated.

Modification: The boundaries of the stipulated area may be modified by the Authorized Officer, if the recreation area boundaries are changed.

Waiver: This stipulation may be waived, if the Authorized Officer determines that the entire leasehold no longer contains developed recreation areas.

No Surface Occupancy

A 30-day public notice period will be required prior to modification or waiver of this stipulation.

Resource: Special Areas

Stipulation: Surface occupancy and use are prohibited within Areas of Critical Environmental Concern (ACEC).

Objective: To protect important historic, cultural, scenic values, natural resources, natural systems or processes, threatened and endangered plant species, and/or natural hazard areas of the ACEC.

Exception: An exception to this stipulation may be granted by the Authorized Officer, if the operator submits a plan demonstrating that impacts from the proposed action are acceptable or can be adequately mitigated.

Modification: The boundaries of the stipulated area may be modified by the Authorized Officer, if the ACEC or EEA boundaries are changed.

Waiver: This stipulation may be waived, if the Authorized Officer determines that the entire leasehold no longer contains designated ACECs or EEAs.

No Surface Occupancy

Resource: Progeny test sites.

Stipulation: Surface occupancy and use are prohibited within progeny test sites.

Objective: To protect progeny test sites.

Exception: None.

Modification: The boundaries of the stipulated area may be modified by the Authorized Officer, if the progeny test site boundaries are changed.

Waiver: This stipulation may be waived, if the Authorized Officer determines that the entire leasehold no longer contains progeny test sites.

No Surface Occupancy

A 30-day public notice period will be required prior to modification or waiver of this stipulation.

Stipulation: Surface occupancy and use are prohibited in VRM Class I areas.

Resource: Visual Resource Management (VRM) Class I

Objective: To maintain soil productivity, provide necessary protection to prevent excessive soil erosion on steep slopes, and to avoid areas subject to slope failure, mass wasting, piping, or having excessive reclamation problems.

Objective: To preserve the existing character of the landscape.

Exception: An exception to this stipulation may be granted by the Authorized Officer, if the operator submits a plan demonstrating that impacts from the proposed action are acceptable or can be adequately mitigated.

Modification: The boundaries of the stipulated area may be modified by the Authorized Officer, if the boundaries of the VRM Class I area are changed.

Waiver: This stipulation may be waived by the Authorized Officer, if all VRM Class I areas within the leasehold are reduced to a lower VRM class. Areas reduced to VRM Class II will be subject to the Controlled Surface Use stipulation for visual resources, and areas reduced to VRM Class III will be subject to standard lease stipulations.

Controlled Surface Use

Resource: Soils

Stipulation: Prior to disturbance of any suspected unstable slopes or slopes over 60 percent, an engineering/reclamation plan must be approved by the Authorized Officer. Such plan must demonstrate how the following will be accomplished:

- Site productivity will be restored.
- Surface runoff will be adequately controlled.
- Off-site areas will be protected from accelerated erosion, such as rilling, gullying, piping, and mass wasting.
- Water quality and quantity will be in conformance with state and federal water quality laws.
- Surface-disturbing activities will not be conducted during extended wet periods.
- Construction will not be allowed when soils are frozen.

Exception: An exception to this stipulation may be granted by the Authorized Officer if the operator submits a plan, which demonstrates that the impacts from the proposed action are acceptable or can be adequately mitigated.

Modification: The area affected by this stipulation may be modified by the Authorized Officer, if it is determined that portions of the area do not include suspected unstable slopes or slopes over 60 percent.

Waiver: This stipulation may be waived by the Authorized Officer if it is determined that the entire leasehold does not include any suspected unstable slopes or slopes over 60 percent.

Controlled Surface Use

A 30-day public notice period will be required prior to modification or waiver of this stipulation.

Resource: Visual Resource Management (VRM) Class II.

Stipulation: All surface-disturbing activities, semipermanent and permanent facilities in VRM Class II areas may require special design including location, painting and camouflage to blend with the natural surroundings and meet the visual quality objectives for the area.

Objective: To control the visual impacts of activities and facilities within acceptable levels.

Exception: None.

Modification: None.

Waiver: This stipulation may be waived, if the Authorized Officer determines that there are no longer any VRM Class II areas in the leasehold.

No Additional Leasing Stipulations for the No Action Alternative

No Additional Leasing Stipulations for Alternative A

Controlled Surface Use

Resource: Designated Mature and Old-Growth Forest Seral Stage Blocks

Stipulation: Unless otherwise authorized, drill site construction and access through designated mature and old-growth forest blocks within this leasehold will be limited to established roadways.

Objective: To protect vegetation to retain and/or restore older forests for seral stage diversity.

Exception: An exception to this stipulation may be granted by the Authorized Officer, if the operator submits a plan which demonstrates

that impacts from the proposed action are acceptable or can be adequately mitigated.

Modification: The area affected by this stipulation may be modified by the Authorized Officer, if it is determined that portions of the area do not include designated mature and old-growth forest blocks.

Waiver: This stipulation may be waived by the Authorized Officer, if it is determined that the entire leasehold no longer includes designated mature and old-growth forest blocks.

Controlled Surface Use

Resource: Riparian Management Areas.

Stipulation: Unless otherwise authorized, drill site construction and access through riparian management areas within this leasehold will be limited to established roadways.

Objective: To protect riparian vegetation and reduce sedimentation.

Exception: An exception to this stipulation may be granted by the Authorized Officer, if the operator submits a plan which demonstrates that impacts from the proposed action are acceptable or can be adequately mitigated.

Modification: The area affected by this stipulation may be modified by the Authorized Officer, if it is determined that portions of the area do not include riparian areas, flood plains, or water bodies.

Waiver: This stipulation may be waived by the Authorized Officer, if it is determined that the entire leasehold no longer includes riparian management areas.

Controlled Surface Use

Resource: Habitat Conservation Areas for the Northern Spotted Owl.

Stipulation: Unless otherwise authorized, drill site construction and access through habitat conservation areas within this leasehold will be limited to established roadways.

Objective: To protect habitat of the Northern Spotted Owl.

Exception: An exception to this stipulation may be granted by the Authorized Officer, if the operator submits a plan which demonstrates that impacts from the proposed action are acceptable or can be adequately mitigated.

Modification: The area affected by this stipulation may be modified by the Authorized Officer, if it is determined that portions of the area do not include habitat conservation areas.

Waiver: This stipulation may be waived by the Authorized Officer, if it is determined that the entire leasehold no longer includes habitat conservation areas, after consultation with the U.S. Fish and Wildlife Service.

Locatable Minerals Surface Management Standards for Exploration, Mining, and Reclamation

The following operational standards for mining activities have been compiled to assist the miner in complying with the 43 CFR 3809 regulations, which apply to all mining operations on BLM administered lands. The manner in which the necessary work is to be done will be site specific and all of the following standards may not apply to every mining operation. It is the mining claimant's and operator's responsibility to avoid "unnecessary or undue degradation," and to perform all the necessary reclamation work. Refer to the 43 CFR 3809 regulations for general requirements.

There is an intergovernmental agreement between the BLM and the Oregon Department of Geology and Mineral Industries that is designed to avoid duplication of regulations, inspections, and approval of reclamation plans as well as to minimize repetitive costs to mining operators. The following guidelines include some, but not all, of the requirements of the various State agencies overseeing mining operations.

Prospecting, Exploration, and Mining

Surface Disturbance

BLM Requirements

Operations ordinarily resulting in only negligible disturbance as defined in 43 CFR 3809.0-5(b) are considered to be casual use and no notification to or approval by the BLM is required. All operators proposing occupancy, timber removal, use of mechanized earth moving equipment, or suction dredges having hoses with an inside diameter greater than 4 inches which would cause a surface disturbance of 5 acres or less during any calendar year must provide written notice to the District Office at least 15 days prior to the commencement of any surface mining disturbance. For operations in sensitive areas or which will cause greater than 5 acres of surface disturbance, the operator is required to submit a plan of operations pursuant to the regulations in 43 CFR 3809.1-4.

State of Oregon Requirements

Any person engaging in mineral exploration that disturbs more than one surface acre or involves drilling to greater than 50 feet must obtain an exploration permit from the Oregon Department of Geology and Mineral Industries (DOGAMI). Mining operations involving 5,000 or more cubic yards of material per year or disturbing one or more acres of land will require an operating permit from DOGAMI.

Vegetation/Timber Removal

Remove only that vegetation which is in the way of mining activities. An application must be submitted to the Authorized Officer pursuant to 43 CFR 3821.4 describing the proposed use of merchantable timber from 0 & C lands for mining purposes. No merchantable trees may be cut until the application is approved and the trees are marked. The Roseburg BLM office recommends that small trees (less than 7 inches dbh) and shrubs be lopped and scattered, or shredded for use as mulch. Trees greater than or equal to 7 inches diameter breast height (dbh) are to be bucked and stacked in an accessible location unless they are needed for the mining operation

Firewood

Merchantable timber may not be used for firewood. Firewood permits may be issued to the operator for use in conjunction with the mining operation but no wood may be used until a permit is obtained from the BLM. Permits will be limited to hardwoods or salvage timber which is not considered to be merchantable. Firewood authorized for use in conjunction with a mining operation is not to be removed from the mining claim.

Topsoil

All excavations should have all the productive topsoil (usually the top 12 to 18 inches) first stripped, stockpiled, and protected from erosion for use in future reclamation. This also includes removal of topsoil before the establishment of mining waste dumps and tailings ponds, if the waste material will be left in place during reclamation.

Roads

Existing roads and trails should be used as much as possible. Temporary roads are to be constructed to a minimum width and with minimum cuts and fills. All roads shall be constructed so as to minimize negative impacts to slope stability.

Water Quality

When mining will be in or near bodies of water, or sediment (or other pollutants) will be discharged, contact the Department of Environmental Quality. A settling pond is required when mining operations discharge turbid water. It is the operator's responsibility to obtain any needed suction dredging, stream bed alteration, or water discharge permits required by the DEQ or other State agencies. Copies of such permits shall be provided to the Authorized Officer when a Notice or Plan of Operations is filed. All operations including casual use, shall be conducted in a manner so as to prevent unnecessary or undue degradation of surface and subsurface water resources and shall comply with all pertinent Federal and State water quality laws.

Claim Monuments

State law prohibits the use of plastic pipe for claim staking in Oregon. BLM policy requires all existing plastic pipe monuments to have all openings permanently closed. Upon loss or abandonment of the claim, all plastic pipe must be removed from the public lands. When old markers are replaced during normal claim maintenance, they shall be either wood posts or stone or earth mounds, constructed in accordance with the requirements of State law.

Drill Sites

Exploratory drill sites should be located next to or on existing roads when possible without blocking public access. When drill sites must be constructed, the size of the disturbance shall be as small as possible. operations. Any operator engaging in mineral exploration that involves drilling to greater than 50 feet must obtain an exploration permit from the Oregon Department of Geology and Mineral Industries (ORS 517.962).

Dust and Erosion Control

While in operation, and during periods of shut-down, exposed ground surfaces susceptible to erosion will need to be protected. This can be accomplished with seeding, mulching, installation of water diversions, and routine watering of dust producing surfaces.

Fire Safety

All State fire regulations must be followed, including obtaining a campfire permit or blasting permit, if needed. All internal gas combustion engines must be equipped with approved spark arresters.

Safety and Public Access

Under Public Law 167, the Government has the right to dispose and manage surface resources (including timber) on mining claims located

after July 23, 1955. These rights are limited to the extent that they do not endanger or materially interfere with any phase of an ongoing mining operation or uses reasonably incident thereto. Claims located prior to July 23, 1955 may have surface rights, if such claims were verified as being valid under Sections 5 and 6 of the Act. Most do not.

Mining claimants shall not exclude the public from mining claims with force, intimidation, or no trespassing signs. In the interest of safety, the general public can be restricted only from specific dangerous areas (underground mines~ open pits or heavy equipment storage areas) by erecting fences, gates and warning signs. It is the operator's responsibility to protect the public from mining hazards. Gates or road blocks may be installed on existing or proposed roads only with BLM approval. Gates restricting public access onto a mine site will only be considered in such cases where there is a large area safety hazard created by the mining activity. The determination as to whether a safety hazard is large enough to warrant a gate will be determined on a case-by-case basis. Fences (rather than gates) or other approved barriers shall be utilized to protect the public from hazards related to small excavations, tunnels, and shafts.

Roads which cross private land to reach BLM administered lands are controlled by the private parties. While some of these roads have been assigned BLM road numbers access may only be granted for administrative use to the BLM, and its licensees and permittees under a nonexclusive easement. Mining claimants are not considered licensees or permittees and so must make their own arrangements with the private party in order to use such roads. No right is granted under any of the mining laws to use a road involved in a nonexclusive easement.

Sewage

Self-contained or chemical toilets are generally to be used at exploration or mining operations and their contents shall be disposed of at approved dump stations. Outhouses and uncontained pit toilets are considered unnecessary and undue degradation and are not allowed. Uncontained pit toilets are not allowed for other users of the public land in this district, and we believe no special rights regarding this issue are granted under the mining laws. County sanitation permits are required for all other types of sanitation facilities.

Structures

Permanent structures will not be allowed for exploration or prospecting operations. Permanent structures are fixed to the ground by any of the various types of foundations, slabs, piers, poles, or other means allowed by State or County building codes. The term shall also include a structure placed on the ground that lacks foundations, slabs, piers or poles, and

that can only be moved through disassembly into its component parts or by techniques commonly used in house moving. Any temporary structures placed on public lands in conjunction with prospecting or exploration are allowed only for the duration of such activities, unless expressly allowed in writing by the Authorized Officer to remain on the public lands. Temporary structures are defined as structures not fixed to the ground by a foundation and that can be moved without disassembly into their component parts.

Permanent structures (as described above) may be allowed for mining operations if they are deemed reasonably incident to conducting the operations. Mining operations are defined as all functions, work, facilities, and activities in connection with development, mining, or processing mineral deposits.

All permanent or temporary structures placed on public lands shall conform with the appropriate State or local building, fire, and electrical codes, and occupational safety and health and mine safety standards.

Equipment

The claimant must maintain the claim site, including structures and equipment, in a safe and orderly condition. Only equipment and supplies that are appropriate, reasonable, and regularly used for exploration or mining will be allowed on the claim. Equipment transportable by a pickup or small trailer or used only infrequently should not be stored 0171 the claim and will not be considered as a justification for site occupancy. Accumulation of unused and/or inoperable equipment, materials not related to actual operations, and trash, garbage, or junk is not allowed on the public lands. The storage of such on the public land is unnecessary and undue degradation and will be treated accordingly.

Animals

If dogs or cats are to be present at the work site, the operator is required to keep them under control at all times so that they do not chase wildlife, or threaten other people, including government employees conducting site inspections on the public lands. Unless otherwise permitted, animals such as cows, chickens, goats, pigs or horses are not considered necessary to conduct mining operations and are not allowed on mining claims.

Suction Dredging

BLM Requirements

Cases Where a Notice or Plan of Operations is Required

Filing either a Notice or Plan of Operations may be required for all suction dredge operations where the dredge has an intake nozzle equal to or greater than 4 inches in diameter, or where any suction dredge operator proposes occupancy on BLM land (in excess of 14 calendar days per year) or the installation of structures of any kind. The determination of the need for a notice on smaller dredges will be made on a case by case basis.

No Notice or Plan of Operations Required

The use of a suction dredge in a stream and having an intake nozzle of less than 4 inches in diameter, where no structures or occupancy beyond the 14 calendar day per year camping limit is proposed, will not generally require the filing of a Notice or Plan of Operations. Such activity is generally considered casual use.

State of Oregon Requirements

All suction dredge operations must be authorized by Permit #0700-J issued by the Department of Environmental Quality. This permit is issued free of charge for dredges having hoses with an inside diameter of 4 inches or less. Registration and a filing fee of $50.00 is required for suction dredges having hoses with an inside diameter greater than 4 inches. Mining operators should contact the Department of Environmental Quality, Water Quality Division, 811 S.W. Sixth Avenue, Portland, Oregon 97204, or the Roseburg DEQ office.

Suction dredging outside the “permitted work period” established for certain waterways by the Oregon Department of Fish and Wildlife (ODFW) will require written permission by an appropriate ODFW District Biologist.

The river beds of navigable waterways are controlled by the Oregon Division of State Lands.

Tailings Ponds

Settling ponds must be used to contain sediment, and any discharge must meet the standards of the Oregon Department of Environmental Quality.

Solid and Hazardous Waste

Trash, garbage, used oil, etc. must be removed from public land and disposed of properly. Trash, garbage or hazardous wastes must not be buried on public lands. The accumulation of trash, debris, or inoperable equipment on public lands is viewed as unnecessary degradation and will not be tolerated. Operators conducting illegal disposals shall be held financially responsible for the clean-up of such disposals.

Cultural and Paleontological Resources

Operators shall not knowingly alter, injure, or destroy any scientifically important paleontological (fossil) remains or any historical or archaeological site, structure, or object on federal lands or any identified traditional use areas. The operator shall immediately bring to the attention of the Authorized Officer, any paleontological (fossil) remains or any historical or archaeological site, identified traditional cultural properties, structure, or object that might be altered or destroyed by exploration or mining operations, and shall leave such discovery intact until told to proceed by the Authorized Officer. The Authorized Officer shall evaluate the discovery, take action to protect or remove the resource, and allow operations to proceed.

Threatened and Endangered Species of Plants and Animals

Operators shall take such action as may be needed to prevent adverse impacts to threatened or(endangered species of plants and animals and their habitat that may be affected by operations, as stipulated in guidelines developed through consultation with the U.S. Fish and Wildlife Service. Under Notice-level operations, if the review of the notice by BLM reveals that a potential conflict with a threatened or endangered species exists, the operator will be advised not to proceed and informed that a knowing violation of the taking provision of the Endangered Species Act will result in a notice of noncompliance and may result in criminal penalties. If the operator wishes to develop measures that will eliminate the conflict, then the Authorized Officer will arrange for the participation of BLM resource specialists and the U.S. Fish and Wildlife Service in , reviewing the proposed revision to the Notice. If processing a proposed Plan of Operations indicates that a potential conflict exists with a threatened or endangered species or its habitat, the Authorized Officer shall notify the operator that the plan cannot be approved until BLM has complied with Section 7 of the Endangered Species Act. Special status species (Federal Candidate/ Bureau Sensitive) plants and animals, and their habitat will be identified by the Authorized Officer, and shall be avoided wherever possible.

Occupancy at Mining Sites

Living on public land, in excess of 14 days per calendar year, must be reasonably incident to and required for actual continuous mining or diligent exploration operations and will require either a Notice or Plan of Operations. In general, operations at the casual use level are not sufficient to warrant occupancy on a mining claim. The following discussion of occupancy only applies to those operators wishing to assert their right to live for an extended period or full-time on public lands pursuant to privileges granted under the mining laws. It does not apply to operators proposing to camp at prospecting or mining sites on weekends or one to two days during the week

Only those persons working on a continuous mining or exploration operation will be allowed to live on the claim beyond the 14-day per calendar year camping limit. A continuous mining or exploration operation is defined as an operation necessitating at least 40 hours of work per week at the operating site. The Oregon State Bureau of Labor and Industries generally considers that full-time work consists of a minimum of 40 hours worked per week. Each person proposing to live full-time at the site would be expected to conduct a minimum of 40 hours of work each week. Work hours are to be specified in the Notice or Plan of Operation at the time of submittal to the district BLM office. Should work hours be altered periodically or seasonally, it is the responsibility of the operator to notify the BLM (prior to the change) so that the Notice or Plan can be modified. Camping sites used in conjunction with mineral exploration or extraction operations are expected to be kept in a neat and orderly condition. If operations cannot be pursued due to high fire danger in forested areas, then living on the claim site will not be permitted. Any occupancy beyond 90 days must be in accordance with the requirements of the County Planning Department.

Security Guard

In some cases, it may be reasonably incident for a security guard to live on site in order to protect valuable property, equipment, or workings which are necessary for the mining operation, or to protect the public from site hazards. The need for a security guard shall be such that the person with those duties is required to be present at the site whenever the operation is shut down temporarily or at the end of the workday, or whenever the mining claimant, operator, or workers are not present on the site. The proposed occupancy by a security guard must be described in the Notice or Plan of Operations.

Reclamation

Reclamation of all disturbed areas must be performed concurrently or as soon as possible after exploration or mining ceases and shall conform to the guidelines described in BLM Handbook H-3042-1. Reclamation shall include, but shall not be limited to: 1) saving topsoil for final application after reshaping disturbed areas; 2) measures to control erosion, landslides, and water runoff; 3) measures to isolate, remove or control toxic materials; 4) reshaping the area disturbed, applying topsoil, and revegetating disturbed areas where reasonably practicable; and 5) rehabilitation of fisheries and wildlife habitat. When reclamation of the disturbed area has been completed, except to the extent necessary to preserve evidence of mineralization, the BLM must be notified so that an inspection of the area can be made.

Equipment and Debris

All mining equipment, vehicles, and structures must be removed from the public lands during extended periods of non-operation and/or at the conclusion of mining, unless authorization from BLM is given to the operator or claimant in writing. Accumulations of debris and trash on mining claims are considered unnecessary and undue degradation and must be removed immediately regardless of the status of the operation. Failure to do so will result in the issuance of a notice of noncompliance or a citation under State law.

Backfilling and Re-contouring

The first steps in reclaiming a disturbed site are backfilling excavations and reducing high walls, if feasible. Coarse rock material should be replaced first, followed by medium sized material, with fine materials to be placed on top. Re-contouring means shaping the disturbed area so that it will blend in with the surrounding lands, minimize the possibility of erosion, and facilitate re-vegetation.

Seedbed Preparation

Re-contouring should include preparation of an adequate seedbed. This is accomplished by ripping or disking compacted soils to a depth of at least 6 inches in rocky areas and at least 18 inches in less rocky areas. This should be done following the contour of the land to limit erosion. All stockpiled settling pond fines, and then topsoil, shall be spread evenly over the disturbed areas.

Fertilizer

Due to the generally poor nutrient value of mined soils, it may be necessary to use fertilizer to ensure maximum yield from the seeding mixture. The fertilizer (16-16-16, or other approved mix) should be spread at the rate of 200 lbs/acre, but not allowed to enter streams or bodies of water.

Seeding

BLM approved seeding prescription must be used to provide adequate re-vegetation for erosion control, wildlife habitat, and productive secondary uses of public lands. Seeding should be done in September or October in the Roseburg District to ensure that seed is in the ground prior to the first significant winter rains. If seeding fails, or is done at the wrong time, the operator may be asked to reseed the area at the appropriate time, as determined by the Authorized Officer.

Broadcast seeding is preferable on smaller sites. When using a whirlybird type seed spreader, it is important to keep the different seeds well mixed to achieve even seed distribution. For the best results, a drag harrow should be pulled over the seeded area to cover the seed before mulching. The Authorized Officer may recommend hydro-seeding on critical sites for rapid coverage and erosion control on cutbanks, fill slopes, and any other disturbed areas.

Tree Replacement

Replacement of destroyed trees may be necessary with the planting of seedlings or container stock.

Mulch

As directed by the BLM, during review of the Notice or Plan of Operations, the disturbed area may require mulching during interim or final reclamation procedures. Depending on site conditions, the mulch may need to be punched, netted, or blown on with a tackifier to hold it in place. In some cases, erosion control blankets may be cost effective for use.

Roads

After mining is completed, all new roads shall be reclaimed, unless otherwise specified by the BLM. High walls and cutbanks are to be knocked down or backfilled to blend with the surrounding landscape. All culverts shall be removed from drainage crossings and the fill shall be cut back to the original channel. The roadbed should be ripped to a minimum depth of 18 inches to reduce compaction and provide a good seedbed. The road must then be fertilized, seeded and mulched if necessary. When necessary, water bars are to be used to block access and provide drainage.

Tailings Ponds

The ponds should be allowed to dry out and the sediments removed and spread with the topsoil, unless the sediments contain toxic materials. If the ponds contain toxic materials, a plan will be developed to identify, dispose, and mitigate effects of the toxic materials. If necessary, a monitoring plan will also be implemented. The ponds should then be backfilled and reclaimed.

Visual Resources

To the extent practicable, the reclaimed landscape should have characteristics that approximate or are compatible with the visual quality of the adjacent area.

Guidelines for Development of Salable Mineral Resources

Proposed Operations

All proposed salable mineral developments, and any exploration that involves surface disturbance, should have operation and reclamation plans approved by the Authorized Officer. All proposals will undergo the appropriate level of review and compliance with the National Environmental Policy Act.

Quarry Design

Due to steep terrain in the operating area, most quarry developments would require a series of benches to effectively maximize the amount of mineral materials to be removed in a safe manner. In all cases, bench height shall not exceed 40 feet. If the bench would be used by bulldozers to access other parts of the quarry, the width of the bench should be at least 25 feet. If the bench won't be used by equipment, then this width can be reduced to approximately 10 feet.

Clearing of timber and brush should be planned at least 10 feet beyond the edge of the excavation limit. Most often the brush would be piled and burned at the site, or scattered nearby.

If at all possible, all topsoil and overburden should be stockpiled and saved for eventual quarry site reclamation. These piles may need to be stabilized by mulching or seeding in order to minimize erosion during the winter months.

As a standard procedure, the excavation of the quarry floor should be designed with an out-slope of approximately two percent in order to provide for adequate drainage of the floor. Compliance with this design should be made a requirement of all operators at the site.

Operating Procedures

Where practicable, the following requirements should be made a part of every contract or permit providing for the use of mineral material sites on the district:

Oversized boulders shall not be wasted, but shall be broken and utilized concurrently with the excavated material unless otherwise specified.

The operator shall comply with local and State safety codes covering quarry operations, warning signs and traffic control. All necessary permits must be obtained from State and County agencies.

Use of the site for equipment storage and stockpiling rock material is allowed for the duration of the contract or permit. Use of the site beyond that time would be authorized under a temporary use permit.

All topsoil shall be stockpiled or windrowed as appropriate, for use in reclamation.

Prior to abandonment, all material sites will be graded to conform with the surrounding topography. Topsoil will be utilized to create a medium for re-vegetation. Reseeding and tree planting, if necessary, will be done as prescribed by the Authorized Officer. Access roads no longer needed by the BLM will be abandoned and reclaimed as directed by the Authorized Officer.

Appendix Q. Vegetation Modeling

This appendix provides background on the vegetation modeling used to simulate the application of the land use allocations, management action, and forest development assumptions to characterize forest conditions into the future.

In this appendix:

Introduction **1505**

BLM Forest Inventory Data **1506**

Use of the Inventory Data in the Modeling **1512**

GIS – Defining the Land Base & Spatial Projections **1534**

Forest Growth and Yield Modeling **1536**

OPTIONS Modeling **1552**

OPTIONS Products **1588**

Introduction

The alternatives considered in the plan revisions outline a range of approaches for managing the BLM forest lands by varying the land allocations and intensity with which these forests are managed. These different management approaches result in a range of outcomes in terms of the structural stages of the forest over time, types of habitat which are developed, and the sustainable harvest levels. Models allow simulation of the development of the forest over time under these various management strategies. Models were used in the plan revision to simulate the application of the land use allocations, management action, and forest development assumptions to characterize forest conditions 10, 20, 50, and 100+ years into the future. The models are also used to determine the level of harvest which can be produced and sustained over time. The outputs from modeling form a factual basis for comparing and evaluating these different land management strategies at the strategic policy level.

Two primary vegetation models were used for the plan revisions.

- ORGANON - Individual tree growth model that was utilized for the development of growth and yield projections for the major species groups on the BLM lands. ORGANON was developed by Oregon State University. http://www.cof.orst.edu/cof/fr/research/ORGANON/
- OPTIONS - Spatially explicit strategic planning model that was utilized to project the forest conditions over time by simulating the land allocations and management action of the alternatives. OPTIONS is proprietary software created by DR Systems Inc. http://www.drsystemsinc.com/prod_options.html

Both of these models have been in use and under continued development for approximately 20 years, and provide a framework to bring the data and assumptions together to simulate these management scenarios. The extent of this modeling effort when looked at from an entire plan revision perspective can seem large and complex. It is easier to understand the modeling by looking at the major components used in the model formulation. These major components include; the GIS data which defines the land allocations and spatial representation of numerous resources, the forest inventory data, growth and yield projections, the definitions of habitats and structural stages, the assumptions on habitat and structural stage development, and management assumptions to simulate the alternatives.

This appendix provides an overview of the key components that were used in formulating the models used in the plan revision.

1. BLM Forest Inventory
2. Use of Inventory Data in Modeling
3. GIS – Defining the Land Base and Spatial Projections
4. Forest Growth and Yield Modeling
5. OPTIONS Modeling
6. OPTIONS Products

BLM Forest Inventory Data

Introduction

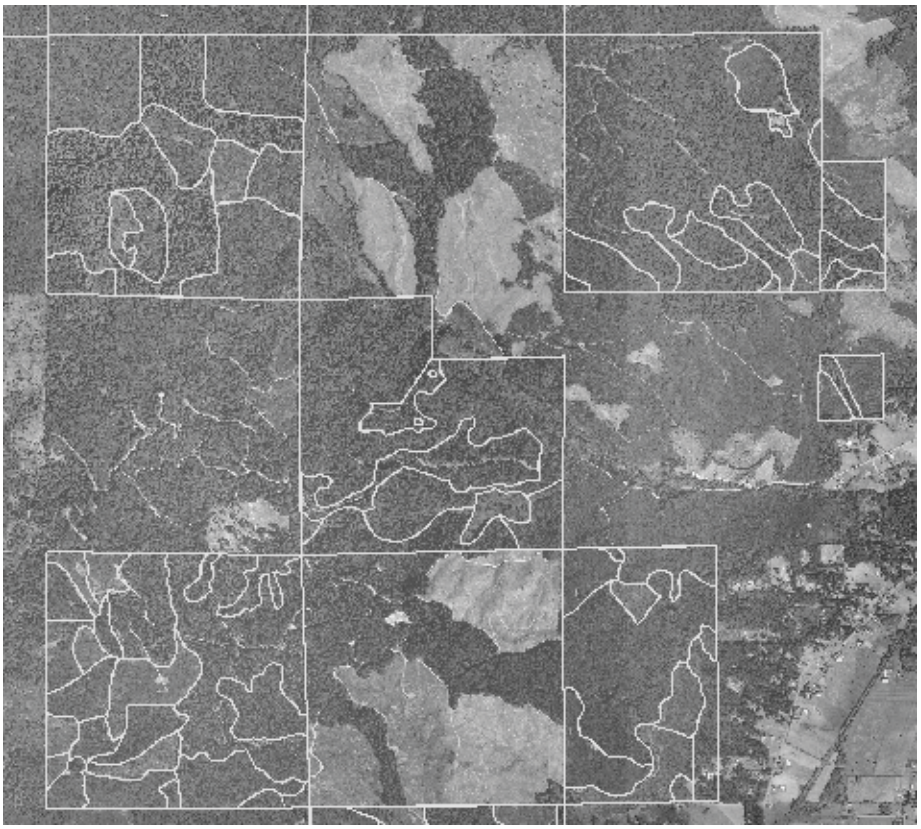
Three inventories of the BLM lands were used in the vegetation modeling for the plan revision.

- GIS Vegetation mapping with stand level attributes.
- Timber Productivity Capability Classification (TPCC)
- Current Vegetation Survey (CVS) – measured permanent plot data.

GIS Vegetation Mapping – Forest Operations Inventory & Micro*Storms

The Forest Operations Inventory (FOI) is a GIS layer which delineates vegetation polygons across BLM lands within the planning area. There are approximately 80,000 stands identified that average 32 acres in size. The minimum mapping feature is generally five acres but some finer scale non forest and harvest features are identified. Polygons are delineated based on vegetation attributes of cover condition, size class, density of trees, and age.

Figure 329. Example of FOI Mapping for approximately a three by three mile area.



The Micro*Storms database contains the attributes for the FOI polygons. The vegetation classification represents stand average characteristics which include:

- Cover Condition – Conifer, hardwood, mixed, or non forest.
- Single or Multi canopy stands.
- Species – Top 5 species with percent occupancy within a stand layer and listing of other species present.
- Stocking Class.
- Size Class – Diameter of the trees species by layer in 10” diameter classes.
- Birthdate of the layer.
- Ten year age class.

Land management treatment history is recorded in Micro*Storms for the FOI polygons. These treatments include; timber harvest, site preparation, planting, stand maintenance / protection, pre-commercial thinning, fertilization, pruning and a variety of other treatments.

The data is updated by the districts on a regular basis as treatments are implemented and as conditions change. The data is updated by a variety of inventory methods. The FOI and its companion database, Micro*Storms, are operational datasets that are in daily-use by the districts for planning and tracking purposes.

The FOI and Micro*Storms data, as used in the plan revision, reflects the conditions of the BLM lands as of October 2005. The FOI data is the spatial representation of the forest conditions for the OPTIONS vegetation modeling. The Micro*Storms data was used to develop modeling stratification for: species groups, site productivity, existing stand conditions, and 10 year age class.

Timber Productivity Capability Classification

The Timber Productivity Capability Classification (TPCC) is a classification of BLM lands based on the physical and biological capability of the site to support and produce commercial forest products on a sustained yield basis. Each TPCC unit is classified based on four assessments.

1) Forest / Non Forest

- ***Forest*** - capable of 10% tree stocking
- ***Non forest***

2) Commercial Forest Lands

- ***Commercial forest lands*** - capable of producing 20 cubic feet of wood per year of commercial species.
- ***Non commercial forest lands –*** not capable of producing 20 cubic feet of wood per year of commercial species.
- ***Sui Woodland –*** Non Commercial Species or Low Site

3) Fragile Conditions

- ***Non Fragile*** – forest yield productivity is not expected to be reduced due to soil erosion, mass wasting, reduction in nutrient levels, reduction in moisture supplying capacity, and or the rise of ground water .
- ***Fragile*** - forest yield productivity may be expected to be reduced by soil erosion, mass wasting, reduction in nutrient levels, reduction in moisture supplying capacity, and or the rise of ground water table.

Fragile sites are classified as:

- ***Restricted*** – Special harvest and or restricted measures are required.

- ***Non Suitable Woodland*** – Future production will be reduced even if special harvest and or restricted measures are applied due to the inherent site factors. These lands are not biologically and or environmentally capable of supporting a sustained yield of forest products.

4) Reforestation

Reforestation problem sites are those where environmental, physical, and biological factors have the potential to reduce the survival and or growth of commercial tree seedlings. These factors include light, temperature, moisture, frost, surface rock, animals and disease.

- ***Non Problem*** – Sites that can be stocked to meet or exceed target stocking levels, of commercial species, within 5 years of harvest, using standard practices.
- ***Restricted*** – Commercial forest land where operational reforestation practices in addition to standard practices are necessary to meet or exceed the minimum stocking levels of commercial species within 5 years of harvest.
- ***Suitable Woodland*** - Operational practices will not meet or exceed minimum stocking levels of commercial species within 5 years of harvest. These sites are biologically capable of producing a sustained yield of timber products.

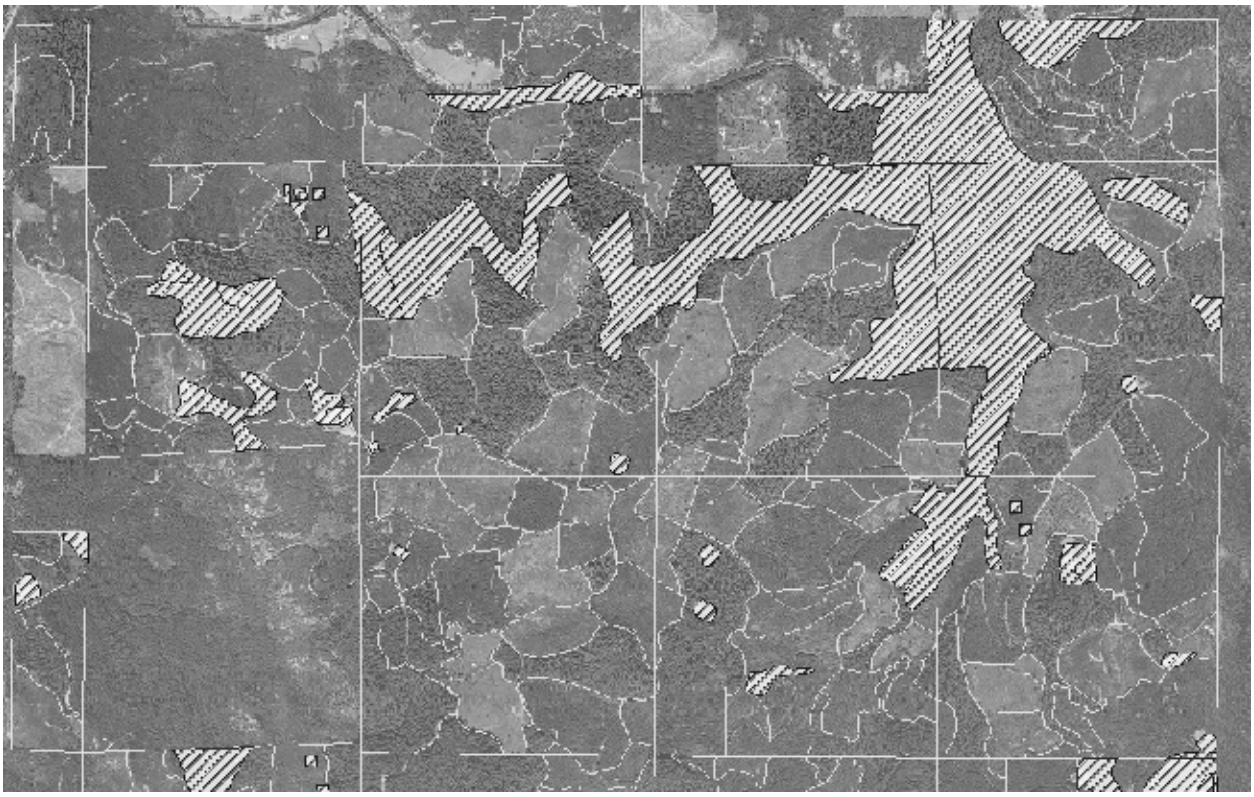
BLM handbook 5251-1 (1986) provides the standards for the TPCC Classification.

There are approximately 66,000 TPCC units mapped in GIS on the BLM lands within the planning area. The minimum mapping feature is generally five acres but some finer scale non forest features are identified in the data. The TPCC initial classification of all BLM lands in the planning area was performed in the late 1980s. The data is updated on an as needed basis as lands are acquired, and new information is obtained through field examination.

The data, as used in the plan revision, reflects the classification of the BLM lands as of October 2005. For the Western Oregon Plan Revision the TPCC data is used to identify what portions of the BLM lands will contribute to the Allowable Sale Quantity. The non forest, suitable woodlands, and non suitable woodland categories are not included in the lands contributing to the Allowable Sale Quantity under the current plan.

In the graphic below the cross hatched areas are examples of TPCC units withdrawn from the lands contributing to the Allowable Sale Quantity. The Forest Operations Inventory units are outlined for approximately a four by two mile area.

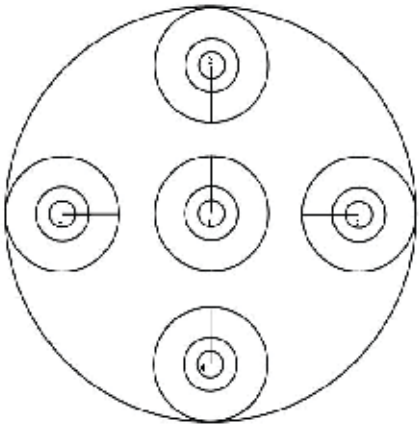
Figure 330. Example of TPCC Withdrawn lands.



Current Vegetation Survey – Measured Plot Inventory

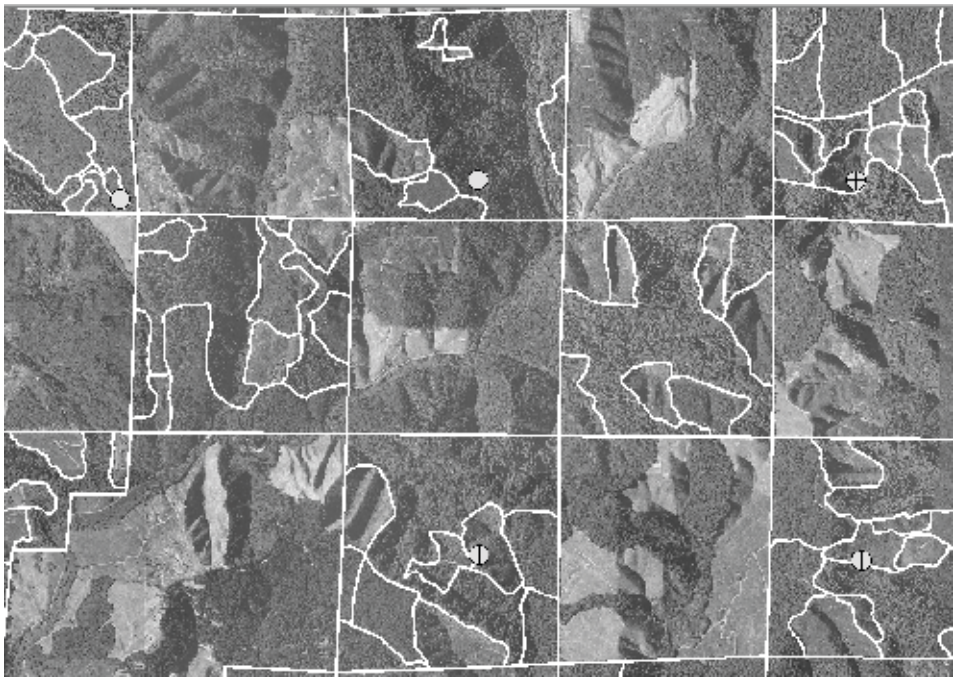
The Current Vegetation Survey (Max, T.A. et al. 1996) provides comprehensive information on vegetative resources on BLM lands within western Oregon. The information was collected during the years 1997 to 2001. It consists of four 3.4-mile grids of field plots that are off-set from one another to produce one 1.7 mile grid across BLM lands for a total of 1,376 plots. The primary sampling unit is one hectare (approximately 2.5 acres) with five fixed-radius sets of subplots with trees 1.0 to 2.9 inches DBH measured on the 11.8 foot radius subplot, 3.0 to 12.9 on a 24.0 foot, 13.0 to 47.9 on a 51.1 foot and trees 48.0 and larger on the 1/5 hectare (approximately ½ acres) nested subplots. There is one subplot located at the plot center and four subplots each in a cardinal direction and 133.9 feet from the center of the plot (See Figure 331). In addition, at each subplot potential natural vegetation is determined using plant indicator keys, and coarse woody debris is measured along a transect. For specific information on the attributes that are collected refer to USDI BLM 2001).

Figure 331. CVS Plot Design



The location of most of the plot centers have differentially corrected GPS coordinates. Since each subplot center was located at a precise distance from the plot center, the coordinates for the subplot centers were calculated and included in a GIS layer. The CVS layer was overlain on the Forest Operation Inventory GIS map. The CVS layer is independent of the FOI layer; consequently, the CVS data represents an unbiased sampling of the FOI layer. In the graphic below the cross hair dot symbols are examples of CVS plot center locations on a 1.7 mile grid. The Forest Operations Inventory units are outlined for approximately a four and half by three mile area.

Figure 332. CVS Plot overlain with Forest Operations Inventory.



Use of the Inventory Data in the Modeling

Introduction

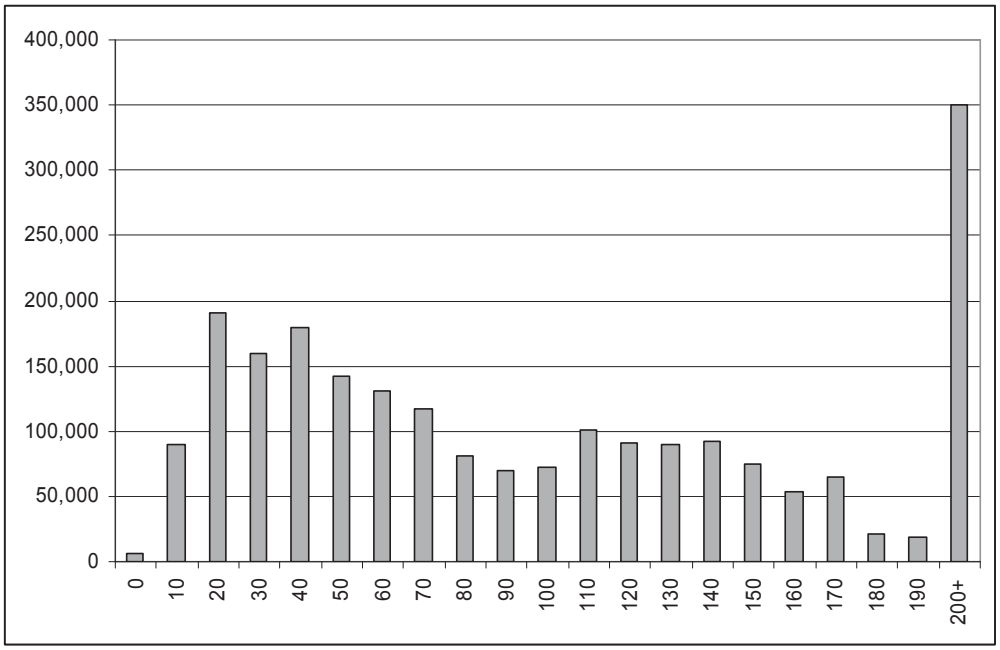
The Forest Operations Inventory (GIS vegetation units) and the Current Vegetation Survey data (measured inventory plots) were divided into stratification units to identify groups of stands with like characteristics. The stratification was based upon Existing Stand Conditions (ESC), site class, stand age, and species groups. This stratification of the data carried forward into both the DBORGANON and OPTIONS modeling. DBORGANON is a version of the ORGANON growth and yield model customized for BLM by FORsight Resources. DBORGANON is discussed in more detail in the Growth and Yield section of this appendix.

Stratification of Forest Operation Inventory

Stand Age

For every Forest Operations Inventory unit there is a stand age recorded in the Micro*Storms database. The stand ages reflect the conditions of the forest as of 2006. A ten year age class was derived from these stand ages which served as the starting ages for the OPTIONS model. For multi-storied stands the ten year age class was assigned to the predominant layer that is being managed. Stand ages over 200 years of age are in 50 year bands. All regeneration harvest timber sales sold by September 30th, 2005 were considered depleted from the inventory and the stand ages were converted to year zero for OPTIONS modeling. Stand ages were not assigned to the Klamath Falls eastside management lands. Update instructions for the Forest Operations Inventory were issued to the districts through BLM Information Bulletin No. OR-2005–142 http://web.or.blm.gov/records/ib/2005/ib-or-2005-142.pdf

Figure 333. Western Oregon Age Class Distribution 2006 (Acres).



Western Oregon Age Class Distribution 2006 by Sustained Yield Unit (Acres)

Age Class	Salem	Eugene	Roseburg	Coos Bay	Medford	Klamath	Total
0	273	110	1,374	1,311	3,654	0	6,722
10	13,172	12,108	23,079	16,176	24,742	969	90,247
20	32,098	30,163	37,483	31,292	56,403	3,483	190,922
30	34,395	31,666	39,203	32,757	20,328	1,595	159,944
40	35,946	32,071	32,483	37,476	38,329	2,578	178,883
50	23,067	27,581	29,673	28,794	30,865	1,731	141,710
60	41,409	41,547	13,198	12,676	20,213	1,913	130,956
70	30,922	29,659	8,997	15,946	28,680	2,699	116,902
80	22,908	12,567	5,387	9,272	26,627	3,905	80,667
90	13,738	6,701	5,584	3,519	35,325	5,365	70,232
100	12,047	4,423	5,607	4,161	42,860	3,421	72,519
110	12,393	6,021	12,661	3,576	62,101	4,216	100,968
120	20,751	7,949	6,573	9,223	44,948	1,908	91,353
130	20,598	6,204	7,679	10,557	43,225	1,048	89,311
140	9,165	1,623	11,233	5,528	62,066	2,797	92,412
150	7,502	1,223	25,360	8,570	30,226	2,046	74,927
160	1,876	2,073	2,310	7,321	39,218	455	53,253
170	2,756	400	8,285	3,810	49,008	396	64,655
180	429	424	1,552	635	17,796	70	20,906
190	201	3,952	2,497	1,739	9,969	92	18,450
200+	29,625	37,571	118,961	57,372	101,156	6,056	350,740
Total	365,272	296,036	399,180	301,710	787,740	46,742	2,196,679

Existing Stand Conditions (ESC)

The Existing Stand Condition coding aggregated Forest Operations inventory based on past management history and similar stand conditions. The Micro*Storms database was used to classify each of the Forest Operations Inventory units into one of the existing stand condition codes. This stratification was done prior to beginning the DBORGANON and OPTIONS modeling. Further collapsing of the ESC coding was done to formulate the DBORGANON and OPTIONS modeling groups.

PROPOSED Existing Stand Condition (ESC) Codes - WOPR					REVISED as of 11/13/2005	
2005 ESC Code	**1994 ESC Code**	**Description**	**Genetic Improved**	**Fertilized**	**Era Stand Created/ Treated**	**Remarks**
1	1	GFMA target stocking (>= 80%) & 250 to 400 TPA density (unimproved TI)			1950 to 1995	previously regen harvested without retention trees including pre-RMP stands with 2 dispersed retention trees per acre
2	6	GFMA target stocking (>= 80%) & 250 to 400 TPA density (unimproved TI) FERTILIZED		X	1950 to 1995	
3	2	GFMA minimum stocking (60-79%) - 150 to 249 TPA density (unimproved TI)			1950 to 1995	
4	6	GFMA minimum stocking (60-79%) - 150 to 249 TPA density (unimproved TI) FERTILIZED		X	1950 to 1995	
5	3	GFMA below minimum stocking (< 60%) - 50 to 149 TPA density (unimproved TI)			1950 to 1995	
6	4	GFMA Overstocked/overdense - > 400 TPA density (unimproved TI)			1950 to 1995	
7	5	GFMA target stocking (>= 80%) & 250 to 400 TPA density (TI genetic stock)	X		1950 to 1995	
8	6	GFMA target stocking (>= 80%) & 250 to 400 TPA density (TI genetic stock) FERTILIZED	X	X	1950 to 1995	
9	5	GFMA minimum stocking (60-79%) - 150 to 250 TPA density (TI genetic stock)	X		1950 to 1995	
10	6	GFMA minimum stocking (60-79%) - 150 to 250 TPA density (TI genetic stock) FERTILIZED	X	X	1950 to 1995	
11	5	GFMA below minimum stocking (< 60%) - 50 to 149 TPA density (TI genetic stock)	X		1950 to 1995	

PROPOSED Existing Stand Condition (ESC) Codes - WOPR					REVISED as of 11/13/2005	
2005 ESC Code	**1994 ESC Code**	**Description**	**Genetic Improved**	**Fertilized**	**Era Stand Created/ Treated**	**Remarks**
13	n/a	6-8 retention trees - at GFMA target stocking & density (TI genetic stock)	X		1996 to 2005	previously regen harvested with low (6-8 TPA) retention trees level
14	n/a	6-8 retention trees - at GFMA minimum stocking & density (TI genetic stock)	X		1996 to 2005	
15	n/a	6-8 retention trees - below GFMA minimum stocking & density (TI genetic stock)	X		1996 to 2005	
16	n/a	6-8 retention trees - Overstocked GFMA standard- need PCT (TI genetic stock)	X		1996 to 2005	
17	n/a	6-8 retention trees - at GFMA target stocking & density (unimproved stock TI)			1996 to 2005	
18	n/a	6-8 retention trees - at GFMA minimum stocking & density (unimproved stock TI)			1996 to 2005	
19	n/a	6-8 retention trees - below GFMA minimum stocking & density (unimproved stock TI)			1996 to 2005	
20	n/a	6-8 retention trees - overstocked GFMA standard- need PCT (unimproved stock)			1996 to 2005	
21	n/a	12-18 retention trees - at GFMA target stocking & density (TI genetic stock)	X		1996 to 2005	previously regen harvested with moderate (12-18 TPA) retention trees level
22	n/a	12-18 retention trees - at GFMA minimum stocking & density (TI genetic stock)	X		1996 to 2005	
23	n/a	12-18 retention trees - below GFMA minimum stocking & density (TI genetic stock)	X		1996 to 2005	

PROPOSED Existing Stand Condition (ESC) Codes - WOPR					REVISED as of 11/13/2005	
2005 ESC Code	**1994 ESC Code**	**Description**	**Genetic Improved**	**Fertilized**	**Era Stand Created/ Treated**	**Remarks**
25	n/a	12-18 retention trees - at GFMA target stocking & density (unimproved stock TI)			1996 to 2005	previously regen harvested with moderate (12-18 TPA) retention trees level
26	n/a	12-18 retention trees - at GFMA minimum stocking & density (unimproved stock TI)			1996 to 2005	
27	n/a	12-18 retention trees - below GFMA minimum stocking & density (unimproved stock TI)			1996 to 2005	
28	n/a	12-18 retention trees - overstocked GFMA standard- need PCT (unimproved stock TI)			1996 to 2005	
30	n/a	Density Mgt at age class 30			1996 to 2005	low/variable residual density commercial thinnings (immediate post-thin Curtis RD < 35)
31	n/a	Density Mgt at age class 40			1996 to 2005	
32	n/a	Density Mgt at age class 50			1996 to 2005	
33	n/a	Density Mgt at age class 60			1996 to 2005	
34	n/a	Density Mgt at age class 70			1996 to 2005	
35	n/a	Density Mgt at age class 80			1996 to 2005	
36	n/a	Density Mgt at age class 90 Plus			1996 to 2005	

PROPOSED Existing Stand Condition (ESC) Codes - WOPR					REVISED as of 11/13/2005	
2005 ESC Code	**1994 ESC Code**	**Description**	**Genetic Improved**	**Fertilized**	**Era Stand Created/ Treated**	**Remarks**
37	10	CTed at age class 30			1950 to 2005	moderate/high residual density commercial thinnings (immediate post-thin Curtis RD > 35)
38	11	CTed & fertilized at age class 30		X	1950 to 2005	
39	12	CTed at age class 40			1950 to 2005	
40	13	CTed & fertilized at age class 40		X	1950 to 2005	
41	14	CTed at age class 50			1950 to 2005	
42	15	CTed & fertilized at age class 50		X	1950 to 2005	
43	16	CTed at age class 60			1950 to 2005	
44	17	CTed & fertilized at age class 60		X	1950 to 2005	
46	19	CTed & fertilized at age class 70		X	1950 to 2005	
47	20	CTed at age class 80			1950 to 2005	
48	22	CTed at age class 90			1950 to 2005	
49	n/a	CTed at age class 100			1950 to 2005	
50	n/a	CTed at age class 110			1950 to 2005	moderate/high residual density commercial thinnings (immediate post-thin Curtis RD > 35)
51	30	Mortality Salvaged or Sanitation Cut			Pre-RMP	
52	40	56 to 500 years-old, no past silvicultural treatment			< 1950	unmanaged stands created prior to 1950
53	50	Brushfield, hardwood, noncommercial conifer or backlog conversion opportunity			Any	
54	60	Sold but not cut - regeneration harvest			Any	includes all unharvested litigated & unawarded sales
55	61	Cut, needs site preparation			Any	
56	62	Site prepped, needs regeneration			Any	
57	99	Nonforest			Any	

PROPOSED Existing Stand Condition (ESC) Codes - WOPR					REVISED as of 11/13/2005	
2005 ESC Code	**1994 ESC Code**	**Description**	**Genetic Improved**	**Fertilized**	**Era Stand Created/ Treated**	**Remarks**
58	n/a	> 18/15 retention trees/acre - at GFMA target stocking & density (TI genetic stock)	X		1950 to 2005	Non SW Oregon - previously regen harvested with high (19-25 TPA) retention trees level SW Oregon - previously regen harvested with high (16-25 TPA) retention trees level
59	n/a	> 18 /15 retention trees/acre - at GFMA minimum stocking & density (TI genetic stock)	X		1950 to 2005	
60	n/a	> 18/ 15 retention trees/acre - below GFMA minimum stocking & density (TI genetic stock)	X		1950 to 2005	
61	n/a	> 18 /15 retention trees/acre - Overstocked GFMA standard- need PCT (TI genetic stock)	X		1950 to 2005	
62	n/a	> 18 /15 retention trees/acre - at GFMA target stocking & density (unimproved stock TI)			1950 to 2005	
63	n/a	> 18 /15 retention trees/acre - at GFMA minimum stocking & density (unimproved stock TI)			1950 to 2005	Non SW Oregon - previously regen harvested with high (19-25 TPA) retention trees level SW Oregon - previously regen harvested with high (16-25 TPA) retention trees level
64	n/a	> 18 /15retention trees/acre - below GFMA minimum stocking & density (unimproved stock TI)			1950 to 2005	
65	n/a	> 18 /15 retention trees/acre - overstocked GFMA standard- need PCT (unimproved stock TI)			1950 to 2005	
66	80	Hardwood-Suitable Woodland CFL			Any	Woodland
67	81	Conifer-Suitable Woodland CFL			Any	
68	85	Hardwood-NonSuitable Woodland CFL			Any	

PROPOSED Existing Stand Condition (ESC) Codes - WOPR					REVISED as of 11/13/2005	
2005 ESC Code	**1994 ESC Code**	**Description**	**Genetic Improved**	**Fertilized**	**Era Stand Created/ Treated**	**Remarks**
69	86	Conifer-NonSuitable Woodland CFL			Any	
70	89	Hardwood-Suitable Woodland NonCFL			Any	
71	90	Conifer-Suitable Woodland NonCFL			Any	
72	n/a	GFMA target stocking (>= 80%) & 250 to 400 TPA density (unimproved TI) PRUNED			1950 to 1995	previously regen harvested without retention trees including pre-RMP stands with 2 dispersed retention trees per acre PRUNED for wood quality only
73	n/a	GFMA target stocking (>= 80%) & 250 to 400 TPA density (unimproved TI) FERTILIZED PRUNED		X	1950 to 1995	
74	n/a	GFMA minimum stocking (60-79%) - 150 to 249 TPA density (unimproved TI) PRUNED			1950 to 1995	
75	n/a	GFMA minimum stocking (60-79%) - 150 to 249 TPA density (unimproved TI) FERTILIZED PRUNED		X	1950 to 1995	
77	n/a	GFMA target stocking (>= 80%) & 250 to 400 TPA density (TI genetic stock) FERTILIZED PRUNED	X	X	1950 to 1995	previously regen harvested without retention trees including pre-RMP stands with 2 dispersed retention trees per acre PRUNED for wood quality only
78	n/a	GFMA minimum stocking (60-79%) - 150 to 250 TPA density (TI genetic stock) PRUNED	X		1950 to 1995	
79	n/a	GFMA minimum stocking (60-79%) - 150 to 250 TPA density (TI genetic stock) FERTILIZED PRUNED	X	X	1950 to 1995	
		Medford and Klamath Falls common codes from 1994 PRMP & Proposed ESC for Southern GFMA				
		Woodland codes may be applicable to all districts				

No Action Alternative Exsiting Stand Condtion Acres by Sustained Yield Unit

ESC	Salem	Eugene	Roseburg	Coos Bay	Medford	Klamath	E. Mgt. Lands	Grand Total
1	83,348	60,695	57,832	31,920	92,475	6,635	398	333,303
2	14,241	11,706	32,549	29,367	9,614			97,476
3	30,299	31,441	28,320	29,331	18,634			138,026
4	1,662	6,464	6,502	16,663	5,269			36,559
5	2,004	222	644	8,383	6,012			17,266
6	14,057	1,269	23,182	6,899	1,811			47,218
7	4,034	13,481	2,158	6,615				26,288
8	338			487	2,037			2,862
9	1,132	231	870	4,576	539			7,348
10	18			380	15			413
11	43	314	1,023	910	211			2,501
12	2,789		1,346	3,443				7,578
13	512	1,983	342	153				2,989
14	13		154					167
16	672		557	778				2,007
17	200		1,135	157	12,178			13,670
18	37		152	20	5,717	19		5,946
19			19		2,254			2,273
20	275		218	424				917
21	62	430						491
22	250							250
24	86		37					123
25	18		19		617	189	2,750	3,592
26	3				225			228
27					77			77
28	46		212					258
30				908	7	683		1,598
31		72	201	1,853	206	2,214		4,547
32	39	676	507	1,139	229	1,437	112	4,138
33	1,123	990	845	809	149	1,362	782	6,059
34	297	754	102	316	839	2,384	629	5,321
35				330	822	3,485	1,183	5,820
36	49			148	9,473	18,482	9,811	37,962
37	458	52	159	313	105			1,087
38	35			131	98			264
39	3,277	851	2,218	992	145			7,483
40	16	283		956				1,255
41	8,935	4,163	3,154	1,919	238			18,408
42	1,766	856	9	2,633				5,265
43	8,201	5,683	2,023	843	204			16,955
44	824	1,049		831				2,704
45	5,674	2,778	1,438		876			10,765
46	354	445	121					919
47	8,252	519	595	120	993			10,480
48	6,643	247	156	6	1,166			8,218
49	824	37	32		2,732			3,624
50	779		170	36	6,793			7,778
51		888	5,330	125	20,481	4,546		31,370
52	186,872	154,570	224,927	144,923	376,391	1,445	171	1,089,298
53		5,248	2,659	8,598	5,906	676	1,265	24,351
54	147		548	909	1,320			2,924
55	133	71		307				511
56		30	249	167				446
57	10,500	2,790	7,711	4,499	42,014	2,131	74,399	144,045
62					53			53
64					79			79
66					2,353			2,353
67					67,045	152	24	67,221
68			5,661		715	62		6,439
69		7	1,145	1,046	39,161	414	4,289	46,063
70					40,972	947	64	41,984
71					87,314	4,043	77,026	168,383
72	622	939	1,471	754	58			3,845
73	224	25	731	1,117	12			2,109
74			2,206	766	56			3,028
75			1,705	2,242				3,947
76			166	467				633
77				46				46
78				349				349
79			82	65				147
Total	402,184	312,261	423,589	321,167	866,694	51,306	172,903	2,550,103

Species Groups

The Micro*Storms database has a listing of the top 5 species within each stand layer with a ranking of relative abundance. This data was utilized to classify each Forest Operations Inventory Unit into one of the following species groups for modeling purposes. The Micro*Storms species group stratification was a starting point. For the OPTIONS and ORGANON modeling some species groups were combined to attain adequate representation by the Current Vegetation Survey plots.

Douglas-fir (DF)

This species group includes stands with single species DF listed, and those stands with minor quantities of either other conifers or hardwoods. They would typically be "FCO" stands (forest conifer), and have either single or multiple sizes and ages indicated.

Northern True Fir (N_TF)

Stands of Noble or Silver fir, including with other species mixed in such as Douglas-fir, western hemlock, or western redcedar, but where Silver or Noble are dominant.

Northern Mixed Conifer (N_MX_CON)

This species group includes stands with single species of western hemlock, western redcedar, Sitka spruce, or mixed conifer stands where Douglas-fir would not be the dominant species. They would typically be "FCO" stands (forest - conifer).

Northern Conifer / Hardwood Mix (N_CON_HWD)

These stands would have both conifer and hardwood species listed. Neither conifer nor hardwood would dominate these stands. Conifers or hardwoods could be indicated in the dominant or secondary position. Hardwoods would include big leaf maple and red alder mixed with conifer species. Many FMX stands (forest - conifer and hardwoods) would be located here.

Northern Hardwood (N_HWD)

Maple/alder mixes and pure alder are here. Pure or nearly pure alder stands, with limited maple fractions. FHD stand (forest - hardwoods) descriptions are here.

Southern Mixed Conifer (S_MX_CON)

Stands containing incense cedar, sugar pine, Ponderosa pine, Douglas-fir and white fir in varying fractions, but not including pure types without any secondary species indicated. This type may include some hardwood component but less than the southern conifer/hardwood mix. Hardwoods would not be listed as the dominant species.

Southern Conifer / Hardwood Mix. (S_CON_HWD)

This type consists of stands with the mixed conifer species, but with southern hardwoods such as oak, madrone, tanoak, myrtle, etc mixed in. The hardwoods may be in the majority or minority. FMX types (forest - conifer and hardwoods) are here.

Southern Hardwood (S_HWD)

This type consists primarily of southern hardwood species with limited mixed conifer component. Hardwoods would comprise the dominant species, possibly FHD types (forest - conifer and hardwoods).

Southern True fir (S_TF)

Shasta red fir and white fir types would be here. White fir types could have other secondary species such as Douglas-fir.

Ponderosa Pine (PP)

Stands with dominant Ponderosa pine. Stands with Douglas-fir or other species in the understory would be here, if not the dominant species. This would include dryer types with juniper as long as the Ponderosa pine was the dominant species.

Juniper (J)

Types with juniper dominant. This type would contain some with limited pine on dryer lower site types.

Depending on the district and the ORGANON variant used, lodgepole pine and knobcone pine types would go into Northern Mixed Conifer or Southern Mixed Conifer. Jeffery pine would go into a low site Ponderosa pine type. Mountain hemlock would go into northern true fir. Port-Orford-cedar would go into Southern Mixed Conifer.

Figure 334. Species Group by District – Forested Acres

Species Group	Salem	Eugene	Roseburg	Coos Bay	Medford	Kfalls	W. Oregon	
DF	284,856	247,212	300,796	250,087	396,459		1,479,411	64%
N_CON_HWD	54,316	40,127	8,883	27,751			131,076	6%
N_HWD	12,506	4,473	596	5,929			23,504	1%
N_MX_CON	17,163	8,127	327	1,818			27,434	1%
N_TF	9,935						9,935	0%
PP			1,437		57,445	33,544	92,426	4%
S_CON_HWD			28,341	11,206	159,802	2,125	201,474	9%
S_HWD			2,768	2,214	39,740		44,722	2%
S_MX_CON			57,653	734	118,473	29,262	206,122	9%
S_TF					21,170	8,277	29,446	1%
J						71,891	71,891	3%
Total	378,775	299,939	400,802	299,738	793,089	145,098	2,317,442	100%

Site Class

Site Class data in the Micro*Storms database / Forest Operation Inventory (FOI) come from a variety of sources, including estimations, measured on site, and or soils mapping. The site class data in FOI is adequate for a general relative portrayal of productivity but due to the variety of sources it is of varying accuracy.

Site index data was measured on the CVS inventory at the plot level. Assignment of site index to the subplot level was made at the time of data collection. Using a site index conversion routine created by Mark Hanus (FORSight Resources), all measured site data for all species and base ages was converted to a Douglas-fir, 50-year base index, using King (1966) for Northwest Oregon, and Hann-Scrivani (1987) for SW Oregon.

It was assumed that the best representation for range of site productivity values and relative proportions of these values are the CVS data for areas as large as those occupied by combined species group within an SYU. The Measured CVS data was used to re-distribute the FOI site class data to reflect the profile of the measured data. Assignment from the CVS to the FOI was based on a set of rules. These data were apportioned to each sustained yield unit forest land base at the FOI unit level. Existing measured site index data from the Micro*Storms / FOI were retained for individual FOI units. For the remaining FOI units, site productivity values were assigned to all stands in the forest land base in such a manner to approximate the expanded CVS distribution for species groups at the SYU level. These FOI unit-level productivity assignments were held constant for the OPTIONS modeling of all alternatives and sub-alternatives.

Methodology for Site Class Re-Distribution - CVS to the FOI

The following methodology was applied at the district level to achieve a similar distribution of acres by species group and site productivity in the inventory as was present within the CVS information.

Source Information:

A Microsoft Excel spreadsheet, with the following information, was prepared for each district:

- CVS Plot Number – unique plot number
- CVS District – the district for the plot
- CVS Species Group – the super species group for the plot
- CVS Site Productivity – the site productive class for the plot

- FOI Number – unique inventory number
- FOI Site Index Conversion Code – the conversion method used to calculate the Douglas-fir, 50-year base index
- FOI District – the district for the FOI
- FOI Species Group – the super species group for the FOI
- FOI Site Productivity – the site productivity class for the FOI
- FOI Acres – the acres for the FOI
- FOI ORGANON Variant - the ORGANON Variant for the FOI

Assumptions:

A) FOI with measured site index information are not redistributed.

B) FOI polygons are treated as whole units. An FOI polygon can not be split in order to achieve desired acre redistribution.

C) Redistribution of acres can not result in an excess of acres over the desired target.

D) Species Groups identified as 'NF' (non-forest) were not redistributed

E) If either CVS or FOI information was not available, then no redistribution would occur, i.e. both CVS and FOI information must be available for redistribution to occur.

Methodology:

1. Using the source CVS information, for each district (SYU) and species group (SSPG) combination, determine the percent distribution of plots within each site productivity class (SP). For example:

SYU_SSPG	SYU_SSPG_SP	# of Plots in SYU_SSPG	# of Plots in SYU_SSPG_SP	% Distribution
Coos Bay_ NDF	Coos Bay_NDF_1	673	132	20
Coos Bay_ NDF	Coos Bay_NDF_2	673	273	41
Coos Bay_ NDF	Coos Bay_NDF_3	673	182	27
Coos Bay_ NDF	Coos Bay_NDF_4	673	61	9
Coos Bay_ NDF	Coos Bay_NDF_5	673	25	3

2. Using the FOI information, for each district (SYU) and species group (SSPG) combination, determine percent distribution of acres within each site productivity class (SP). For example:

SUY_SSPG	SYU_SSPG_SP	Total Acres in SYU_SSPG	Total Acres in SYU_SSPG_SP	% Distribution
Coos Bay_ NDF	Coos Bay_NDF_1	254347	38372	15
Coos Bay_ NDF	Coos Bay_NDF_2	254347	133575	53
Coos Bay_ NDF	Coos Bay_NDF_3	254347	68960	27
Coos Bay_ NDF	Coos Bay_NDF_4	254347	13440	5
Coos Bay_ NDF	Coos Bay_NDF_5	254347	0	0

3. Redistribute FOI acres between site productivity classes within the district species group to obtain the same percent distribution as indicated by the CVS information. Beginning redistribution starting with the highest site (1) and progress to the lowest site (5) as follows:

    a) Identify initial acres based on FOI information for the desired site productivity class

    b) Determine target acres based on percent distribution from CVS information for the desired site productivity class.

    c) If the initial acres are less then the target acres, then reassign acres from the next lowest site productivity class to the desired site productivity class until the target acres are met (but not exceeded). Acres from each subsequent site productivity class are reassigned until the target acres are achieved.

In our example, for site productivity class 1, the initial 38,372 acres is less than the target acres of 50,869. Therefore, approximately 12,500 acres from productivity class 2 are reassigned to site productivity class 1.

    d) If the initial acres are greater then the target acres, then reassign acres from the current site productivity class to the next successively lower site productivity class until the target is met (but not exceeded).

If our example was reversed and the initial acres for site productivity class were 50,869, then approximately 12,500 acres would be reassigned to site productivity class 2.

SYU_SSPG_SP	Total Acres in SYU_SSPG	Target %	Target Acres	Resulting Redistributed Acres	Resulting Redistributed % Distribution
Coos Bay_NDF_1	254347	0.20	50869	50884	20
Coos Bay_NDF_2	254347	0.41	104282	104224	41
Coos Bay_NDF_3	254347	0.27	68674	68324	27
Coos Bay_NDF_4	254347	0.09	22891	22538	9
Coos Bay_NDF_5	254347	0.03	7630	8376	3

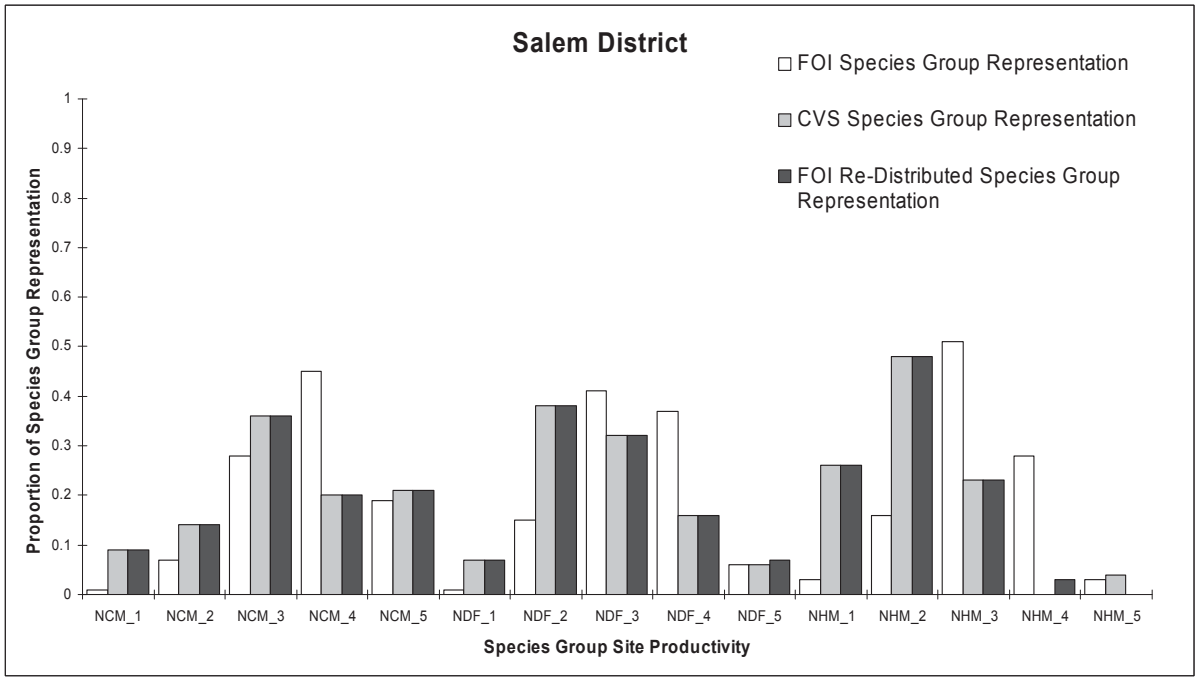
4. For each FOI, reassign the corresponding mid-point site index value based on the new site productivity class and ORGANON variant code.

   1: Southwest Oregon (SWO)

   2: Northwest Oregon (NWO)

Site Productivity Class Midpoints by ORGANON Variant Code	2	1
5	70	60
4	85	75
3	105	95
2	125	115
1	140	130

Figure 335. Salem District Site Class Re-Distribution Example (Species Groups NCM – Northern Conifer Mixed, NDF – Northern Douglas-Fir, NHM – Northern Hardwood Mixed).



Collapsing the Stratification into Modeling Groups

Both the Forest Operation Inventory (FOI) and Current Vegetation Survey (CVS) had an initial stratification based on stand age, existing stand condition (ESC), site productivity class, and species groups. Modeling Groups were developed to aggregate like types which represented significant quantities of the FOI acres and to assure there was sufficient measured data from CVS for each group.

The modeling groups were developed to:

- Classify the CVS data for the development of growth and yield curves with the ORGANON model for each Modeling Group.
- Provide a consistent linkage between the growth and yield data from ORGANON with the Forest Operation Inventory (FOI) for configuration, projection and the OPTIONS modeling.

The first step in the process involved grouping the CVS subplots, by ORGANON variant, into strata of similar forest, past treatment, and productivity types. For each CVS subplot, the forest type and past treatment data was extracted from the FOI. The forest type was an assignment of a species group which had been derived by district personnel thru a series of queries on stand level information.

The past treatment groupings consisted of stands with similar management histories or trajectories. This designation was based on their existing stand condition data which had been reviewed and brought up to date (as of September 30, 2005) by district personnel. The third consideration used in this stratification process was the productivity level (50-year Douglas-fir Site Class) assigned to each CVS subplot.

DBORGANON variants for Northwest (NWO) and Southwestern Oregon (SWO) were split primarily on District boundaries. The Salem, Eugene and Coos Bay districts are being assigned to the NWO variant, with one exception. The southern portion of Coos Bay District which lies primarily in the Tanoak Zone was assigned to SWO for modeling. Roseburg, Medford and Lakeview districts were assigned to the SWO variant, again with one exception. Within the northwest portion of Roseburg district, some CVS subplots and a companion set of FOI units were within stands designated as species groups modeled only in the NWO variant.

Figure 336. Organon Variants

The stratification process involved partitioning the entire planning area, sampled by the over 5,300 forested CVS inventory plots, into logical modeling groups. This process involved a multi-day session with a workgroup of district personnel including but not limited to silviculture, timber and inventory specialists. A majority of these same district personnel were in a subsequent stage of the project, involved in development of the Guide and Treatment Curves modeling the grouped CVS data with DBORGANON. Through an iterative process, the number of modeling groups with fewer than 30 subplots was minimized. Out of the final 53 existing-stand modeling groups, 22 for NWO and 31 for SWO, only 2 had fewer than 30 subplots.

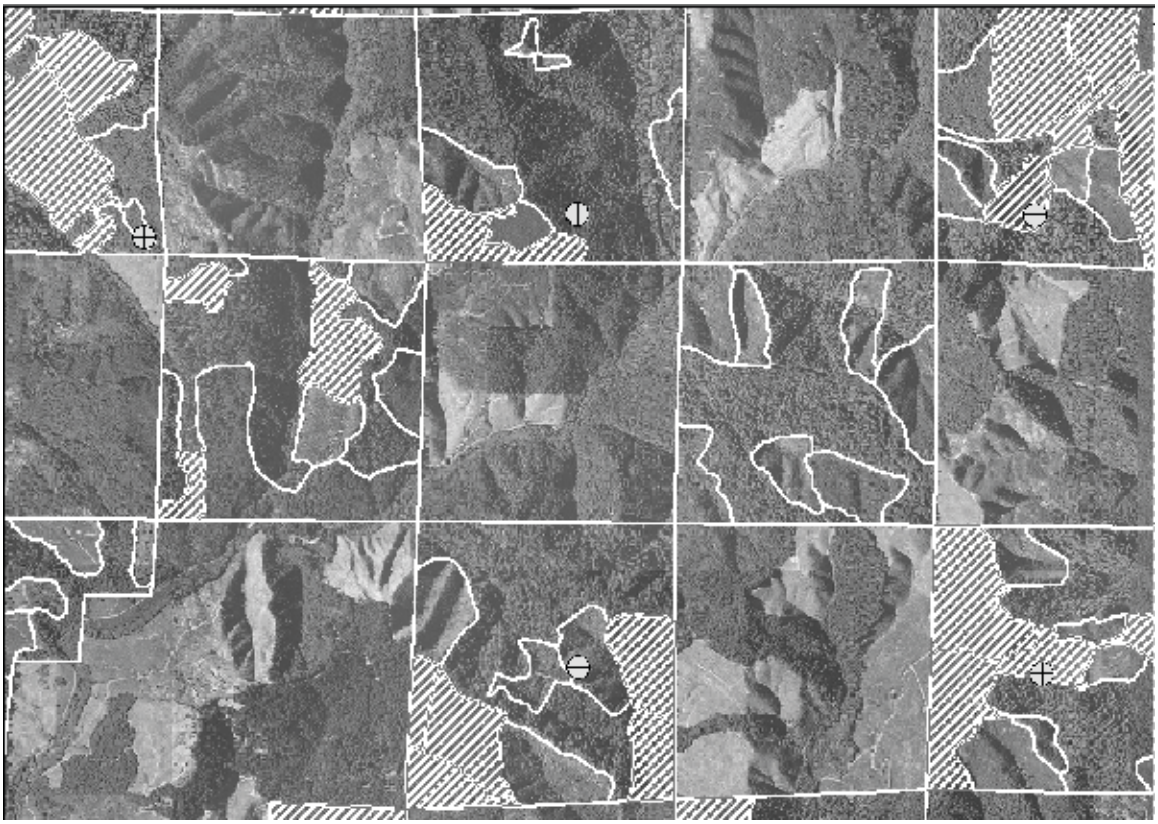
Imputing Data from Current Vegetation Survey (CVS) to the Forest Operation Inventory (FOI)

The objective was to create summary information for each Forest Operation Inventory (FOI) unit within the forested landbase and to mimic the natural variation that exists among the FOI units. There is information to stratify each of the FOI units into Existing Stand Condition (ESC), Site Class, Age and Species Groups. There is CVS data for nearly every combination of characteristics found on BLM lands but there are FOI units without CVS data.

Information from the FOI: Existing Stand Condition (ESC), redistributed site productivity, stand age and species group, were used to stratify both the FOI and CVS. The combination of ESC, site class, age and species groups are non-overlapping strata. The resultant spatial relationship between the CVS plots and the FOI creates a stratified random sample of the plots with unequal number of subplots per plot. The CVS data within each of the characteristic combination represents an unbiased collection of data for that stratum.

In the Figure below, the two plots on the right fall within the selected stratum (cross-hatched). These represent stands with common ESC, site productivity class and species groups.

Figure 337. Example of CVS plots and FOI Units with a common existing stand condition.

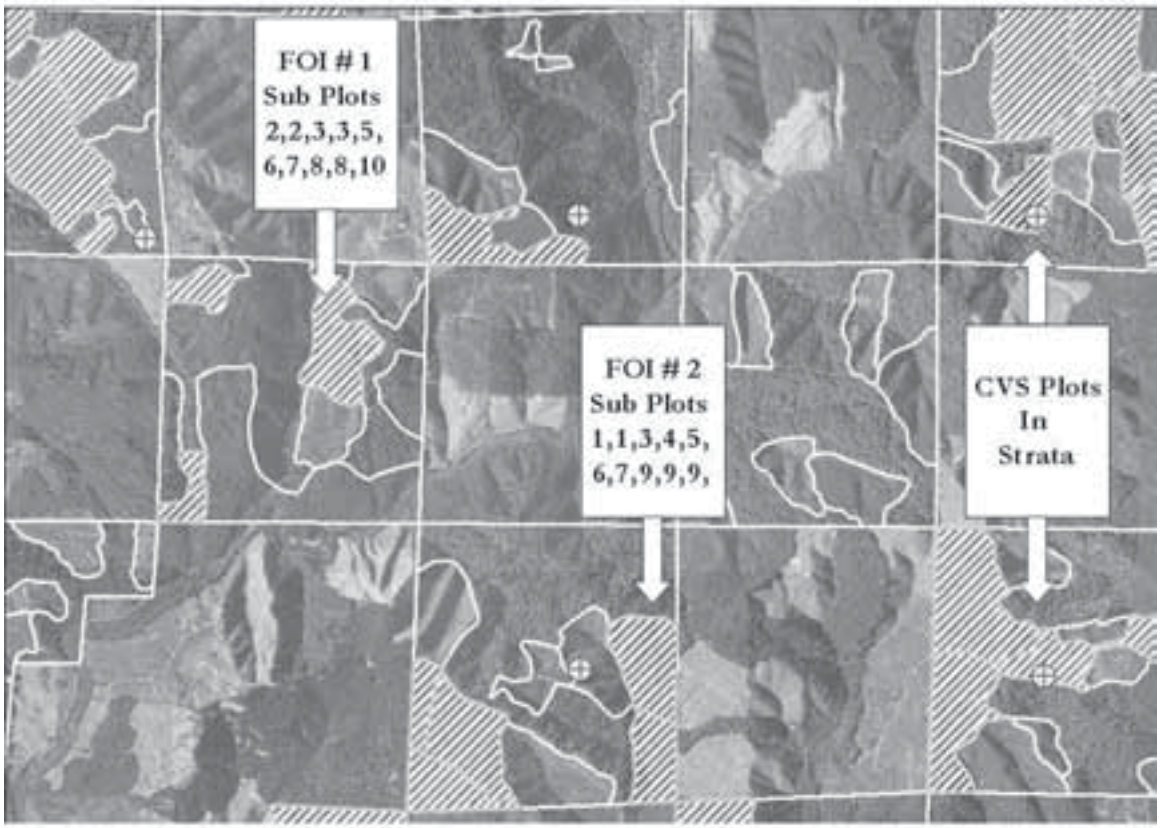


The collection of CVS subplots that fell within the same stratum (defined by ESC, site productivity class and species groups but including different age categories) were projected with no future silvicultural treatments applied. This produced a smooth empirical curve that borrowed strength from adjacent age categories with more data to predict the current inventories for ages with less data.

To derive a set of stand attributes fore each forested FOI unit, the subplots that fell within each stratum (ESC, site class, species group and age) were pooled and the subplots were drawn with replacement equal to the number of subplots within the category. If the number of subplots exceeded 30, then the summary information was calculated using the tree lists associated with each selected subplot and the summary information was assigned to an FOI unit. This process was repeated for each FOI unit within the stratum. This technique imputes values into each FOI unit.

Below is an example of two FOI units that have been assigned 10 subplots with replacement from an original list of subplots numbered from 1 to10.

Figure 338. Examples of subplot data imputed into FOI units



If the number of subplots within a stratum was less than 30, a shrinkage estimate was employed where the predicted attributed associated with the category was combined with the imputed summary statistic and combined estimate was assigned to the FOI unit. The shrinkage estimate can best be illustrated by an example. Say there were 20 CVS subplots within a category, the shrinkage estimate is:

20/30 x CVS statistics + (30-20)/30 x modeled predicted values.

As the number of subplots approach 30, most of the information comes from the CVS data. Conversely if there were relatively few CVS subplots, then the majority of the information came from the ORGANON model. This method was repeated for each FOI unit with the category.

The stratification for the forested FOI units was the basis for applying the CVS derived values for basal area, trees per acre, height, quadratic mean diameter, and board foot volume for the initial inventory in the OPTIONS modeling. The imputed initial inventory dataset provided a consistent basis for the OPTIONS modeling of all alternatives and sub-alternatives.

The use of the imputation provided attributes to the OPTIONS model which did not exist in the Forest Operations Inventory. Attributes assigned through imputation will not match

the characteristics of each individual stand as measured on the ground but the statistics applied to the grouping of stands in the population, is statistically sound. The use of imputation is an attempt to mimic the natural variation that exists among the stands. Although, no process can accurately reflect the actual variation short of conducting a 100 percent cruise, this process is seen as more realistic than assigning the mean value for these statistics to all FOI units within a group.

Application of the Stratification in Growth and Yield Modeling

Each CVS subplot tree list within an existing stand modeling group was projected in the ORGANON growth and yield model individually to simulate future development with and without future silvicultural treatments. Results from the simulations were averaged together to predict stand attributes at any point in time and to define an average yield function. This method is based on the fact that the CVS data represents a random sample of the modeling group hence the average of all projected curves for a modeling group represents the average projection for the FOI units within the modeling group. In OPTIONS terminology these average yield functions are the Guide Curves.

GIS – Defining the Land Base & Spatial Projections

Introduction

The Geographic Information System (GIS) data provides the OPTIONS model with a set of polygons with unique identifiers, covering BLM lands in the planning area. Each of these polygons has attribute data which is used in defining the land base for application of modeling rules for simulation of the alternatives and sub-alternatives. GIS is also used for mapping the OPTIONS projections results of the forest conditions over time. This section provides an overview of the GIS process. The type of GIS data that was used for analyzing the alternatives and how it was applied is covered in the OPTIONS modeling section. Details on the GIS processing and datasets themselves are recorded with the GIS metadata.–

Defining BLM Lands

The land lines theme (LLI) is the BLM corporate GIS layer for land status - O&C, Public Domain, Coos Bay Wagon Road. The Forest Operations Inventory (FOI) is the spatial vegetation layer used for the OPTIONS modeling. The Forest Operations Inventory and Land Lines themes are not vertically integrated in GIS which results in slivering in the areas of misalignment. For the analytical purposes, BLM lands are defined by the area in which the FOI and LLI overlap. This FOI & LLI mask was subsequently used to minimize the slivers from all GIS layers used in the analysis.

Figure 339. Differences between the FOI and LLI themes.

Acres		
FOI & LLI	2,550,000	100.00%
FOI Only	9,200	0.36%
LLI Only	8,200	0.32%

Intersection Versus Majority Rules

Where the subdivision of the FOI was important for simulating different modeling rules within each stand, within, the data layers were intersected in GIS to create unique areas. Riparian reserves and roads are good examples of this within stand subdivision which was important for simulating different modeling rules.

Some data layers came from external sources which were captured at coarser scales than the FOI mapping and do not align well with BLM checkerboard ownership. Northern Spotted Owl Critical Habitat Units is an example of this disparity between GIS data layers. In these situations, a majority rules analysis was performed where 50% or more of the FOI unit would need to coincide with the data theme, such as critical habitat, to receive the designation. This majority rules process was also applied to themes where spatial subdivision of FOI polygons was not needed and stand level designation was sufficient for the analysis.

Rasterizing and Unique ID Assignment

To facilitate GIS processing all vector GIS data layers were converted to a 10 by 10 meter raster cells (1 cell = .025 acres – UTM zone 10, NAD83) and the data was partitioned into tiles which were based on 24K USGS Quads (~ 35,000 acres, 6 miles east/west by 8.5 miles north/south). Within each tile every unique combination of GIS data layers was intersected with the Forest Operations Inventory received a unique identifier (WPR_ID). The example below illustrates one FOI unit (840369) being subdivided into 4 unique areas based on how riparian reserves and roads intersected the forest stand. This GIS subdivision of the forest stands allows the OPTIONS model to simulate how each of these portions of the stands would develop.

WPR_ID	FOI #	GIS ACRES	RIPARIAN RESERVE	ROAD BUFFER	DESCRIPTION
124000005	840369	28.84	N	N	Outside riparian reserve Outside of road buffer
124000008	840369	0.99	N	Y	Outside riparian reserve Within road buffer
124000004	840369	10.90	Y	N	Inside riparian reserve Outside of road buffer
124000013	840369	0.49	Y	Y	Inside riparian reserve Within road buffer

The unique ID (WPR_ID) carries through the OPTIONS modeling projections for the purpose of tracking each spatial entity. OPTIONS classification of allocations or projections of forest conditions were returned to GIS as attributes with the unique IDs which were linked back to the original grid to produce spatial products.

Data Vintage

A snap shot of the Forest Operations Inventory (FOI), Land Use Allocation (LUA), Timber Production Capability Classification (TPC), Occupied Marbled Murrelet Sites (OMMS), and the Landlines (LLI) data were captured for the Western Oregon Plan Revision (WOPR) analysis. The data represents the conditions as of 10/1/2005. The guidance on capture of this data was issued in the 2005 Information Bulletin IB-OR-2005-142. The other GIS datasets reflect the best available information at the time of the analysis.

GIS Data Themes

See the modeling rules section for further description of the GIS data themes used in the modeling.

Forest Growth and Yield Modeling

Introduction

The purpose of simulating forest stand growth and development is to permit analysis of the effects of different silvicultural systems and silvicultural practices on timber yield and stand structure. Modeling estimates are not intended to describe the structures and volumes of current stands which may be quite different (higher or lower in volume) than projected future stands depending on the kind of management questions explored in the analysis.

The yield tables described in this section were used in the OPTIONS model to produce a series of different Allowable Sale Quantity (ASQ) estimates for different management alternatives.

Two computer growth and yield simulation models; ORGANON and CONIFERS were used to project the growth and development of forest stands under various silvicultural prescriptions.

Organon Model Description

ORGANON is an individual-tree, distance-independent model developed by Oregon State University using data from western Oregon forest stands with ages of the dominant trees ranging from 10 to 120-years-old breast height age (Hann 2005). The architecture of the model makes it applicable for simulations of traditional and non-traditional silviculture (Hann 1998).

Simulations of stand growth of the WOPR silvicultural prescriptions extend beyond the ORGANON model's range of data. However, the timing of harvests and other silvicultural treatments generally occur within the range of the model's validated height growth projection and volume prediction capabilities. Height growth is the primary driving function in ORGANON (Ritchie 1999). Hann (1998) found that the ORGANON height growth equations can be extended to up to 245 years without loss of accuracy, or precision. Validation tests of ORGANON comparing projected volumes to those found in the published normal yield tables for predominantly Douglas-fir and mixed-conifer stands applicable to western Oregon and northern California indicated that ORGANON projected volumes were within the limits of the values found in "fully" stocked natural stands, out to stand ages of 160 to180-years-old, the upper data limit of the published normal yield table (Hann 1992).

Three variants of ORGANON are available for use in western Oregon, two of which were deemed appropriate for modeling conditions and proposed actions on BLM land. The northwest Oregon variant (NWO-ORGANON) was used to project the growth of forest stands located on the Salem, Eugene, Coos Bay and Roseburg Districts. The southwest Oregon variant (SWO-ORGANON) was used to project forest stand growth on the Roseburg, Coos Bay, Medford and Lakeview Districts.

The standard ORGANON configuration is not conducive to the efficient processing of large numbers of individual tree lists representing forest stands within a stratum, and merging simulation results to develop average timber yield functions. Also, the standard model does not produce specific stand structural characteristics that have utility for effects analysis on resources other than timber production, or for the incorporation of factors to simulate growth improvement of trees due to genetic improvement programs. FORsight Resources developed a version of ORGANON for BLM, referred to as DBORGANON, which incorporates all the basic ORGANON functions and meets the additional BLM requirements. DBORGANON was used to project the growth of forest stands greater than or equal to 15 years-old.

Conifers Model Description

CONIFERS is an individual-plant growth and yield simulator developed from young mixed-conifer stands in southern Oregon and northern California by the U.S. Forest Service. CONIFERS provides growth forecasts for young plantations of single species or mixed-species growing with or without competition from shrubs (Ritchie 2006). The growth of forest stands less than 15 years-old was simulated using the CONIFERS young stand growth model. The tree lists were exported to DBORGANON at stand age 15 years-old for further simulation.

Stand Modeling Process

The prediction of forest stand development requires the growth projection of BLM's *existing* forest stand types into the future, with and without further silvicultural treatments, and the simulation of stands which represent *future* stands, i.e., new stands created following timber harvest. Depending on the management direction of the alternatives, both existing and future stands may be subject to different intensities of silvicultural treatments.

Existing Stands Modeling Groups Description

The land base consists of *existing* forest stands, the result of past harvests and natural disturbances, of various ages, structures, past management histories and potential for forest management. Tree lists from Current Vegetation Survey (CVS) inventory subplots were stratified into modeling groups as described in section 2 of this appendix. Using DBORGANON, these modeling groups were used for depicting current stand condition and simulating future development with and without future silvicultural treatments.

Each individual CVS subplot tree list within a modeling group was projected by DBORGANON subject to a common silvicultural prescription to stand ages 200 or 400 years-old, depending on the initial range of stand ages in the various modeling groups or the requirements of an alternative. Modeling groups consisting of younger managed stands, generally less than 60 years-old, were generally projected to stand age of 200 years. Older stand modeling groups were projected to a stand age of 400 years to insure that all CVS plots would be incorporated into the simulation.

Each individual tree list entered the simulation at its current age. This resulted in some stands having a greater weight on the overall group average characteristics, depending on the distribution of plot ages in a particular modeling group.

Future Stands Modeling Groups Description

Modeling groups and tree lists for forest stand types or silvicultural prescriptions for which little or no specific CVS data existed, were developed from subsets of the CVS data and growth was modeled with CONIFERS.

Initial stand attributes for the future stands tree lists were derived from the 10 and 20 years-old age class CVS subplots, stratified by DBORGANON variant, species group and site class. It was assumed that the future young stand management intensity and tools available would be similar to the past two decades.

Review of the data indicated that the *future* stands could be represented by three basic modeling groups for the northwestern Oregon and six groups for the

southwestern Oregon. A single future stand tree list for each modeling group and site productivity was grown in CONIFERS to age 15 years-old, at which time the tree lists were exported to DBORGANON for further simulation. Projections were simulated to a stand age of 200 years-old, except for Alternative 3 where 400-year projections were required.

These future stand projections formed the basis for initiating *new* stands following regeneration harvests in all alternatives and the "partial" harvests in Alterative 3. The future stands category includes "existing" stand types created as a result of regeneration harvest prescriptions under the current BLM Resource Management Plans. There were an insufficient number of CVS subplots with this type of management for Guide Curve modeling. Therefore, it was necessary and appropriate to create tree lists for simulating those silvicultural prescriptions for existing and future stands under the Alternative NA.

For all alternatives, a special subset of modeling groups was developed for modeling future stands within geographic areas currently identified with a high incidence of Swiss needle cast disease. Future tree lists species composition in the Swiss needle cast zone was based on an assumption of higher proportions of disease resistant species being used for reforestation of harvested areas.

Types of Growth Curves

The results of DBORGANON growth projections are summarized in tabular form. Two types of curves are produced from DBORGANON simulations for further use by the OPTIONS model. The curves are referred to as *guide* and *treatment response* curves.

Guide Curves

Guide curves are used to provide guidance to the OPTIONS model with respect to growth curve shape and projection values. Simply stated, guide curves represent the growth projection of forest stands without any additional silvicultural treatments. Individual guide curves are developed for each modeling group which incorporates geographical province, species groups, current stand condition, and site productivity class. Future stand guide curves developed from CVS data were applicable to all alternatives. Separate guide curves reflecting two-aged silvicultural prescriptions were prepared for Alternatives NA and 3. Even-aged curves were developed for Alternatives 1, 2, and 3.

Treatment Response Curves

Treatment Response curves were used to adjust the guide curves to reflect the effects of various silvicultural treatments (see discussion of Treatment Response). Simulations were done to produce curves incorporating commercial thinning and fertilization treatments. Precommercial thinning of future stands was

incorporated into the initial ORGANON guide curve tree lists, so no growth response curves were necessary for that treatment type.

Silvicultural prescriptions incorporating commercial thinning were developed using the modeling groups with stands less than 60 years-old. Guide curve simulations were examined for each modeling group to determine the earliest average age when an initial commercial thinning was feasible.

Evaluation criteria included three factors 1) stand relative density (Curtis 1982), 2) attainment of minimum average stand diameter and 3) minimum harvestable volumes. For each modeling group simulations were done to determine the appropriate timing of treatment based on relative density rules. Proportional thinning is simulated when minimum criteria were met.

Relative density rules vary by land used allocation within alternatives. Silviculture prescriptions for land use allocations with timber production emphasis goals [Northern General Forest Management Area (Alternative NA); Timber Management Area (Alternatives 1 and 2) and General Landscape Area (Alternative 3) were thinned to maintain relative densities between 35 and 55. The final thinning should not prevent the recovery of relative density to a minimum of 55 at rotation age. Assumed rotation ages for treatment response simulations in timber emphasis land use allocations were based on *culmination of mean annual increment (CMAI)* and range from 100 to 125 years..

Commercial thinnings have been found to contribute to the establishment of conifer regeneration in the understory of thinned stands (Bailey and Tappeiner 1998). Simulation of the recruitment of this regeneration in the growth simulations was done to reflect expected stand dynamics following commercial thinning harvests. The ORGANON growth and yield model (Hann 2005) does not recognize trees with diameters less than 4.5 feet at breast height. Therefore, regeneration tree lists were developed using existing CVS data and growth relationships from current published and unpublished studies. The regeneration trees were added to DBORGANON simulations 20 to 25 years following any commercial thinning. The time lag represented the estimated time for all trees in the regeneration tree list to reach 4.5 feet tall.

Silviculture prescriptions for land use allocations where objectives other than timber are emphasized [Southern General Forest Management Area, Connectivity/Diversity Block, Riparian Reserve, Late Successional Reserve (Alternative NA); Riparian Management Area, Late Successional Management Area (Alternatives 1, 2, and 3)] were thinned to maintain relative densities between 30 to 50 to a maximum age of 80 years-old in Alternative NA, or until minimum desired stand structural class is attained in Alternatives 1, 2, and 3. Fertilization is not assumed to occur on these land use allocations.

Fertilization:

Fertilization with 200 pounds of active nitrogen per acre is simulated to occur after thinning in all alternatives**.** Fertilization was modeled when the land use allocation was considered part of the timber base, the stand is even-aged, two-aged with low green tree retention (≤ 8 dispersed retention trees per acre), two-aged with aggregated retention (partial harvested areas) and when DBORGANON criteria were met. DBORGANON criteria for treatment were when the stand contains 80% or more Douglas-fir by basal area and is less than 70 years-old.

Within the constraints of other modeling assumptions, all possible combinations of treatments were simulated for each modeling group to allow a wide range of treatment timing, combination and flexibility within the OPTIONS model.

General Silvicultural Systems and Modeling Approaches

A *silvicultural system* is a planned series of treatments for tending, harvesting, and re-establishing a *stand.* The system name is based on the number of age classes managed within a stand: *even-aged, two-aged, uneven-aged.* These three general silvicultural systems were modeled using CONIFERS in concert with DBORGANON to meet the objectives of the alternatives. The type of systems employed varied by alternative and land use allocations within alternatives. The three general systems as traditionally defined are most applicable to the land use allocations comprising the ASQ *timber base*.

The even-aged system uses the *clearcutting* or *shelterwood cutting* method to regenerate existing stands. The two-aged system uses a *variable-retention harvest* method to achieve the same goals. The uneven-aged system achieves regeneration through *selection harvest.*

Common to All Alternatives

The management of the non-ASQ land base such as; Late Successional Reserve/ Management Area and the Riparian Reserve/Management Area does not correspond well with any of the general silvicultural system definitions. In practice it is assumed that a *variable-density thinning* harvesting method is used. For modeling purposes, a commercial thinning harvest cutting trees in proportion to their representation in the stand was simulated for all alternatives following the previously described relative density criteria.

Alternative NA

Alternative NA employs a two-aged silvicultural system on the General Forest Management Areas, Southern General Forest Management Area and

Connectivity/Diversity Block land use allocations. Regeneration harvests were modeled with the retention of a specific number of the largest overstory trees for non-timber objectives. The number of retention trees per acre totaled 7, 16 or 12 respective of the Northern General Forest Management Area, Southern General Forest Management Area, and Connectivity/Diversity Blocks land use allocations. In addition, 0, 3 and 4 hardwood trees were retained respectively. The spatial arrangement of retention trees was modeled as *dispersed retention.*

The OPTIONS model simulates retention trees by assuming that the retention trees continue to grow on the pre-harvest existing stand guide curve generated by DBORGANON while the regenerated portion of the stand follows a new DBORGANON generated future guide curve. The amount of green tree retention is determined on the basis of pre-harvest basal area being retained. For each land use allocation a single percent basal are was applied to all age groups, site classes, and modeling groups.

For Alternative NA the amount of retention tree basal area was determined by simulating the growth of a young stand modeling group of average density and site productivity to age 100 years-old, at which time a harvest treatment leaving the largest 7, 12 or 15 retention trees representing the Northern General Forest Management Area, Connectivity/Diversity Blocks, and Southern General Forest Management Area respectively is done. The percentage of the retention tree basal area divided by the pre-harvest total stand basal area at age 100 years-old determines the appropriate allocation for modeling green tree retention in OPTIONS.

Alternatives 1 and 2

Application of even-aged systems without green tree retention was modeled in Timber Emphasis Area land use allocation. Green tree retention is not required for Alternative 1. Green tree retention for Alternative 2 was not modeled due to the small amount of volume required as a minimum.

Alternative 3

Alternative 3 employs a two-aged silvicultural system in the General Landscape Area generally north of Grants Pass, Oregon. Depending on landscape structural stage criteria and vegetation zone, regeneration harvests were modeled with varying amounts of retained overstory trees as dispersed retention or aggregated retention. An uneven-aged management silvicultural system is applied in the zone south of Grants Pass, Oregon on the Medford and Lakeview Districts.

The dispersed retention approach used the DBORGANON yield functions derived for the Alternative NA, Northern General Forest Management Area land use allocation which closely approximated (seven trees per acre) the Alternative 3 retention tree requirements for regeneration harvests of six

trees per acre in the western hemlock zone or nine green trees per acre in the Douglas-fir and tanoak zones.

Aggregated retention is designated as “partial harvest” to further distinguish the difference in Alternative 3 with the dispersed retention harvest method. Partial harvests retained retention tree blocks constituting 18%, 33% or 37% of the existing stand in the Douglas-fir, tanoak, and western hemlock zones respectively. The proportion of the pre-harvest stand basal area retained was determined using similar methodology to that used for Alternative NA described above with the following exceptions. Simulated harvest ages were 80 years-old for the Douglas-fir and tanoak zones, and 120 years-old for the western hemlock zone. Also, the retention tree basal area was estimated using Alternative 3 retention tree minimum size classes definitions, which varied by vegetation zone. The basal area calculations also included some merchantable trees which did not meet the minimum retention tree size. Inclusion of these smaller trees was done based on the assumption that little or no harvest would generally occur within the aggregated retention blocks.

Future growth of the aggregated retention blocks was represented by their continued growth using the pre-harvest existing stand guide curve. Growth of the harvested portion was represented by Alternative 1 even-aged future stand guide curves with no retention.

The uneven-aged management zone harvests consisted of periodic selection cuttings applied to stands from each representative modeling group. Harvest frequency ranged from 20 years to 60 years with harvests generally occurring more frequently on higher sites. Selection cutting was modeled as a proportional commercial thinning at regular intervals using residual basal area targets which varied by modeling group. Predominantly Ponderosa pine stands were managed at lower residual basal area levels than mixed-conifer groups. After each harvest a regeneration tree list was added to the simulation to reflect natural and artificial reforestation occurring. Regeneration tree lists generally included a proportional representation of species included in the stand’s original species mixture.

Special adaptations to cutting practices were applied to the various modeling groups. For example, in the Ponderosa pine modeling groups, some stands were managed to reduce the proportion of Douglas-fir to favor pine growth.

Growth and Yield Adjustments

DBORGANON projections of timber yields needed to be adjusted to account for increased growth due to genetic tree improvement and reduced to account for the effects of additional overstory mortality in older and partial cut stands. Adjustments for factors which could substantially affect stand dynamics; including genetic tree improvement, Swiss needle cast disease and other overstory mortality were accomplished by means of factors applied within the DBORGANON model. Other factors affecting recoverable

commodity volumes were modeled as a percent reduction in volume. Timber defect and breakage, endemic insects and disease, soil compaction, future snag creation, future coarse woody debris creation, green tree retention were applied in the OPTIONS dataprep program to account for guidance requirements specific to each alternative.

Tree Improvement

Conifer species such as Douglas-fir and western hemlock have been selected for genetically controlled characteristics such as high growth rates and tree form. BLM in cooperation with other landowners have established field test sites using progeny from the selected trees. These *progeny test sites* have been measured at regular intervals and the data collected has been used to select those parent trees which are ranked highest in growth rates. *Seed orchard*s have been established to produce locally adapted seed from these selected trees for reforestation of harvested stands and natural deforestation.

The increased growth and yield effects from utilization of genetically improved seedlings was accomplished by the use of a one-time growth increase to tree lists exported from CONIFERS and the application of growth modifiers applied to future stand modeling groups in DBORGANON.

Height and diameter of genetically improved trees exported from CONIFERS at age 15 years-old were increased before importation into DBORGANON by 7% and 8% respectively based on the observed height and diameter percentage increase of the top one-quarter trees in the progeny tests. After importation of the tree lists into DBORGANON, growth modifiers were applied to future stand modeling groups to account for incremental *genetic gain* expected to accrue beyond age 15 years-old. Growth modifiers have been found to be an effective way to incorporate genetic gain from tree improvement programs into growth models (Carson 2003).

Growth modifiers have not been publicly developed for Pacific Northwest tree improvement programs, although work is currently underway (USDA 2006). Finalized growth modifiers for regional growth and yield models are expected within a year or perhaps more.

In the interim, growth modifiers were adapted from the preliminary feasibility work (Johnson and Marshall 2005) by BLM personnel. These factors are used to modify growth and mortality rates of genetically improved seedlings for simulations of the future stands modeling groups. The DBORGANON model was specifically configured to allow the use of growth modifiers for simulation of genetic gain and other purposes.

Growth modifiers are applied in DBORGANON as described below.

1) Growth modifiers apply to Douglas-fir within land used allocations designated as part of the timber base for all alternatives, when stands are managed under even-aged silvicultural systems, two-aged systems with aggregated overstory

retention, or dispersed retention with low overstory density. No increased growth from genetic improvement is simulated for lands managed using uneven-aged silvicultural systems, or with high levels of dispersed retention overstory

2) Growth modifiers apply to western hemlock using the criteria as Douglas-fir except that it is confined to area designated as the Swiss needle cast zone on Salem District only (see Disease section).

3) Growth modifiers were calculated for each BLM district, but since no significant difference was observed, average westside BLM growth modifiers were used.

4) Existing BLM seed orchards have the biological capability to produce improved seed in excess of probable need.

5) Growth modifiers were reduced to account for pollen contamination from non-genetically improved trees adjacent to and within the BLM seed orchards.

6) Growth modifiers are applied from stand age 15 to 100 years-old.

Defect and breakage

A proportion of harvested trees can contain defects which reduce its utility from a commodity standpoint. Also, damage can occur during harvesting, that results in breakage which reduces recoverable timber volume. The proportion of volume which is not recoverable for commodity use generally increases with stand age. DBORGANON generated timber volume yields were reduced by BLM district specific factors derived from historical timber sale cruise and scale data.

Soil Compaction

Districts with available data as to the extent and degree of soil compaction applied a yield reduction factor to DBORGANON yields. The deductions were applied to on the Lakeview, Medford and Salem Districts.

Snag Retention

The yield impact of retaining varying amount of green trees for the creation of future snags was done by leaving extra retention trees or applying a percent volume reduction to meet the minimum snag requirements at the time of harvest. Retention requirements varied by alternative and by land use allocation.

Coarse Woody Debris Retention

The yield impact of retaining varying amounts for future down woody debris on timber yield was modeled as a percent volume reduction at the time of harvest. Retention requirements were varied by alternative and land use allocation.

Stocking Irregularity

For any level of stocking, a portion of a stand may consist of openings which do not contribute to stand volume at any point in time, i.e., a stand may contain non-stocked openings of a size sufficient to affect timber yield. These openings may be thought of in terms of less-than-perfect stocking or in terms of variation in tree location and fall into two categories; permanently incapable of growing commercial tree species, and those temporarily unoccupied by desirable trees.

Portions of stands may contain permanent areas of non-productive rock or other areas incapable of growing commercial tree species. This condition is partially accounted for through reductions in the timber base through the Timber Productivity Capability Classification.

Temporarily non-stocked areas occur due to variation in reforestation success from a variety of non-permanent factors, such as vegetative competition or logging slash.

The ORGANON model accounts for stocking variation by assuming that the degree of local competition experienced by a tree is reflected in its crown size. Trees growing next to openings have longer crowns and poor growth reflected as stem taper which reduces the volume of a tree next to the opening, compared to a similar size tree with shorter crown in an area with more uniform tree distribution. As long as the crown characteristics of sample trees are measured, then any long-term spatial variation within the stand will be modeled appropriately (Forsight 2006).

Since existing CVS data used for existing stands and the development of future stands modeling groups contain the necessary crown measurement, no external adjustment for stocking irregularity was applied to DBORGANON yields.

Green tree retention has two effects from a stand growth and yield standpoint. First, otherwise harvestable volume is foregone for commodity use at the time of harvest. Methodology for determining this allowance was described previously for each alternative. Second, retention trees compete for growing space with the newly regenerated trees.

The first effect of retained trees on foregone harvest volume is modeled with the OPTIONS model as a stand constraint. A proportion of the stand equating to the amount of basal area per acre of the uncut stand retained is “set-aside” and is simulated to continue to grow on the existing guide curve until the next regeneration harvest. At that time a new set of retention trees would be set-aside to grow for the subsequent harvest cycle. The proportions ranged from approximately 10% to 20% for Alternative NA and from 18% to 37% for Alternative 3 depending on land use allocation or vegetation zone..

The second effect was modeled using DBORGANON for Alternative NA and by using a fixed percentage yield reduction for Alternative 3.

Alternative NA future modeling group tree lists included the required number of retained trees as overstory. The retained trees slowed the growth of the "new" understory in roughly proportional to the amount of retained overstory trees. The volume of the retention trees was not included in DBORGANON estimates of potential timber yield, but included for evaluating overall stand characteristics and structural stages.

Alternative 3 partial harvest yields from future stands were reduced by 5% percent to account for "edge effect", i.e., the effects of the aggregated retention blocks of overstory trees competing with the new tree regeneration. The factor used is an average reduction observed from modeling work in British Columbia (Di Lucca et al. 2004).

Disease

Two types of reductions were used to simulate the effects of endemic levels of insect and disease on timber yields. The first method was through the DBORGANON model using a growth modifiers approach for areas of Salem District with moderate to severe levels of Swiss needle cast disease. The second method used a percentage reduction in yield approach applied in OPTIONS data-prep program to the guide curves for all districts to account for other insect and disease effects.

Swiss needle cast

Portions of the Salem District are located in an area with moderate to high occurrences of Swiss needle cast disease. This disease infects Douglas-fir trees only and substantially reduces growth rates. It does not affect the growth of other tree species. A growth modifier approach similar to that used for modeling growth of genetically improved trees was employed in DBORGANON to reflect estimated growth reductions for Douglas-fir in the Swiss needle cast zone.

Three Swiss needle cast (SNC) zones were developed for BLM land consistent with Oregon Department of Forestry (ODF) criteria, a severe, moderate, and a no impact zone.

BLM calculated mean foliage retention values for the severe and moderate zone using plot data from ODF Swiss need cast surveys. The foliage retention values were used to calculate growth loss in height and basal area by severity zone using ODF methodology (ODF 2005). The growth loss modifiers were applied in DBORGANON to existing and future stand modeling groups in order to simulate more realistic stand dynamics.

As stands are regeneration harvested in the Swiss needle cast zones, an average mix of tree species will be used for reforestation that is different than the current stands composition. Future tree lists reflecting tree lists with a minority of Douglas-fir were generated using the process described above for future stands modeling

groups. Tree lists with a single average species composition for both zones containing 28% Douglas-fir was used. Examination of the simulation results for the moderate and severe Swiss needle cast zones showed no substantial difference in predicted timber yields (<1%) so a single yield function was used.

Other Insects and Disease

Some of the effects of endemic levels of insects and disease other than Swiss needle cast on timber yields are assumed to be reflected in the defect and breakage allowance described previously and the additional overstory mortality factor described below. In addition to those factors, further allowance was deemed appropriate for insects and diseases by adjusting timber yields down by a percent volume reduction. These factors generally vary from about 1% to 3% increasing with stand age and are based are based on literature and professional judgment.

Additional Overstory Mortality Factor

The ORGANON model underestimates tree mortality from causes other than inter-tree competition, such as insects, disease, windthrow and stem breakage, (Tappeiner et al. 1997). This type of mortality is often *irregular*, or episodic in nature, and it is inherently difficult to predict the exact time period in which it will occur (Franklin et al 1987). For mature stands, mortality from inter-tree competition becomes less significant as stands age and mortality from other factors becomes more substantial.

To account for mortality from these other factors, an irregular mortality adjustment of 1.4% per DBORGANON growth cycle (five years) was determined from a review of ecological literature and Continuous Forest Inventory data (Lewis and Pierle 1991).

The 1.4% factor was applied to existing and future stand modeling groups through a function in the DBORGANON model. The factor applied only to trees greater than 20" diameter breast height in stands aged 100 years-old and older, to simulate mortality of larger trees from causes other than inter-tree competition.

In addition, partial cutting has been reported to significantly increase wind damage, especially during the first few years after treatment. Amount and extent are dependent on individual site factors, landscape conditions, and severity of the storm event (Strathers et al 1994). Average mortality for retained trees in partial cut Douglas-fir stand during the first five years post harvest from non-suppression factors averages about 1-2% Williamson and Price 1973; McDonald 1976; Jull 2001). To account for this type of mortality, the same 1.4% factor was applied to stands which represented regeneration harvests with dispersed green tree retention. Model limitations allowed the use of only one additional mortality factor in a simulation. Therefore, the additional mortality factor was applied at stand age of 20 years-old, corresponding to the end of the first growth cycle in

DBORGANON to trees greater than 20” diameter breast height.

Application of the additional 1.4% mortality rate during growth simulations produced modeling results which more closely matched patterns of stand development supported by empirical data and ecological theory than simulations done without the factor (Lewis and Pierle 1991).

Definitions

Aggregated retention - See *variable-retention harvest system*

Annual Productive Capacity / Allowable Sale Quantity - These terms are synonymous. The timber yield that a forest can produce continuously under the intensity of management outlined in the RMP from those lands which are allocated for permanent forest production.

Board foot - A unit of solid wood, one foot square and one inch thick.

Canopy - The more or less continuous cover of branches and foliage formed collectively by adjacent trees and other woody species in a forest stand. Where significant height differences occur between trees within a stand, formation of a multiple canopy (multi-layered) condition can result.

Clearcutting - The cutting of essentially all trees, producing a fully exposed microclimate for the development of a new stand of trees.

Coarse woody debris (CWD) - Any piece(s) of dead woody material, e.g., dead boles, limbs, and large root masses, on the ground or in forest streams

Commercial thinning - Any type of thinning operation producing merchantable material at least equal to the value of the direct cost of harvesting and hauling the timber to market.

Culmination of mean annual increment (CMAI) - The age in the growth cycle of a tree or stand at which the *mean annual increment* (MAI) for volume is at maximum. At culmination, MAI equals the *periodic annual increment* (PAI). CMAI computations can vary widely depending on the purpose (economic or biological) and measurement criteria (board-foot vs. cubic-foot)

Dispersed retention - See *variable-retention harvest system*

Even-aged management - A silvicultural system which creates forest stands that are primarily of a single age or very narrow range of ages.

Even-aged stand - A stand of trees composed of a single age class in which the range of tree ages is usually ± 20% of rotation

Genetic gain - The average improvement of a specific trait in a population of progeny over the average of the parental population, e.g., height growth increase

Tree retention - A stand management practice in which live trees as well as snags and large down wood, are left within harvest units to provide habitat components over the next management cycle

Mean annual increment (MAI) - The total cumulative quantity produced over time of some attribute of a tree or stand growth, e.g., wood volume divided by the total age of the tree or stand

Merchantable - Trees or stands having the size, quality and condition suitable for marketing under a given economic condition, even if not immediately accessible for logging

Multi-layered canopy - Forest stands with two or more distinct tree layers in the *canopy*

Overstory - That portion of trees which form the uppermost layer in a forest stand which consists of more than one distinct layer

Periodic annual increment (PAI) - The difference in stand volume at two successive measurements, divided by the number of years between measurements. PAI is sometimes termed current annual increment (CAI).

Precommercial thinning (PCT) - The practice of reducing the density of trees within a stand by manual cutting, girdling, or herbicides to promote growth increases or maintain growth rates of desirable tree species. The trees killed are generally unmerchantable and retained on the treated area.

Progeny test site - A test area for evaluating parent seed trees by comparing the growth of their offspring seedlings

Regeneration - Tree seedlings or saplings existing in a stand

Regeneration harvest - A timber harvest conducted with the partial objective of opening a forest stand to the point where seedlings of favored tree species will be established.

Relative density - A means of describing the level of competition among trees or site occupancy in a stand relative to some theoretical maximum based on tree size and species composition

Rotation - The number of years between establishment of a forest stand and its regeneration harvest

Seed orchard - A plantation of clones or seedlings from selected trees; isolated to reduce pollination from outside sources, weeded of undesirables, and cultured for early and abundant production of seed

Selection cutting - A method of uneven-aged management involving the harvesting of single trees from stands (single-tree selection) or in groups (group selection) without harvesting the entire stand at any one time

Shelterwood cutting - A method of regeneration harvest under an even-aged silvicultural management system. With this method a portion of the mature stand is retained as a source of seed and/or protection during the regeneration period. The retained trees are usually removed in one or more cuttings.

Silvicultural prescription - A planned series of treatments designed to change current stand structure to one that meets management goals

Silvicultural system - A planned series of treatments for tending, harvesting, and re-establishing a stand. The system name is based on the number of age classes managed within a stand, e.g., *even-aged, two-aged, uneven-aged*.

Snag - Any standing (upright) dead tree

Stand - An aggregation of trees occupying a specific area and sufficiently uniform in composition, age, arrangement, and condition so that it is distinguishable from the forest in adjoining areas

Thinning - A silvicultural treatment made to reduce the density of trees within a stand primarily to improve tree/stand growth and vigor, and/or recover potential mortality of trees, generally for commodity use

Timber Productivity Capability Classification (TPCC). - Classification of BLM lands based on the physical and biological capability of the site to support and produce forest products on a sustained yield basis.

Two-aged system - A silvicultural system that regenerates and maintain stands with two age classes – the resulting stand maybe two-aged or trend towards an uneven-aged condition as a consequence of both an extended period of regeneration establishment and the retention of reserve (green live) trees that may represent one or more age classes.

Two-aged stand - A stand of trees composed of a two distinct age classes separated in age by more than ± 20% of rotation

Understory - That portion of trees or other woody vegetation which form the lower layer in a forest stand which consists of more than one distinct layer.

Uneven-aged management - A combination of actions that simultaneously maintain a nearly continuous forest cover, recurring regeneration of desirable species, and the orderly growth and development of trees through a range of diameter or age classes.

Uneven-aged stand - A stand with three (3) or more distinct age classes, either intimately mixed or in small groups

Variable-density thinning (VDT) - A thinning method where ≥ 2 densities of retained trees are used to promote stand heterogeneity through the development of *multi-layered canopies*. Provision of conditions conducive to the initiation and growth of regeneration is often an objective of VDT to encourage understory development

Variable-retention harvest system - An approach to harvesting based on the retention of structural elements or biological legacies (trees, snags, logs, etc.) from the harvested stand for integration into the new stand to achieve various ecological objectives – note the major variables in variable retention harvest systems are types, densities and spatial arrangement of retained structures; 1) *aggregated retention* is the retention of structures as (typically) small intact forest patches within the harvest unit; 2) *dispersed retention* is the retention of structures or biological legacies in a dispersed or uniform manner.

Windthrow - A tree or trees uprooted or felled by the wind.

OPTIONS Modeling

OPTIONS Model

Background

The OPTIONS model version V (OPTIONS or the model) is a spatially explicit, rules-based, land management simulation model. OPTIONS, developed by D.R. systems inc. (DRSI), has been in use for more than 20 years and is regularly updated and refined to reflect current knowledge, issues in land management and modeling techniques. The model has been used to develop land management strategies and operationally feasible plans on more than 500 million acres throughout North America, South America, the South Pacific and Asia. Most of these projects involved complex, multi-resource objectives and environmental regulations.

In the western United States OPTIONS has been used for a wide range of industrial and government analyses, including land trades, evaluation of lands for sale or purchase and the development of sustainable, multi-resource management plans. The model was used in Plum Creek Timber Company's 1997 Cascades Habitat Conservation Plan for central Washington State. The Habitat Conservation Plan was the first major, multi-species habitat conservation plan developed in the USA; for it Plum Creek won the 1997 U.S. Wildlife Stewardship Award. OPTIONS was also used in the Washington State Department of Natural Resources 2004 Sustainable Forest Management Harvest Calculations. The Sustainable Forest Management Harvest Calculations applied an alternatives based approach toward developing a long-term, sustainable, multi-resource forest management plan on approximately 2.1 million acres of Washington State Trust Lands. The approved management plan improved net revenues from State Trust Lands by more than 40% (more than $50 million dollars/year) while providing increased wildlife habitat and riparian resource protection. The model was also recently used to complete Pacific Lumber Company's (PALCO) 2005 Long-term Sustainable Yield Calculations PALCO owns approximately 217,000 acres of redwood forest land in northern California. The PALCO project set new standards for sustainable yield calculations and planning in California.

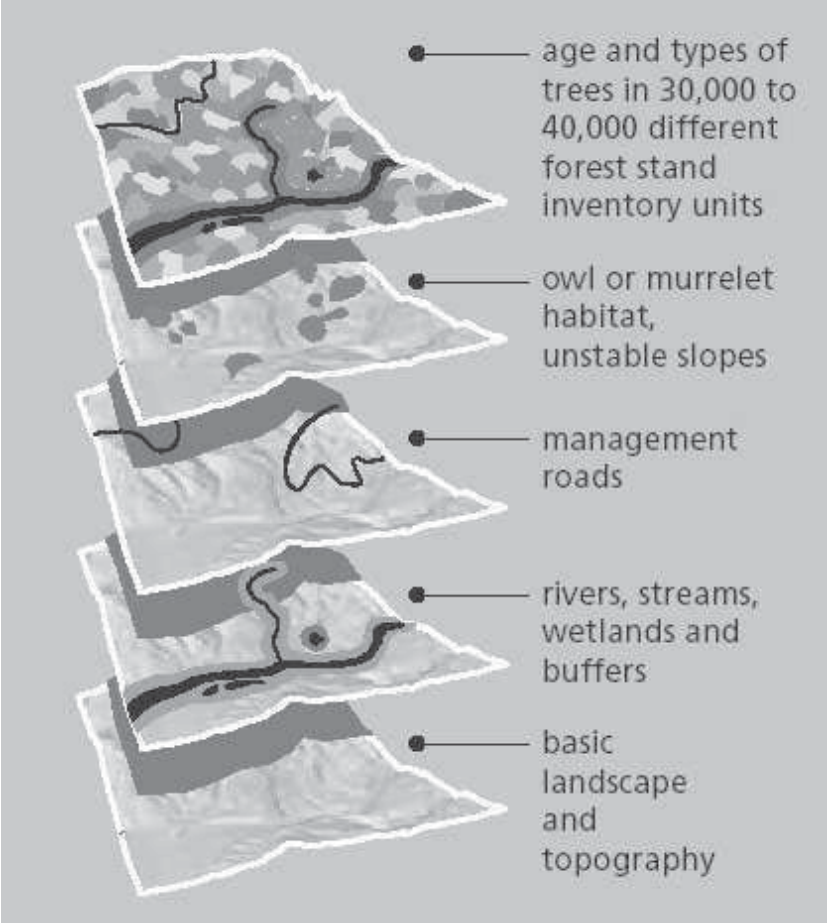
Currently the model is also being used by the University of Georgia to analyze the impacts of proposed regulations and policies on the States' long-term timber supply, by the California Department of Forestry in a pilot project investigating new approaches to the States' sustainable yield calculations, as well as numerous operational analyses in Washington, Alaska and British Columbia, Canada. DR Systems' expertise in partnership with BLM staff is using the OPTIONS model to analyze alternative management strategies for the Western Oregon Plan Revision.

This analysis provides the factual basis for comparing alternatives in terms of the forest conditions / habitats created over time as well as determining the sustainable harvest levels for the Western Oregon BLM districts.

OPTIONS Model Overview

OPTIONS simulates the growth and management of individual land management units within a BLM Sustained Yield Unit (SYU). Land management units are created in a GIS process that combines multiple layers of resource information and objectives into a single resultant layer. Examples of these resource layers would include Forest Operations Inventory units, administrative boundaries, riparian management areas, Late-Successional Management Areas, Visual Resource Management areas, etc.

Figure 340. Graphic example how a resultant layer is created from a number of resource layers. Multiple resource layers are overlaid in a GIS process to create a single resultant layer for use in OPTIONS.



The model utilizes the resultant file to dynamically maintain all of the spatial identity across all contributing layers enabling the model to apply spatially explicit growth projections and management rules to individual resultant units (polygons), or groups of polygons throughout the Sustained Yield Unit.

The planning horizon of a simulation can extend as far as 400 years. Inventory information for each resultant unit is used to initialize the model and for each subsequent year in the planning horizon growth projections forecast future conditions for each polygon. However, these growth projections are sensitive to management activities and rules.

Management activities, such as silvicultural treatments (for example site preparation, fertilization or pre-commercial thinning) and harvesting activities (for example commercial thinnings, selection harvest or regeneration harvest) are distinguished from management objectives such as the exclusion of harvesting activities within riparian management areas. Activities are applied to polygons individually, while objectives may be applied to individual polygons, portions of a polygon, or collectively to a group of polygons.

Importantly, all objectives are implemented before any management activity can be applied, so harvest activities are simulated only after all environmental and habitat requirements have been satisfied.

Growth Projections

Throughout the planning horizon individual polygons are grown according to their individual forest inventory characteristics and growth trends established from a set of generalized growth projections. For this project, the growth projections were generated with the ORGANON growth and yield model. These projections are imported into OPTIONS and used to forecast the nominal growth trend of each polygon. Within the model these growth projections are further refined to accommodate the unique characteristics of each polygon, including any unique management objectives, environmental conditions or inventory information. Growth projection attributes are tracked and reported including: stand height, diameter, basal area, density, volume and live crown ratio.

Incorporating Existing Inventory Information into the Simulation

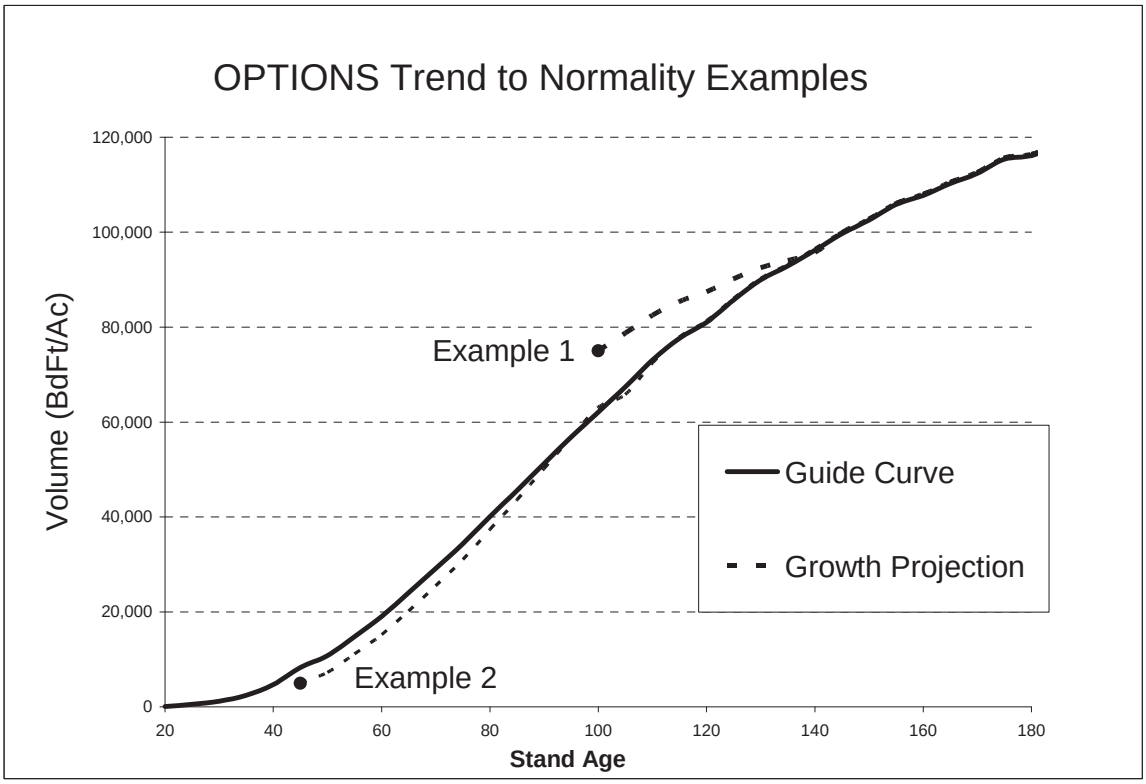
Spatially explicit forest inventory information reflects current forest conditions. Depicting current conditions accurately is important in forecasting how alternative management strategies impact future forest conditions, particularly in the short-term (first 20 - 50 years).

Where available, OPTIONS incorporates existing forest inventory information into the simulation analysis. Spatially explicit forest inventory information improves the analysis, but can create challenges because resource inventory classification systems often do not coincide

directly with modeled growth projections. Although the generalized growth projections are accurate across a broad set of polygons, they do not capture variations of current inventory conditions at the individual polygon level. Thus, projecting the future growth of individual polygons requires an integration of existing inventory information with the generalized growth model projection. This integration is accomplished by utilizing algorithms to normalize future growth from the individual polygon's current inventory condition towards the long-term growth model projection. The rate of normalization is scaled according to the proximity of the inventory value to the model prediction. The process, referred to as the "trend to normality" captures, with spatial integrity, current conditions while accounting for the future growth within the polygon.

The figure below provides two examples of the trend to normality process. The solid line represents the growth model projection, while the dashed lines represent the trend to normality projections for the individual polygon.

Figure 341. OPTIONS trend to normality examples.



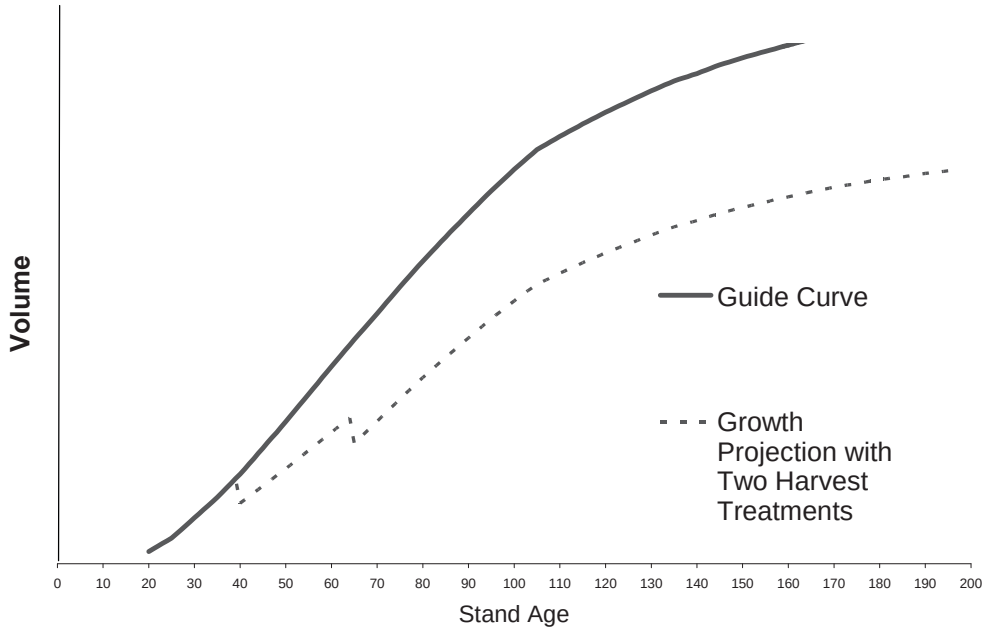
Treatment Adjustments and Responses

Growth projections are sensitive to management activities such as silvicultural treatments. Management activities are applied to individual polygons only when a set of eligibility criteria are met. Polygons that do not meet these criteria are not treated and their growth projection

is uninterrupted. Stands that meet the eligibility criteria, as well as all other management objectives, are treated and their growth projection is adjusted. This adjustment is specific to stand age, species, site productivity level, as well as treatment type and intensity. All of these treatment and adjustment variables are defined in the model based on experience gained from the growth and yield modeling, professional judgment, research, and management objectives.

The figure below provides an example of a volume growth projection and the adjustments applied for two stand thinning treatments. Growth projection for a polygon without treatment following the guide curve and the adjustments for two stand treatments at ages 40 and 60.

Figure 342. Example of a volume growth projection curve and adjustments for thinning treatments.



Management Activities and Rules

Management Activities

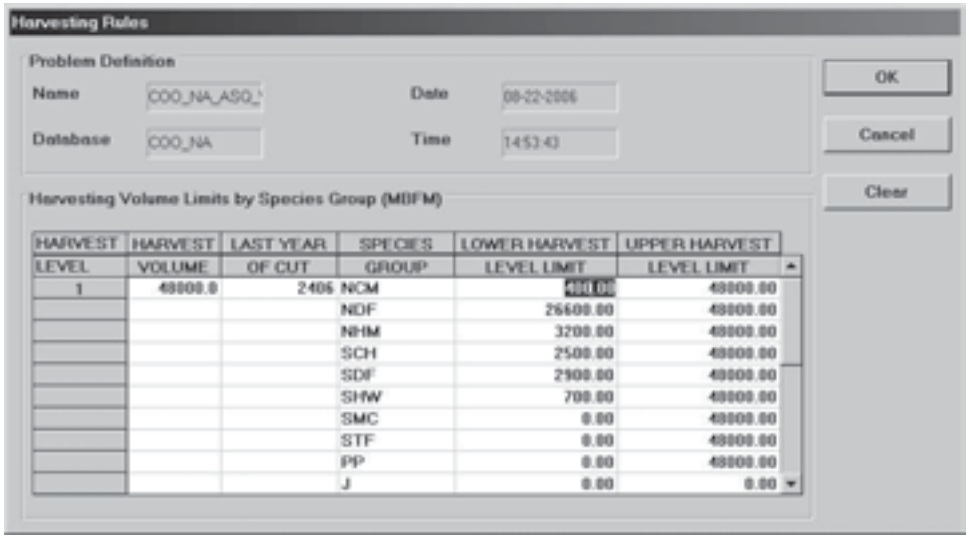
Forest management often requires intervention activities such as silvicultural treatments or harvesting activities. Silviculture treatments such as planting, pre-commercial thinning, pruning, fertilization, commercial thinning and selection harvest are explicitly defined, that is; their timing, intensity, duration and biological response are all defined in the model based on experience gained from the growth and yield modeling, professional judgment, and research.

Additionally, treatments are subject to stand (polygon) level and landscape level eligibility criteria. An example of a stand level eligibility rule would be a minimum age or basal area threshold. A landscape level eligibility criteria would be an upper limit on the commercial thinning volume, within a Sustain Yield Unit. Silviculture treatments were not applied unless all eligibility criteria were met.

Harvesting activities are also subject to stand level and landscape level rules. An example of a polygon level harvest rule would be a minimum harvest age or a minimum residual volume per acre. There can be a number of landscape level harvest rules that control the maximum and minimum harvest levels by species type, species and wood-type priorities, polygon age and treatment type and landscape management objectives.

The figure below provides an example set of landscape level harvest rules requesting minimum and maximum board foot volume level by species group.

Figure 343. Landscape level harvest rules example.



Numerous management activities and silvicultural treatments, can be developed and applied in various combinations, each combination defines a unique management regime. Polygons within a Sustained Yield Unit are assigned to a single, starting management regime. On completion of the management regime, or because of a specific harvest treatment, the polygon may return to the same management regime or continue under a new management regime.

Land and Resource Management Rules

In OPTIONS, resource management objectives can be applied as targets or constraints.

Targets and constraints can be applied to individual polygons or collectively to a group of polygons. Targets and constraints are applied for each year in the planning horizon, so all management objectives are maintained for every year within the planning horizon.

Targets are used to control conditions at the landscape level. For example, a target may be used to ensure that at any point in time 15% of the forested BLM ownership within a fifth field watershed will be in stands 80 years and older before regeneration harvest may occur. The model is flexible about which particular polygons are reserved to satisfy the target criteria. If current stand conditions do not achieve the target criterion the model will evaluate and recruit polygons that will contribute toward meeting the criterion soonest. Recruited polygons are deferred from harvest ensuring that the target criterion is met as soon as possible. Each year within the planning horizon, the model checks that sufficient polygons are available and deferred to meet the target criteria. The model only defers reserves enough polygons to meet the modeling targets, thus allowing non-deferred polygons to contribute toward meeting other management objectives.

Constraints set explicit limitations on the amount, or kind, of activities permitted for an individual polygon, portion of a polygon or across a group of polygons, for a defined period. The defined period can extend through the entire planning horizon, or it can be defined for a shorter timeframe. For example, constraints can be used to exclude regeneration harvest activities from a riparian area throughout the entire planning horizon, while allowing commercial thinning activities until the stand reaches an age of 80, after which no further treatments are permitted.

GIS Based Modeling Rules

Introduction

The attributes associated the GIS spatial data are used in OPTIONS to identify areas which modeling rules are applied to simulate the management action and land use allocations for the alternatives. This section will describe, by topic area, the modeling rules and GIS data as they were applied to simulate the alternatives with the OPTIONS model.

1) Sustained Yield Units (SYU) -

The BLM lands are subdivided into Sustained Yield Units for the purpose of defining the area which the allowable sale quantity will be based. The Sustained Yield Units are based on the BLM lands within the District boundaries for Salem, Eugene, Roseburg, Coos Bay, and Medford Districts. The western portion of the Klamath Falls Resource Area within the Lakeview District is also a SYU. The eastern portion of the Klamath Falls Resource Area does not contain any O&C lands and a sustained yield unit is not designated. The Forest Operations Inventory (FOI) District attribute data was used as the basis for the Sustained Yield Units in the OPTIONS modeling. The Land Use Allocation data segregated the Klamath Falls Resource into the Klamath SYU and the eastside management lands. An estimate of the sustainable harvest level was done for the eastside management lands under the No Action Alternative modeling assumptions. Allocations and management direction did not vary across alternatives for the eastside management lands and so they were not modeled in action Alternatives.

2) Non Forest -

Non forest areas in the OPTIONS model remain static in the projections and do not carry vegetation attributes. Non forest information was derived from multiple sources of GIS data to form the non forest class in the OPTIONS modeling.

- Transportation data buffered by 22.5 feet to simulate the road network.
- Timber Productivity Capability Classification non forest classes.
- Forest Operations Inventory Existing Stand Condition non forest class.
- In Alternatives 2 and 3 – open water class from the streams data.

3) Timber Productivity Capability Classification (TPCC)

- The TPCC inventory is described in detail in the Inventory Data section of this appendix. Common to all alternatives the non suitable woodlands and the suitable woodland categories of low site and non commercial species had no harvest modeled and were not included in the ASQ.

In the No Action Alternative the reforestation suitable woodlands had no harvest modeled and were not included in the ASQ. In the Action Alternatives these lands had harvest modeled and did contribute to the ASQ.

4) Recreation Sites -

In all Alternatives the existing recreation sites had no harvest modeled and were not included in the ASQ. In the Action Alternatives the proposed recreation sites had no harvest modeled and were not included in the ASQ. In the No Action Alternative the proposed recreation sites lands had harvest modeled and did contribute to the ASQ.

5) Wild and Scenic Rivers -

In all Alternatives the existing Wild and Scenic Rivers had no harvest modeled and were not included in the ASQ. In the Action Alternatives the eligible Wild and Scenic Rivers had no harvest modeled and were not included in the ASQ. In the No Action Alternative the eligible Wild and Scenic Rivers had harvest modeled and did contribute to the ASQ. In the No Action Alternative the existing recreation segments had harvest modeled and did contribute to the ASQ. (Note: not all recreation segments were able to be identified and put in the harvest land base)

6) Visual Resource Management (VRM) -

In all Alternatives the VRM class one had no harvest modeled and was not included in the ASQ. Under alternative 2, on the PD or acquired lands, no regeneration harvest was applied on VRM class two (Note: The VRM class one GIS data was only used in the No Action Alternative and Alternative 2. In the Action Alternatives the combination of the Wild and Scenic River and Congressionally Reserved covered this allocation.)

7) Areas of Critical Environmental Concern (ACEC) –

In the No Action Alternative all of the existing ACECs had no harvest modeled and were not included in the ASQ. The proposed ACECs had harvest modeled and did contribute to the ASQ. In the Action Alternatives all of the existing and proposed ACECs which passed through the O&C filter had no harvest modeled and were not included in the ASQ. Those ACECs which did not pass through the O&C filter had harvest modeled and did contribute to the ASQ.

O&C Filter - Used the following evaluation to determine how the each ACEC was modeled.

a) All ACECs which were Research Natural Areas (RNAs) had no harvest modeled and were not included in the ASQ.

b) For each of the Action Alternatives the districts reviewed the existing and proposed ACECs and designated them as:

- Whole ACEC does not conflict with the timber management objectives (On PD lands or on non commercial forest lands). These areas had no harvest modeled and were not included in the ASQ.
- A portion of the ACEC is in conflict with timber management but the portion of the ACEC outside of the O&C lands would remain as a valid ACEC. These portions of the ACECs that were not on O&C or CBWR lands had no harvest modeled and were not included in the ASQ.
- The entire ACEC conflicts with timber management objectives and is not carried forward under the alternative. These areas had harvest modeled and did contribute to the ASQ.

8) Marbled Murrelet Sites

Existing occupied marbled murrelet sites.

- No Action, and Alternative 1, these areas had no harvest modeled and were not included in the ASQ.
- Alternative 2 they became part of the Late-Successional Management Area which had thinning harvest modeled but this volume does not contribute to the ASQ.
- Alternative 3 had no harvest modeled until the landscape targets were met. In the modeling one decade after the landscape target were met these areas became available for harvest and they contributed to the ASQ. See the Assessment Area description for further information on the landscape targets and release dates.

The No Action Occupied Marbled Murrelet Site (OMMS) data was used to simulate the existing sites.

Projected future marbled murrelet sites.

Some alternatives have management action to limit harvest around marbled murrelet sites as they are identified. To simulate this in the modeling the stands which are 120 years and older that are within 4 townships from the coast were used as a surrogate.

- No Action and Alternative 1, for Coos Bay only, had no harvest modeled and were not included in the ASQ. The LSR / LSMA in Salem and Eugene encompassed the majority of the area within 4 townships of the coast so no simulation was needed.
- Alternative 2 had no projection for future sites.

- Alternative 3 had no harvest modeled until the landscape targets were met. In the modeling, one decade after the landscape target was met, these areas became available for harvest and they contributed to the ASQ. See the Assessment Area description for further information on the landscape targets and release dates.

9) Northern Spotted Owl

- No Action alternative had 100 acres known owl activity centers identified which had no harvest modeled and were not included in the ASQ.
- No Action Alternative had Reserve Pair Areas identified in the Salem district.
    - The suitable and next best reserved areas had no harvest modeled and were not included in the ASQ.
    - The dispersal, next best, and non-habitat received thinning only with no regeneration harvest. These lands had thinning harvest modeled but this volume did not contribute to the ASQ.
- Alternatives 1 and 2 no provisions for site management.
- Alternative 3 had 250 acre activity centers identified which had no harvest modeled until the landscape targets were met. In the modeling, one decade after the landscape target was met, these areas became available for harvest and they contributed to the ASQ. See the Assessment Area description for further information on the landscape targets and release dates.

10) Survey and Manage Species –

In the No Action alternative the survey and manage species sites had no harvest modeled and were not included in the ASQ.

11) Special Status Species –

In the action alternatives the special status species which were on Public Domain or Acquired lands had no harvest modeled and were not included in the ASQ.

12) Species Management Areas

- No Action alternative species management areas were identified for bald eagle, golden eagles, goshawk, and great grey owl sites. These areas had no harvest modeled and were not included in the ASQ.
- In the action alternatives the bald eagle sites had no harvest modeled and were not included in the ASQ.

13) Riparian

GIS Modeling

The riparian reserves / riparian management areas vary across the alternatives based upon the management action outlined in chapter two. GIS modeling was employed to estimate the extent of riparian areas so that management action could be simulated in the OPTIONS modeling. The GIS modeling, depending on the alternative, had many factors to consider in estimating the riparian area; presence/absence of fish, potential tree height adjusted specifically for each area, perennial versus intermittent streams, wetlands, lakes, ponds, and the potential to deliver large wood to streams. The description below is general in nature. The GIS metadata contains the technical details of the GIS riparian modeling.

- No Action Alternative and Alternative 1. GIS modeling varied the application of the site potential tree height based on district computed values usually by fifth field watershed. To determine the GIS buffering widths the potential tree heights were adjusted for the average stream side adjacent slope as determined by GIS analysis for each 5th field watershed. Attributes from the hydrography data were used to determine the presence and absence of fish, if a stream was intermittent or perennial, and the identification of ponds, wetlands and lakes. The GIS data for the OPTIONS modeling identified those areas in the riparian reserves as a Y/N classification.
- Alternative 2. Three riparian management area zones were identified with GIS buffering of the hydrography data. All fish bearing streams 0-25 feet (buf25). All non fish bearing intermittent 0-25 feet (shrub). Perennial and fish bearing 25-100 feet (buf100). GIS modeling was done to identify the areas likely to deliver large wood to streams which were identified in addition to the GIS buffering of the hydrography data (WDFLOW).
- Alternative 3. Four riparian management areas zones were identified with GIS buffering of the hydrography data. 0-25 feet on all streams. Within the Coquille tribal management area for all perennial streams and all intermittent streams with fish 25-50 feet. Within the Coquille tribal management area for all fish bearing streams 50-100 feet. Outside the Coquille tribal management area for all perennial streams and all intermittent streams with fish 25-100 feet.
- Alternative 2 and 3 riparian GIS analysis identified open water which was not recognized in the No Action and alternative 1 data. The open water was added to the other classes of non forest and not included in the riparian area in Alternatives 2 and 3.

OPTIONS Modeling Rules

In the OPTIONS modeling any harvest coming from the riparian areas does not contribute to the ASQ since the management action / modeling rules preclude continuous management. The shrub riparian area in Alternative 2 does contribute to the ASQ because these harvest practices can continue over time. Harvest levels are determined for these lands along for the duration which harvest can occur given the modeling rules.

Operability limitations were modeled by limiting thinning activities within each riparian polygon to a maximum of 50% of the polygon area. Additionally, riparian stand that were commercially thinned were then deferred from subsequent thinning treatments for 60 years. This deferral was applied to the entire polygon.

Table 296. Riparian modeling rules by alternative

Alternative	GIS Data	Riparian Modeling Rules
No Action	Y – Yes inside riparian reserve	• No regeneration harvest • Commercial thinning modeled up to age 80, in Salem Adaptive Management Areas up to age 110 • 50% operability by polygon
Alternative 1	Y – Yes, inside riparian management area	• No regeneration harvest • Commercial thinning modeled up to age 80. • 50% operability by polygon
Alternative 2	0-25 ft	• No harvesting activities modeled
	25-100 ft	• No harvest in stands 80 years and older. • No regeneration harvest modeled • Commercial thinning modeled up to age 80 • 50% operability by polygon
	Shrub	• Regeneration harvest modeled with 10-15 conifer green tree retention. (Contributes to ASQ)
	Wood Debris Flow Area	• No harvest activities modeled.
Alternative 2 Sub-Alternative Maximum Harvest	0-25 ft	• No harvest activities modeled.
Alternative 3	0-25 ft	• No harvesting activities modeled
	25-50 ft Coquille Management Area	• No harvest in stands 80 years and older. • No regeneration harvest modeled. • Commercial thinning modeled to age 80 • 50% operability by polygon
	50-100 ft Coquille Management Area	• No regeneration harvest modeled • 50% operability by polygon
	25-100 ft Outside Coquille Management Area	• No harvest in stands 80 years and older • No regeneration harvest modeled • Commercial thinning modeled to age 80 • 50% operability by polygon

14) Congressionally Reserved -

Congressionally reserved areas had no harvest modeled and were not included in the ASQ across all alternatives. The Land Use Allocation and Wild and Scenic Rivers GIS data was used to define these areas.

15) Late-Successional Reserves (LSR) -

The Late-Successional Reserves had only thinning harvests modeled in those stands less than 80 years of age for the No Action Alternative. This volume estimate is not included in the ASQ since the harvest would diminish over time as the stands eligible for thinning matured. The OPTIONS modeling projected the duration and volume levels for this harvest as it stepped down over time. The Land Use Allocation GIS theme was used to define this allocation. The other Northwest Forest Plan LSR components, Occupied Marbled Murrelet Sites and Know Owl Activity Centers, were modeled independently of the large block reserves. Also see the Adaptive Management Area Reserve section.

16) Late-Successional Management Areas (LSMA) -

Late-Successional Management Areas were defined for Alternatives 1 and 2.

- Alternative 1 LSMAs were based on the No Action alternative Late-Successional Reserves. Commercial thinning treatments within LSMA were consistent with the No Action LSR thinning treatments. Thinning was modeled in stands less than 80 years of age.
- Alternative 2 LSMAs were developed by BLM utilizing rules for size and spacing of large blocks which was based on current science for the Northern Spotted Owl and discussions from the draft Northern Spotted Owl recovery team. The initial GIS mapping of these large blocks was revised in the OPTIONS data preparation program to designate whole BLM parcels/sections based on a majority rule. In addition the existing Occupied Marbled Murrelet Sites were added to the LSMA. Commercial thinning treatments within LSMA were consistent with the No Action LSR thinning treatments. Thinning was modeled in stands less than 80 years of age.

Harvest projections for the LSMAs are not included in the ASQ estimates. With the absence of regeneration harvest, timber production from commercial thinning would diminish over time as the stands mature and become ineligible for thinning.

17) Adaptive Management Area and Late Successional Reserves –

Under the No Action alternative there are Adaptive Management Area designations which overlap the Late-Successional Reserves in the Salem

and Medford Districts. The Medford area was modeled the same as the Late-Successional Reserves, with thinning harvests limited to those stands less than 80 years of age. For the Salem area the thinning harvest was modeled up to age 110. Harvest projections for the areas are not included in the ASQ estimates. With the absence of regeneration harvest, timber production from commercial thinning would diminish over time as the stands mature and become ineligible for thinning. The OPTIONS modeling projected the duration and volume levels for this harvest as it stepped down over time. The Land Use Allocation GIS theme was used to define this allocation.

18) Adaptive Management Areas (AMAs) -

Adaptive Management Areas applied to the No Action Alternative. These are the portions of the AMA that exist outside Late-Successional Reserves.

- The AMAs in the Eugene and Roseburg, were modeled the same as General Forest Management Areas (GFMA).
- The Medford AMA was modeled the same the same as Southern General Forest Management Areas (S_GFMA).

The modeled harvest from these areas was included in the ASQ.

- The Salem AMA was modeled under thinning only, up through age 110, with no regeneration harvest. Since this harvest level would diminish over time the modeled volume was not included in the Allowable Sale Quantity.

Modeling reductions to the harvest land base for administratively withdrawn and riparian reserves within the AMAs was the same as within the surrounding matrix lands. The Land Use Allocation GIS layer was used to define this allocation.

19) Connectivity Diversity Blocks -

The connectivity diversity block allocations applied only to the No Action alternative. OPTIONS modeling rules were established so regeneration harvest will not occur until at least 25% of the forest area in the blocks was in stands 80 years or older. For each block a maximum of $1/150^{th}$ of the forested area could be at age zero (regenerated) to simulate the area control requirement. The modeling blocks were based on all of the connectivity diversity lands within a township and Sustained Yield Unit. The Land Use Allocation GIS layer was used to define this allocation on a gross basis. The net acreage modeled for harvest is the area remains after all other reductions to the harvest land base have been made. The modeled harvest from these areas was included in the ASQ.

20) General Forest Management Areas (GFMA) -

The GFMA allocation applied only to the No Action alternative. The Southern GFMA in the Medford District and the Klamath Falls SYU has older minimum harvest ages and higher green tree retention than the GFMA allocations in the other SYUs. The Land Use Allocation GIS layer was used to define this allocation on a gross basis. The net acreage modeled for harvest is the area remains after all other reductions to the harvest land base. The modeled harvest from these areas was included in the ASQ.

21) Timber Management Area (TMA) -

The TMA allocation applied to Alternatives 1 and 2. On a gross basis these are the lands outside of the Late-Successional Management Area, Riparian Management Area, Congressionally Reserved, and the Monument. The net acreage modeled for harvest is the area which remains after all other reductions to the harvest land base. The modeled harvest from these areas was included in the ASQ.

22) General Landscape Area (GLA) -

The GLA allocation applied to Alternative 3. On a gross basis these are the lands outside of the Riparian Management Area, Congressionally Reserved, and the Monument. The net acreage modeled for harvest is the area which remains after all other reductions to the harvest land. The modeled harvest from these areas was included in the ASQ.

23) District Defined Reserves -

Under the No Action Alternative there are district defined reserves that were established in the 1995 RMP. These lands are defined in the Land Use Allocation GIS layer. No harvest was modeled for these areas and they were not included in the ASQ.

24) Miscellaneous District No Harvest Areas -

Under all alternatives individual OI units were earmarked by the districts to be excluded from the harvest land base for modeling. These included communications sites, seed orchards, and some omissions in the TPCC data for Klamath Falls. No harvest was modeled for these areas and they were not included in the ASQ.

25) Wilderness Characteristics -

Under the action alternatives wilderness characteristics areas were identified in GIS. Only those lands which fell on Public Domain were

considered in the modeling. For those areas no harvest was modeled for these and they were not included in the ASQ.

26) Medford Granitic Soils -

For the No Action Alternative the areas identified in GIS for the Medford district as granitic soils in the Northern General Forest management Areas were modeled under the southern General Forest Management Areas prescriptions.

27) Medford Frost Areas -

For the No Action Alternative the areas identified in GIS for the Medford district as frost areas called for developing unique prescriptions to establish shelterwood prescriptions to retain trees for 30 years. The area was 8,000 acres in size. Due to the small size and complexity of modeling this no specific modeling was done for this area.

28) Medford Deferred Watersheds -

The Medford district 1995 RMP identified a set of monitoring watersheds which were deferred from harvest for one decade.

- In the No Action Alternative these areas had no harvest modeled for 1 decade. After that these areas would have harvest modeled according to the underlying land use allocation and contribute to the ASQ. There was a GIS data issue that one watershed was included that was not intended to be deferred and another was omitted. Overall the modeling was 500 acres short on modeling this deferral.
- In Alternative 1 these watersheds were modeled as completely deferred with no harvest activities simulated. These lands did not contribute to the ASQ. The GIS data was corrected from the No Action dataset.

29) 15% Standard and Guideline (15% S&G) -

The 15% S&G was modeled in the No Action Alternative. The OPTIONS model did not conduct any regeneration harvest until 15% of the forest area with in each fifth field (with in the SYU) was in stands 80 years or older. This constraint was enforced annually, prohibiting watersheds from going below the threshold. Thinning treatments were modeled irrespective of the 15% S&G status. Harvest in these areas does or does not contribute to the ASQ depending on the underlying land use allocation.

30) Swiss Needle Cast Area -

The Salem district identified the current extent of the Swiss needle cast infection exists. The OPTIONS model used a unique set of species groups to reflect the reduced yields of existing stands or the future growth and yields of disease resistant species mixes in the existing infection area.

31) Alt 3 Assessment Areas – Landscape Targets -

A review of the age which the OPTIONS projection achieved Northern Spotted Owl habitat (category 4) was conducted for each province / SYU. From this review age 90 years or 140 years thresholds were established for each province / SYU for use as the landscape targets. Assessment areas were established based on the combination of province / SYU which were outside of the Uneven-aged management area in Medford and Klamath Falls and the Coquille Tribal management area. In OPTIONS regeneration harvest was not modeled until 50% of the forest area in each assessment area was above the landscape target age. Partial harvest and commercial thinning were modeled for the entire projection period independent of the landscape targets and assessment areas. Marbled Murrelet Sites and Northern Spotted owl sites were modeled as no harvest until one decade after the landscape targets were met. At that time those lands were available for harvest.

Table 297. Alt 3 Landscape Areas, Habitat Threshold Ages and Assessment Area Names

Alt 3 Landscape Areas, Habitat Threshold Ages and Assessment Area Names				
	Cascades	Coast	Klamath	Total (acres)
Coos Bay		269,634	51,533	321,166
Threshold Age		90 Years	90 Years	
Assessment Area		CB Coast / Coquille	CB Klamath	
Eugene	151,974	160,286		312,261
Threshold Age	90 Years	90 Years		
Assessment Area	Eug Cascades	Eug Coast		
K-Falls	51,306			51,306
Threshold Age	n/a			
Assessment Area	Uneven Age			
Medford	229,873		636,819	866,692
Threshold Age	140 Years & n/a		140 Years & n/a	
Assessment Area	Med Cascades & Uneven Age		Med Klamath & Uneven Age	
Roseburg	152,313	129,039	142,236	423,588
Threshold Age	90 Years	90 Years	140 Years	
Assessment Area	Ros Cacades	Ros Coast	Ros Klamath	
Salem	170,027	232,157		402,184
Threshold Age	90 Years	90 Years		
Assessment Area	Sal Cascades	Sal Coast		

32) Coquille Tribal Management Area

The Coquille Tribal Management Area was modeled in Alternative 2 and 3. No northern spotted owl site harvest constraints were applied in this area under both alternatives. Under Alternative 3 the landscape targets were not applied which limited regeneration harvest. See Riparian section for Alternative 3 modeling for the riparian area. The TMA/ GLA lands were modeled under the No Action GFMA prescription.

GIS Data – Modeling Harvest and Contribution to ASQ

The Table below provides a summary of how each category of GIS data was modeled and which categories contribute to the Allowable Sale Quantity.

Table 298. GIS Modeling Data Categories

GIS Modeling Data Categories	No Action	Alternative 1	Alternative 2	Alternative 3
Roads	X	X	X	X
TPCC Non Forest	X	X	X	X
TPCC Non Suitable Woodlands	N	N	N	N
TPCC Suitable Woodlands - Low Site and Non Commercial Species	N	N	N	N
TPCC Suitable Woodlands - Reforestation	N	Y	Y	Y
Recreation Sites Existing	N	N	N	N
Recreation Sites Proposed	Y	N	N	N
Wild and Scenic Rivers - Existing	N	N	N	N
Wild and Scenic Rivers - Eligible	Y	N	N	N
Visual Resource Management Class 1	N	N	N	N
Areas Of Critical Environmental Concern - Existing	N	N – If Passes O&C Filter	N –If Passes O&C Filter	N – If Passes O&C Filter
Areas Of Critical Environmental Concern - Proposed	Y	N – If Passes O&C Filter	N – If Passes O&C Filter	N – If Passes O&C Filter
Occupied Marbled Murrelet Sites	N	N	N	D
Simulation Future Marbled Murrelet Sites	N	N	N	D
Known Owl Activity Centers	N - 100 Acres	Y	Y	D - 250 Acres
Reserve Pair Areas (Salem)	N	N/A	N/A	N/A
Survey and Manage Species	N	N/A	N/A	N/A
Special Status Species	N/A	N - For Those On PD Lands	N - For Those On PD Lands	N - For Those On PD Lands
Species Mangement Areas	N	N - For Eagle Sites	N - For Eagle Sites	N - For Eagle Sites
Riparian Reserves	P	N/A	N/A	N/A
Riparian Mangement Areas	N/A	P	P	P
LUA - Congressionally Reserved	N	N	N	N
LUA - Late-Successional Reserves	P	N/A	N/A	N/A
LUA - Late-Successional Management Areas	N/A	P	P	N/A
LUA - Adaptive Management Areas	Y/P	N/A	N/A	N/A
LUA - Adaptive Management Areas/Reserves	P	N/A	N/A	N/A
LUA - Connectivity Diversity Blocks	Y	N/A	N/A	N/A
LUA - General Forest Management Areas	Y	N/A	N/A	N/A

LUA - Southern General Forest Management Areas	Y	N/A	N/A	N/A
LUA - Timber Management Area	N/A	Y	Y	N/A
LUA - Gen Landscape Area	N/A	N/A	N/A	Y
LUA - District Defined Reserves	N	N/A	N/A	N/A
Misc. District No Harvest Areas	N	N	N	N
Wilderness Characteristics on PD Lands	Y	N	N	N
Medford Deferred Watersheds	D	N	N/A	N/A
15% Standard & Guide	D	N/A	N/A	N/A

- Y = Harvest is modeled and contributes to ASQ
- P = Harvest is modeled but does not contribute to ASQ since the harvest can not be sustained continuously over time.
- N = No harvest is modeled.
- D = Harvest is deferred for 1 or more decades and contributes to ASQ.
- X = Non Forest
- N/A = Does not apply to the alternative

Sub Alternatives & Benchmark Analysis Modeling Rules

Sub Alternative Analysis

1) **Alternative 1 with No harvest of stands 200 years and older**. All existing Forest Operations Inventory units with a stand age of 200 years or older were modeled as not available for harvest.

2) **Alternative 1 with No harvest of stands 80 years and older**. All existing Forest Operations Inventory units with a stand age of 80 years or older were modeled as not available for harvest.

3) **Alternative 1 with No Regeneration Harvest until Thinning Opportunities were Depleted** – Thinning was given the highest priority in requested volume.

4) **Alternative 1 adding Northern Spotted Owl (NSO) Critical Habitat to the Late-Successional Management Area (LSMA).** The GIS data for NSO critical habitat was added to the LSMA allocation and modeled under those rules.

5) **Alternative 2 Short Rotation -** The objective was to mimic industrial forestry practices within the Timber Management Area minimum harvest ages were set to approximate the general range of harvest ages displayed in Figures 6.1, 6.3 and 6.4 of PNW GTR-633. Within the OPTIONS model, no commercial thinning was applied to the Timber Management Area for this sub-alternative.

6) **Alternative 3 – Low Government Ownership.** Those BLM sections or parcels of land which were in areas that were in less than 50% (based on a roving 25 square mile circle) in State or Federal Ownership were identified as low government ownership. For these lands no landscape target (50% of assessment area in stands 90/140 years of age) was applied. The assessment areas for the high government lands were changed to the entire SYU, excluding the uneven aged management area and Coquille management area. This change was made because the exclusion of the low ownership areas from the assessment areas made for illogical variable sized assessment areas.

Table 299. Alt 2 Short Rotation Subalternative - Minimum Harvest Ages by Species Group and Site (Productivity) Class

Alt 2 Short Rotation Subalternative - Minimum Harvest Ages by Species Group and Site (Productivity) Class						
W. Hemlock Zone	**Douglas-fir & Tanoak Zones**					
Species	**Species**	**Forest Maturity Criteria**				
Group	Group	SP5	SP4	SP3	SP2	SP1
HNCM	ONCM	60	55	50	45	40
HNDF	ONDF	60	55	50	45	40
HNHM	ONHM	60	55	50	45	40
HSCH	OSCH	70	65	60	55	50
HSDF	OSDF	70	65	60	55	50
HSHW	OSHW	70	65	60	55	50
HSMC	OSMC	70	65	60	55	50
HSTF	OSTF	80	75	70	65	60
HPP	OPP	80	75	70	65	60
J	J					
NF	NF					
ROAD	ROAD					
SSCH	SSCH					
SSDF	SSDF					
SSHW	SSHW					
SSMC	SSMC					
SSTF	SSTF					
SPP	SPP					
SJ	SJ					
HCNCM	OCNCM	60	55	50	45	40
HCNDF	OCNDF	60	55	50	45	40
HCNHM	OCNHM	60	55	50	45	40

Reference Analysis

1) Maximum Harvest –

The Alternative 2 data was used for this analysis. All lands were made available for harvest with the exception of ; TPCC Non Suitable Woodlands, TPCC Suitable Woodland (low site and non commercial species), Wild and Scenic Rivers, existing recreation sites. 25' buffer on streams (buf_25), Congressionally Reserved lands, and the National Monument. CMAI was used in setting the minimum harvest ages similar to Alternative 2.

2) No Harvest –

No harvest was simulated.

Green Tree Retention

No Action Alternative

Green Tree Retention (GTR) was modeled as a stand level constraint in the No Action Alternative. Within each polygon a retention level was applied at the time of harvest. Retention levels varied by land use allocation as presented in Table 300.

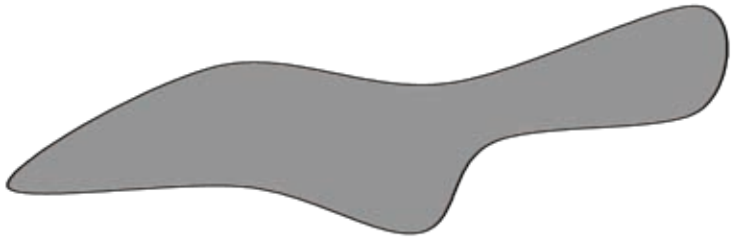
Table 300. Green tree retention percent by land use allocation for the No Action analysis

Land Use Allocation	Green Tree Retention Percent
General Forest Management Area (GFMA), North GFMA, Adaptive Management Areas, No Designation	11%
South General Forest Management Area (including Granitic Soils Areas)	24%
Connectivity Diversity Blocks, District Defined Reserves, Congressionally Reserved, National Monument	18%
Late Successional Reserves, Adaptive Management Area Reserves	Not Applicable
Eastside Management Lands	Not Applicable

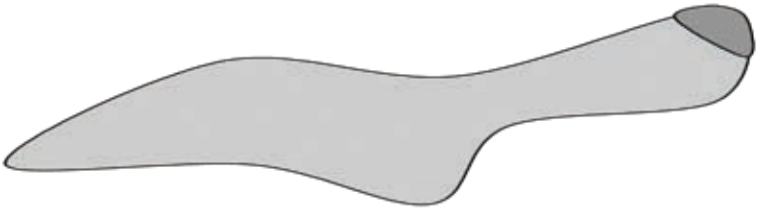
The retained portions of the polygons were modeled as contiguous areas and reserved until a subsequent rotation when the areas were made available for harvest and GTR retention was applied. Thus, in each subsequent harvest a smaller portion of the original retention area was reserved while younger GTR areas were also retained.

The figure below provides a graphic example of modeling 11% green tree retention. In the model the retention areas is not spatially defined with in the polygon but is tracked as a proportion of the area.

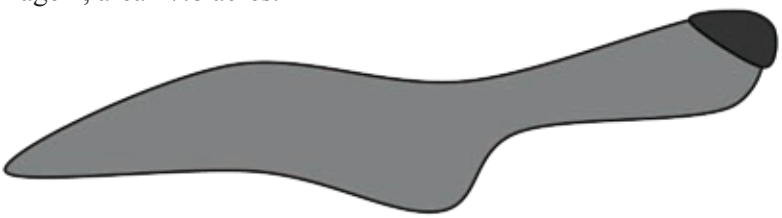
Figure 344. Green tree retention accounting within the OPTIONS model.



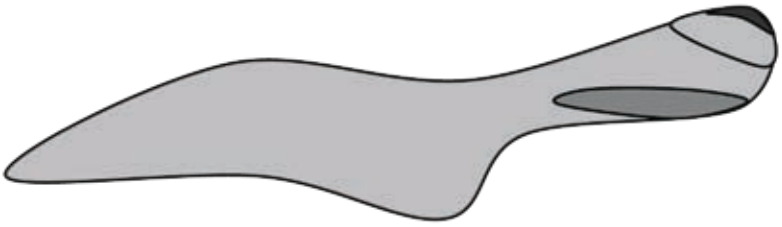
Polygon prior to first harvest. Stand age 100 years. Area 20 acres.



Polygon after first harvest. Retention stand age 101, area 2.2 acres; regeneration age 1, area 17.8 acres.



Polygon prior to second harvest. Retention stand age 181, area 2.2 acres; regeneration age 81, area 17.8 acres.



Polygon after second harvest. Oldest retention stand age 181, area 0.24 acres; younger retention stand age 81, area 1.96 acres; regeneration age 1, area 17.8 acres.

Alternative 1

No green tree retention was applied in Alternative 1

Alternative 2

Management action for two trees per acre green tree retention was not simulated in the modeling since the volume reduction would be minor. Green tree retention for the Coquille Management Area was modeled the same as the No Action alternative General Forest Management Area.

Modeling of the tree retention levels for future snags and coarse woody debris in the Late-Successional Management Areas varied individual SYUs and physiographic provinces. This retention was modeled as a stand level constraint by reserving a percentage of each stand being thinned.

Table 301. Late Successional Management Areas tree retention percent by Sustained Yield Unit / Retention Zone.

Retention Zone	Lakeview	Salem	Eugene	Roseburg	Medford	Coos Bay
Western Hemlock	0%	7%	8%	14%	0%	8%
Douglas-fir	9%	0%	0%	8%	12%	0%
Tan Oak	9%	0%	0%	0%	13%	5%

Alternative 3

Assessment areas were established based on the combination of province / SYU which were outside of the Uneven-aged management area in Medford and Klamath Falls and the Coquille Tribal management area. Age thresholds (90 yr or 140 yr) were established as landscape target for each assessment area. (See GIS Based Modeling Rules – Assessment Areas) Regeneration harvests were not modeled until 50% of the Assessment Area was in ages at or above the landscape target threshold.

After regeneration harvests green tree retention was modeled in a similar manner as in the No Action and Alternative 2. However, retention levels for Alternative 3 were based on species group.

Table 302. Regeneration harvest percent volume tree retention for green tree, snag, and coarse woody debris creation by species group.

Species Group	Green Tree Retention Percent	Green Tree + Future Snag and CWD
Northern Hardwood Mixed	7%	15%
Northern Mixed Conifer	6%	14%
Northern Douglas-fir	6%	14%
Southern Douglas-fir	7%	10%
Southern Mixed Conifer	8%	12%
Sothern Conifer Hardwood	10%	13%
Southern Hardwood	9%	13%
Southern True Fir	8%	11%
Ponderosa Pine	15%	24%

In Alternative 3 intermediate harvests, termed partial harvests, were permitted prior meeting the older forest targets. For intermediate harvests green tree retention was modeled as a partial harvest, and stand attributes of the retained stems were incorporated into the blended yield curves. The blended yield curves reduced the retained and regenerated components of the harvest unit proportionally, similar to the stand level constraint method described above, however, the retained portions of the polygons are not reported independently.

Table 303. Stand treatment age and retention used to blend yield curves for intermediate harvests.

	1st Intermediate Harvest		2nd Intermediate Harvest		3rd Intermediate Harvest		4th Regeneration Harvest	
Zone	Age	%	Age	%	Age	%	Age	%
Hemlock	120	35	240	35	0	0	360	n/a
Douglas fir	80	19	160	19	0	0	240	n/a
Tanoak	60	35	120	35	180	35	240	n/a

Table 304. Partial Harvest Retention plus Supplemental Retention for Snag and Coarse Woody Debris Creation

	1st Intermediate Harvest		2nd Intermediate Harvest		3rd Intermediate Harvest		4th Regeneration Harvest	
Zone	Age	%	Age	%	Age	%	Age	%
Hemlock	120	42	240	42	0	0	360	*
Douglas fir	80	22	160	22	0	0	240	*
Tanoak	60	39	120	39	180	39	240	*

* GTR levels by Species Group

The Coquille Management Area was modeled the same as the No Action General Forest Management Area.

Scribner Volume

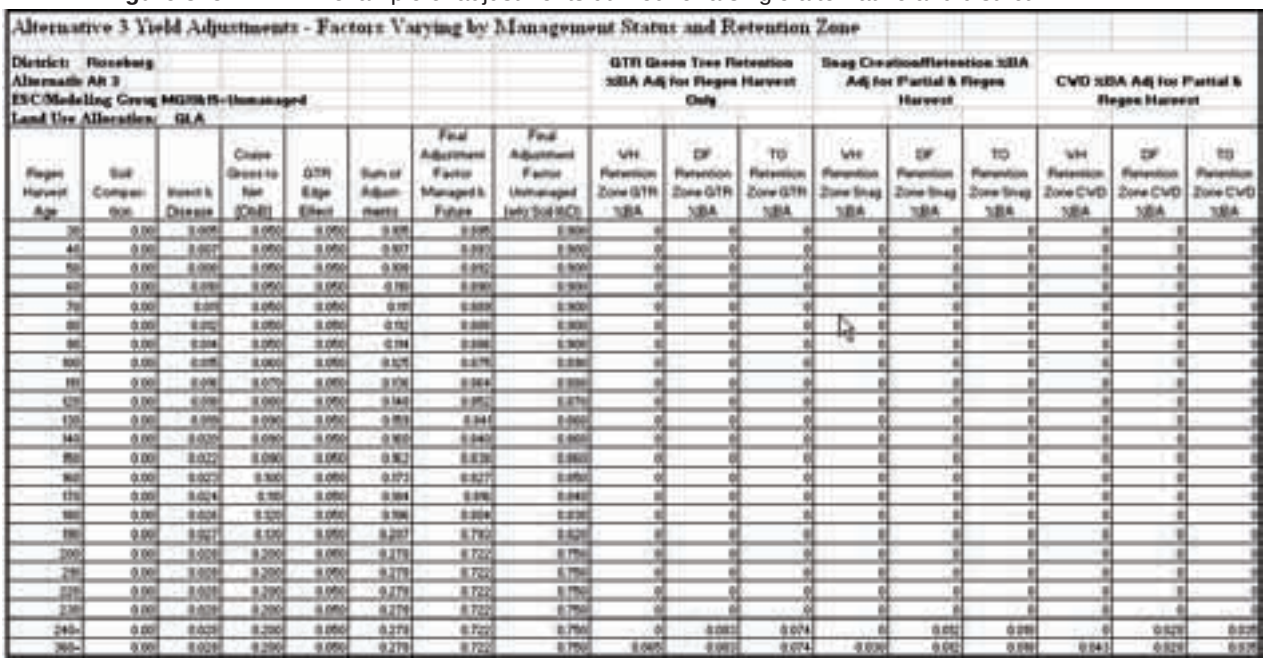
For OPTIONS modeling, Scribner volumes were generated as a part of the guide curve modeling with the ORGANON Shell. The equations for these volumes are based 16-foot BLM volume rules.

Volume Adjustments

Guide Curve Adjustments to volume were made for Defect and Breakage (D&B), Green Tree Retention (GTR), Snags, Coarse Woody Debris (CWD), Insect and Disease, and Soil Compaction

With the exception of GTR, all adjustments to the Guide Curves were compiled outside the OPTIONS model as percent basal area reductions. Estimates for D&B, Insect and Disease, and Soil Compaction were supplied by the districts or based on values derived for the most recent RMP. Guidelines for Snags and Coarse Woody Debris (CWD) varied by alternative. These adjustments were made to the Guide Curves with the OPTIONS data preparation program and applied within the OPTIONS modeling as volume reductions. Adjustments were compiled and applied by ORGANON variant, Species Group, stand type (managed, unmanaged, or future) and harvest type where appropriate. For Alternative 3, these adjustments were further stratified by Vegetation Zone; Western Hemlock, Douglas-fir and Tanoak to account for differences in Snag and Coarse Woody Debris requirements.

Figure 345. An example of adjustments utilized for a single alternative and district.



Alternative 3 Yield Adjustments - Factors Varying by Management Status and Retention Zone

District: Roseburg
Alternative Alt 3
ES/Modeling Group MG/Mat-Unmanaged
Land Use Allocation: GLA

Regen Harvest Age	Soil Compaction	Insect & Disease	Crown Gross to Net (Orbit)	GTR Edge Effect	Sum of Adjustments	Final Adjustment Factor Managed & Future	Final Adjustment Factor Unmanaged (wtr) Soil MC)	GTR Green Tree Retention %BA Adj for Regen Harvest Only: WH Retention Zone GTR %BA	DF Retention Zone GTR %BA	TO Retention Zone GTR %BA	Snag Creation/Retention %BA Adj for Partial & Regen Harvest: WH Retention Zone Snag %BA	DF Retention Zone Snag %BA	TO Retention Zone Snag %BA	CWD %BA Adj for Partial & Regen Harvest: WH Retention Zone CWD %BA	DF Retention Zone CWD %BA	TO Retention Zone CWD %BA
30	0.00	0.005	0.050	0.050	0.105	0.895	0.900	0	0	0	0	0	0	0	0	0
40	0.00	0.007	0.050	0.050	0.107	0.893	0.900	0	0	0	0	0	0	0	0	0
50	0.00	0.009	0.050	0.050	0.109	0.891	0.900	0	0	0	0	0	0	0	0	0
60	0.00	0.010	0.050	0.050	0.110	0.890	0.900	0	0	0	0	0	0	0	0	0
70	0.00	0.010	0.050	0.050	0.110	0.890	0.900	0	0	0	0	0	0	0	0	0
80	0.00	0.010	0.050	0.050	0.110	0.890	0.900	0	0	0	0	0	0	0	0	0
90	0.00	0.010	0.050	0.050	0.110	0.890	0.900	0	0	0	0	0	0	0	0	0
100	0.00	0.010	0.050	0.050	0.110	0.890	0.900	0	0	0	0	0	0	0	0	0
110	0.00	0.010	0.050	0.050	0.110	0.890	0.900	0	0	0	0	0	0	0	0	0
120	0.00	0.010	0.050	0.050	0.110	0.890	0.900	0	0	0	0	0	0	0	0	0
130	0.00	0.010	0.050	0.050	0.110	0.890	0.900	0	0	0	0	0	0	0	0	0
140	0.00	0.010	0.050	0.050	0.110	0.890	0.900	0	0	0	0	0	0	0	0	0
150	0.00	0.010	0.050	0.050	0.110	0.890	0.900	0	0	0	0	0	0	0	0	0
160	0.00	0.010	0.050	0.050	0.110	0.890	0.900	0	0	0	0	0	0	0	0	0
170	0.00	0.010	0.050	0.050	0.110	0.890	0.900	0	0	0	0	0	0	0	0	0
180	0.00	0.010	0.050	0.050	0.110	0.890	0.900	0	0	0	0	0	0	0	0	0
190	0.00	0.010	0.050	0.050	0.110	0.890	0.900	0	0	0	0	0	0	0	0	0
200	0.00	0.010	0.050	0.050	0.110	0.890	0.900	0	0	0	0	0	0	0	0	0
210	0.00	0.010	0.050	0.050	0.110	0.890	0.900	0	0	0	0	0	0	0	0	0
220	0.00	0.010	0.050	0.050	0.110	0.890	0.900	0	0	0	0	0	0	0	0	0
230	0.00	0.010	0.050	0.050	0.110	0.890	0.900	0	0	0	0	0	0	0	0	0
240+	0.00	0.010	0.050	0.050	0.110	0.890	0.900	0	0.083	0.074	0	0.052	0.098	0	0.029	0.035
360+	0.00	0.010	0.050	0.050	0.110	0.890	0.900	0.045	0.083	0.074	0.036	0.052	0.098	0.041	0.029	0.035

Exceptions to these were limited to the modeling of GTR for Regeneration harvests in the No Action Alternative and Alternative 3 and the Partial harvests in Alternative 3. These reductions were taken at time of harvest within the OPTIONS model in the form of a reduced harvest unit acreage.

Minimum Harvest Age

The OPTIONS model uses a minimum harvest age to control the lower limit where regeneration harvest can occur.

In the No Action Alternative the minimum harvest ages were set by direction in the current plans. For all districts, except Medford, the minimum regeneration harvest age was set to 60 years. For the Medford district, the minimums were 100 years in the North General Forest Management Areas and 120 years in the South General Forest Management Areas.

For alternatives 1 and 2 minimum harvest ages were based on Culmination of Mean Annual Increment (CMAI) for regeneration harvests.

Culmination of Mean Annual Increment (CMAI) results can vary widely depending on the unit of measurement used, the utilization standards and whether net or gross growth is considered. It has been a commonly accepted forestry theorem that even- aged stands should be harvested at CMAI in order to maximize biological yields.

Current Annual Increment (CAI) is defined as the annual increment of wood grown for a particular stand, or in this case a group of inventory plots representing similar growing

conditions. Mean Annual Increment (MAI) for a particular stand or set of plots is the total increment of wood at a given stand age divided by that stand age. CMAI is the point when the CAI, sometimes termed Periodic Annual Increment (PAI) and the MAI are equal. Culmination occurs when the maximum MAI is reached. From the ORGANON Guide Curve runs, Total Stem Cubic Volume (TSCV) was used for CMAI determination. This approximates a biological decision rule for the point of harvest. For this evaluation, the CMAI threshold was assumed to be the first age (5-year ORGANON modeling cycle) at which the difference between PAI and MAI was zero or negative. The gross volume CMAI statistics generated from ORGANON were adjusted to approximate net volume CMAI and allow the OPTIONS modeling greater flexibility in harvest scheduling.

In Alternative 1 and 2 the OPTIONS minimum harvest age was set at the 90% level of CMAI to give the model a reasonable level to vary from the estimated values.

Table 305. Forest Maturity Criteria - Proposed Minimum Harvest Ages at 90% CMAI by Species Group and Site (Productivity) Class

Forest Maturity Criteria - Proposed Minimum Harvest Ages at 90% CMAI by Species Group and Site (Productivity) Class					
Species	Productivity Classes				
Group	SP5	SP4	SP3	SP2	SP1
NCM	110	105	95	95	85
NDF	110	95	85	85	75
NHM	95	95	85	80	80
SCH	155	120	110	110	110
SDF	140	120	110	105	100
SHW	155	120	110	110	110
SMC	155	120	110	110	110
STF	145	140	120	120	120
PP	140	115	115	115	115
SSCH	155	120	110	110	110
SSDF	140	120	110	105	100
SSHW	155	120	110	110	110
SSMC	155	120	110	110	110
SSTF	145	140	120	120	120
SPP	140	115	115	115	115
CNCM	130	110	95	90	85
CNDF	130	110	95	90	85
CNHM	130	110	95	90	85

For Alternative 3 minimum both partial harvest and regeneration harvest minimum harvest ages were established in the management action.

Table 306. Alternative 3 Minimum Stand Treatment Ages for Partial and Regeneration Harvests

	1st Partial Harvest	2nd Partial Harvest	3rd Partial Harvest	Regeneration Harvest
Zone	Stand Age (years)	Stand Age (years)	Stand Age (years)	Stand Age (years)
Hemlock	120	240	0	360
Douglas fir	80	160	0	240
Tanoak	60	120	180	240

Modeling Thinnings

Commercial thinning modeling criteria were derived from two sources.

- Simulation rules for management action for an alternative.

  Example - Modeling "caps' were used to limit commercial thinning in Late-Successional Reserves to stands less than 80 years to simulate the plan requirement to only apply treatments that would promote the development of late-successional forest.

- Growth and yield team's results for the ORGANON modeling of existing and future stands.

  ORGANON modeling determined the timing, extent and number of treatments which were specific to modeling groups. The lower and upper treatment ages, treatment intensity and the number of treatments along with modeling criteria, targets and guidelines are documented under the Forest Growth and Yield Modeling section.

The Treatment Response approach allows the OPTIONS model to adjust for the total growth in the thinned stand by modifying the growth rate (slope) of the Guide Curve for the untreated stand. The growth rate is adjusted such that the ORGANON modeled growth response of the treated stand, i.e. the increase in volume growth at the end of the treatment response period, is approximated within the OPTIONS modeling for that particular stand type and a specific thinning treatment. For use in the OPTIONS model, the commercial thinning treatment results, for each modeled combination of Species Group(s), Productivity Class(es) and thinning entry number (1st, 2nd, 3rd…) were subsequently analyzed to determine a "Treatment Response". Treatment Response Period was defined as 30 years or the number of years between modeled thinning entries, whichever was less.

Within the OPTIONS model, the thinning availability window was set in all alternatives to 5 years prior and 15 years after the ORGANON modeled treatment age for a specific stand type. If, within the OPTIONS model, a particular vegetation polygon was not thinned during a treatment window, the opportunity for the model to apply that specific commercial thinning treatment was foregone. If that particular stand was modeled for

subsequent thinning treatments at older ages, it became available for treatment evaluation like any other stand regardless of whether the previous treatment was applied.

Before the OPTIONS model can apply a commercial thinning treatment to a particular stand, the current stand attributes are reviewed to insure that the prescribed removal will meet the minimum per acre harvest targets. The minimum targets were – Salem Roseburg, Coos Bay – 8,000 board feet per acre, Eugene – 6,000 board feet per acre, Medford 4,000 board feet per acre, and Klamath Falls 2,000 board feet per acre. If the residual stand criteria cannot be met, the stand will be left to grow and re-evaluated in subsequent years as long as it remains within the treatment window or until the treatment is applied. Since all the existing stands were assigned an imputed stand attributes, not the average guide curve values, some lower-stocked stands which can not meet the minimum post-harvest criteria may be left to grow. Depending on the stand, the priority for commercial thinning in a particular alternative and the harvest related criteria described above, stands may or may not receive treatment.

Harvest Priorities

Within the OPTIONS model the source of harvest volume could be prioritized by three categories of "Wood Type" were defined and held constant across all alternatives.

- Older Forest – Regeneration harvest stands 200 years and older.
- Second Growth – Regeneration harvest of stands less than 200 years.
- Thinning – All thinning, intermediate, or partial harvests.

Within the model, Wood Types are assigned priorities 1 through 3, with 1 being the highest and 3 the lowest priority for harvest.

Within each Wood Type a lower and an upper harvest request limit can be designated.

An overall harvest volume is established in the Model as a maximum harvest level for any one year. The model will then attempt to satisfy the first priority Wood Type lower harvest request. Then do the same with the other two Wood Type priorities. After the lower harvest limits have been, to the extent possible, implemented across all three Wood Types, the model goes through the Wood Types by priority to satisfy any upper limit of harvest requests. If the upper harvest limit can not be satisfied in the first wood type priority then it proceeds to the next wood type priority until it attains the over all harvest level requested.

These lower and upper limits for each wood type can be modified for specific time periods of the projection.

These harvest priority controls can be used to control the rate of harvest in a particular Wood Type as well as balancing the levels of harvest across wood types.

Establishing Harvest Levels

OPTIONS modeling projections occur in increments of 1 year. Thus, all management objectives were maintained, and requested harvest levels met, in each year of the planning horizon. The planning horizon for all analyses was 100 years, although the final ASQ harvest level for each alternative was tested at 400 years to ensure its long-term sustainability. The sustainability analyses were subject to the same criteria as the 100 year analyses.

Harvest volume projections are based on the lands available for harvest, under the assumptions of the alternative within each sustained yield unit. Those lands which contribute to the ASQ can be managed over an extended period of time to provide a sustainable non declining level of harvest. Harvest from reserves (Late-Successional Reserves / Management Areas and or Riparian Reserves / Management Areas) will diminish as stands grow past the conditions suitable for thinning and will not produce a sustainable harvest over time.

The sustainable harvest level from the land base supporting the ASQ was modeled separately from that harvest which can be derived from the reserves. Segregating the landbase and modeling of harvest volume in this manner isolated the interaction of these two types of allocations.

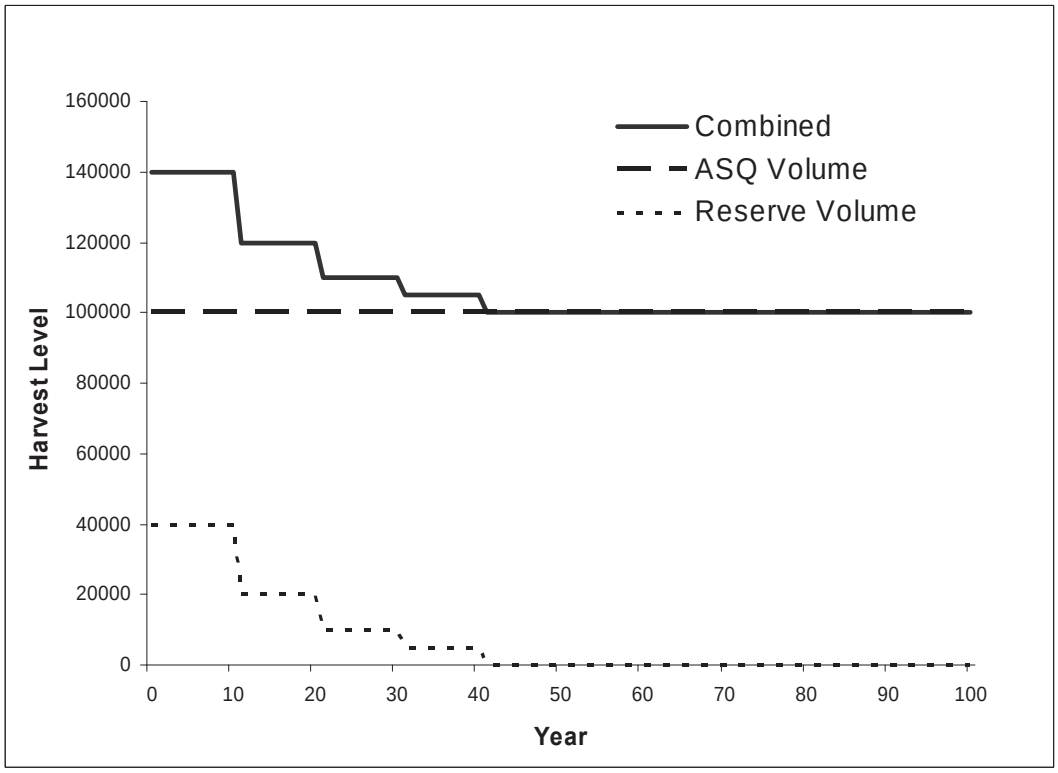
For ASQ lands, a non-declining even flow (NDEF) strategy was applied. Based on this approach a single maximum harvest level was modeled for the entire planning horizon and tested within a defined level of precision (increments of 1 million board feet, 0.1 for Klamath Falls). The exception to this approach was in the modeling of Alternative 3 where a future increase in the ASQ harvest levels were determined after landscape targets were achieved for an entire Sustained Yield Unit (SYU).

Generally, reserve lands permitted limited management activities and had a limited period of availability. The NDEF strategy was not an appropriate method of modeling these areas so an uneven flow strategy was applied. Reserve lands only provided timber within the short-term (within the first 80 to 100 years, depending on the alternative), so a 'stair-stepped' method was used to characterize and report partial harvest volume. With this approach a maximum harvest volume for each 10-year period was determined.

A combined ASQ and reserve land OPTIONS run was performed for the production of the Ten Year Scenario, Northern Spotted Owl Habitat Projections, Structural Stage Projections and other post processing reporting. A maximum harvest level of the larger combined harvest landbase was not modeled. The total harvest volume modeled was the simple sum of the ASQ and reserve harvest volumes, although the reserve harvest volume amount was first reduced by 20% to approximate operational fall down. A maximum harvest volume level of the larger combined harvest levels landbase was not tested modeled. The overall thinning harvest level in terms of acres and volume matched the combined request but the proportions coming from inside and outside reserves was not controlled in the combined run. This appeared in Alternative 3 where a very small amount of riparian thinning (2 MMBF out of 473 MMBF total) was requested in the combined run but none if occurred in the riparian areas.

The Figure below is an example of non-declining ASQ harvest volume, stair-stepped reserve harvest volume and combined harvest volumes.

Figure 346. Reserve, ASQ, and Total Volume..



Creating Blended Yield Curves for Alternative 3

Alternative 3 included rules that excluded regeneration harvests until older forest retention target thresholds were achieved. Additionally, within each landscape unit intermediate harvests with high levels of green trees were retention were permitted prior to achieving the landscape target levels of older forests.

Table 307. Stand treatment age and percent retention used to blend yield curves for intermediate harvests.

	1st Intermediate Harvest		2nd Intermediate Harvest		3rd Intermediate Harvest		4th Intermediate Harvest	
Zone	Age	%	Age	%	Age	%	Age	%
Hemlock	120	35	240	35	0	0	0	0
Douglas-fir	80	19	160	19	240	19	0	0
Tanoak	60	35	120	35	180	35	240	35

In the other alternatives, yield curves were developed by the growth and yield team with the Organon model. However, the high retention levels of the intermediate harvests in Alternative 3 presented a modeling challenge for Organon. Investigation by the growth and yield specialists revealed that in the

ORGANON model, it would be difficult to develop an appropriate set of tree data to represent the multi-storied character of the intermediate harvests. As an alternative, a simple mathematical approach was considered a suitable technique for developing the blended guide curves for the multi-storied stand conditions resulting from intermediate harvests. It was recognized that this approach does not account for the treatment, competition or edge effects of the intermediate harvest. The blending process was applied to the Organon stand summary table for the OPTIONS analysis, and for the Organon detailed stand tables for use with the Northern Spotted Owl habitat index and structural stage classification.

This mathematical approach involved combining (or blending) the yield curve of the untreated portion of the stand with the yield curve of the treated portion of the stand. The 'blending' technique apportioned basal area, volume and density based on the retention level of the intermediate harvest. Stand height and diameter were not blended. These attributes were based wholly on the yield curves for the treated portion of the stand.

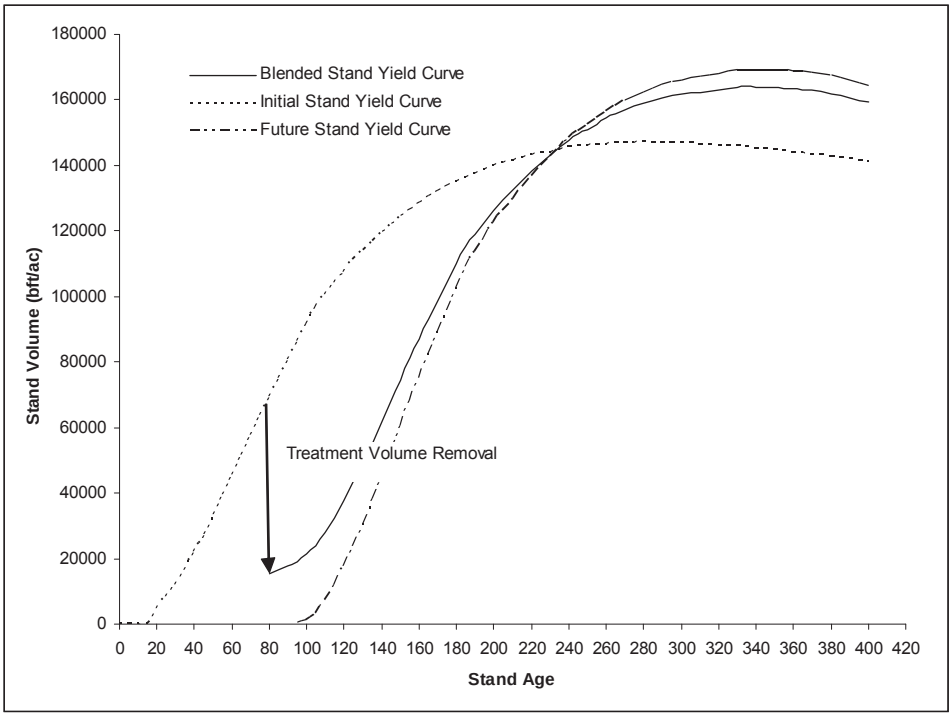
The table below provides an example of the pairing between the untreated overstory yield curve and the treated understory yield curve that results in a blended yield curve. The values represent the Current Vegetation Survey name prefix. A curve naming convention was established to identify the resulting blended yield curve based on the zone and treatment age. For example, the generation of the 1st intermediate harvest at age 120 for the Hemlock Zone would result in the following blended curves.

Table 308. Initial, regeneration and resulting blended yield curves.

Overstory Curve	Understory Curve	Blended Curve
MG1_1_NCM_NONE	NDF_NO_OS_1_PCT260	ALT3_H120_MG1_1_NDF
MG1_2_NCM_NONE	NDF_NO_OS_2_PCT260	ALT3_H120_MG1_2_NDF
MG1_3_NCM_NONE	NDF_NO_OS_3_PCT260	ALT3_H120_MG1_3_NDF
MG1_4_NCM_NONE	NDF_NO_OS_4_PCT260	ALT3_H120_MG1_4_NDF
MG1_5_NCM_NONE	NDF_NO_OS_5_PCT260	ALT3_H120_MG1_5_NDF

For example, if the intermediate harvest retained 40% of the original stand, the blended curve would include 40% of the stems from the original and 60% of the regenerated stand curve. The curves assigned to existing stands differed from curves assigned to recently regenerated areas to reflect current and/or future regenerations standards. In the model the treated stand retains the age of the overstory which represents the initial age of the blended curve. Figure 346 compares a stand's initial yield curve, the regeneration yield curve, the blended curve, and how a stand progresses from its initial curve to the blended curve. In the example below a stand receives an intermediate harvest at age 80. At the time of treatment, the stand supports a volume of approximately 70,000 board feet/acre. Immediately after treatment, the stand retains its age of 80, and has a residual volume of approximately 15,000 board feet/acre, or approximately 22% of the original stand volume. After treatment the stand is assigned to the blended yield curve and grows at the blended rate.

Figure 347. A comparison of an initial yield curve, the regenerated (future) yield curve and the blended curve.



Within the various landscape units multiple intermediate harvests were permitted, and for each possible intermediate harvest an additional blended yield curve was required. Blended curves were applied after intermediate harvest treatments. Where the blended curve of the first intermediate harvest was created from the initial curve combined with a regeneration curve, each successive treatment combined the previously blended curve with a regeneration curve. Once the landscape targets were achieved stands were regeneration harvested and then assigned to an unblended regeneration curve. The blended curves extended to a stand age of 400 years. In OPTIONS stand older than this were assigned the attributes of the 400 year old stand.

Alternative 3 Blended Curve Procedures

Create a blended curve for a stand within the Douglas-fir Zone (DF) with an intermediate harvest at age 80 years. This is the first intermediate harvest age and the green tree retention level is 19%.

Stand Summary Blending

1. Initialize the new blended yield curve with the stand characteristic from the overstory yield curve beginning at the blending age and continuing to the end of the projection horizon.

2. Incorporate the stand characteristics from the understory yield curve, matching the blended stand age with the initial understory age. In this example, the overstory stand characteristics at age 80 are matched with the stand characteristics of the understory at age 0.

3. Calculate the blended stand characteristics through the simple mathematical approach of summing the retention percent of the overstory stand and the remaining percent of the understory stand. In this example, 19% of the overstory stand is combined with 81% of the understory stand. This approach is applied to basal area, trees per acre and volume. Quadratic Mean Diameter (QMD) and height are re-set to the understory levels. Relative density (RD) is recalculated based on blended values for QMD and basal area.

Stand Table Blending:

1. Initialize the new blended stand table with the overstory stand table values for each species and diameter beginning at the blended stand age and continuing to the end of the projection horizon.

2. Incorporate the stand table values from the understory stand table by species and diameter, matching the blended stand age with the initial understory age. In the case where there is no matching understory species and diameter, incorporate these additional stand table values into to the blended stand table.

3. Calculate the blended stand table values through the simple mathematical approach of summing the retention percent of the overstory stand with the remaining percent of the understory stand. This approach is applied to basal area, live trees per acre, dead trees per acre and board foot volume and cubic foot volume. Height is re-set to the understory value.

In the case where there are only overstory stand values, the retention percent of the overstory stand values are used. In our example, 19% of the overstory stand values would be used.

OPTIONS Products

Introduction

The projection of forest conditions with OPTIONS is based in the model tracking the change over time for five basic attributes.

- Density – trees per acre
- Volume – board feet per acre
- Diameter
- Basal Area
- Height

The growth and yield curves coming from the ORGANON modeling can also be used as a source for forest attribute information since each OPTIONS polygon has a relationship with a growth curve.

Additional modeling was performed to create look up tables for the presence and absence of dead wood which could be related back to the OPTIONS projections.

Considering each alternative has between 4,000,000-600,000 GIS polygons, with 5 attributes, projected in annual increments for 200-400 years the potential data array from OPTIONS alone is considerable. Drawing data relationships from ORGANON or other models to derive forest attributes related to the OPTIONS projections increase that potential data to draw upon. Many of the outputs for the modeling required custom programming to extract and formulate the products for the ID team analysis.

Although OPTIONS performs it's projections in annual increments, only key projection reporting periods (10, 20, 50, and 100 years) were established for the ID team analysis.

The following products from the OPTIONS modeling are described in this section.

- ASQ / NON ASQ Volume
- Ten Year Scenario
- Projections
  - Structural Stages Projection
  - Northern Spotted Owl Habitat Projection.
  - Age Projection
  - OPTIONS Projections – Technical Paper
- Economic Analysis Data
- Time Slice Report
- State of the Forest

- Net Down Report
- Attribute Data for GIS

ASQ / NON ASQ Volume

Harvest volumes are a direct output from the OPTIONS model. Volumes from OPTIONS for the plan revisions are based upon scribner16 foot short log volumes. Harvest volumes are based on the capabilities of the forest lands in each individual Sustained Yield Unit given the management action and allocations of the alternative. All volumes are rounded down to the nearest whole million board feet.

- ASQ Volume - ASQ is synonymous with the O&C Act term Annual Productive Capacity. For each alternative the non declining even flow volume that can be sustained from the harvest land base is the basis for the determining the Allowable Sale Quantity. Under Alternative 3 a two tiered volume was reported to account for the increased harvest level that can be attained after the landscape targets are met (regeneration harvest begins) and the owl and murrelet sites are released and increase the size of the harvest land base
- Non ASQ – Thinning harvest is simulated for the riparian reserves / management areas and for the late-successional reserves / management areas as they apply to the alternatives. The management actions for these allocations do not permit regeneration harvest and there are modeling age caps on the thinning treatments, thus a sustainable source of harvest cannot be expected from these lands. The OPTIONS modeling determined the amount of harvest volume that could be produced from these lands and step down levels as the stands age and their thinning treatment windows close.

The ASQ and Non ASQ volumes are recorded by SYU for each alternative, sub alternative and benchmark analysis in an Excel spreadsheet. The duration of the Non ASQ volume and the long term increase in ASQ for Alternative 3 is summarized as well.

Harvest estimates were modeled for the east side management lands in Klamath Falls only in the No Action Alternative since the silviculture treatments do not vary across the alternatives for those lands. No ASQ is declared for these lands since there are no O&C lands in that area.

Ten Year Scenario

The Ten Year Scenario selects polygon records that were harvested in the first ten years of the OPTIONS projections. For each polygon the acreage and volume harvested is reported by harvest type; regeneration, commercial thinning or selection. The OPTIONS Ten-Year Scenario report also identifies a random 1/3 sample of BLM sections that were harvested in the first decade and identifies all harvest units within those sections.

The OPTIONS output of the polygons harvested by harvest type with acreages and volume were brought back to GIS to make map products with these attributes. The Districts evaluated the harvest units in the sample sections to identify the logging system, and road construction needs.

Ten Year Scenario reports were produced for the No Action and all Action alternatives but not for the sub alternatives. An Access database was created with the first decade polygons harvested, with acreage and volume by harvest type at the SYU and District level. This data was linked to the vegetation polygons to make GIS coverages and map products.

Projections

Post processing of the OPTIONS data created a classification of every OPTIONS vegetation polygon record at year 0, 10, 20, 50, and 100 years for the structural stage classification, Northern Spotted Owl habitat classification and age class distributions. Databases were created for the No Action, Action alternatives, and the following sub alternatives / benchmark analysis; no harvest, no harvest of stands 80 years and older, no harvest of stands 200 years and older, add NSO critical habitat to the LSMA in alternative 1, short rotation, and maximum harvest. This data was linked to the vegetation polygons in GIS for further spatial analysis.

1) Structural Stage Projections

Richard Hardt (ID Team Ecologist) developed the criteria for the Structural Stage Classification used in the plan revision. There is a structural stage appendix further describing the criteria used in this classification.

1) Stand Establishment

- 1a.) Without Structural Legacies
- 1b.) With Structural Legacies

2) Young

- 2a.) Young High Density
  - 2a1.) Without Structural Legacies
  - 2a2.) With Structural Legacies
- 2b.) Young Low Density
  - 2b1.) Without Structural Legacies
  - 2b2.) With Structural Legacies

.

3) Mature

3a.) Single Canopy

3b.) Multiple Canopy

4) Structurally Complex

4a.) Existing Structurally Complex

4a1.) Existing Old Forest

4a2.) Existing Very Old Forest

4b.) Developed Structurally Complex

2) Northern Spotted Owl Habitat Projections

Chris Foster (ID Team Wildlife Biologist) developed the criteria for the Northern Spotted Owl Habitat Classification used in the plan revision (see table below). Three classes of habitat are determined based on diameter class, canopy cover, presence/ absence of snags (10 snags per hectare greater than 25 centimeters), presence / absence of down woody debris (greater than 2% ground cover).

Table 309. Northern Spotted Owl Habitat Projections

Diameter Class	Canopy Cover	Snag Presence / Absence	Down Woody Debris Presence / Absence	Habitat Code Version 4 - Finalized 10/18/06
Habitat values; 1 - non-habitat, 2 - dispersal, 3 - suitable and dispersal.				
11-20	0-40	a	a	1
11-20	0-40	p	a	1
11-20	0-40	a	p	1
11-20	0-40	p	p	1
0-11	0-100			1
20-30	0-40	a	a	1
20-30	0-40	p	a	1
20-30	0-40	a	a	1
20-30	0-40	p	a	1
20-30	0-40	a	p	1
20-30	0-40	p	p	1
20-30	0-40	a	p	1
20-30	0-40	p	p	1
30-100	0-40	a	a	1
30-100	0-40	p	a	1
30-100	0-40	a	a	1
30-100	0-40	p	a	1
30-100	0-40	a	p	1
30-100	0-40	p	p	1

Diameter Class	Canopy Cover	Snag Presence / Absence	Down Woody Debris Presence / Absence	Habitat Code Version 4 - Finalized 10/18/06
30-100	0-40	a	p	1
30-100	0-40	p	p	1
11-20	40-60	a	a	2
11-20	40-60	p	a	2
11-20	40-60	a	p	2
11-20	60-100	a	a	2
11-20	60-100	p	a	2
20-30	40-60	a	a	2
20-30	40-60	p	a	2
20-30	40-60	a	a	2
20-30	40-60	a	p	2
20-30	60-100	a	a	2
20-30	60-100	a	a	2
30-100	40-60	a	a	2
30-100	40-60	p	a	2
30-100	40-60	a	a	2
30-100	40-60	p	a	2
30-100	60-100	a	a	2
30-100	60-100	a	a	2
11-20	40-60	p	p	2
11-20	60-100	a	p	4
11-20	60-100	p	p	4
20-30	40-60	p	a	2
20-30	40-60	p	p	2
20-30	40-60	a	p	2
20-30	60-100	p	a	4
20-30	60-100	p	a	4
20-30	60-100	a	p	4
20-30	60-100	p	p	4
30-100	40-60	a	p	2
30-100	40-60	p	p	2
30-100	60-100	p	a	4
30-100	60-100	a	p	4
20-30	40-60	p	p	4
20-30	60-100	a	p	4
20-30	60-100	p	p	4
30-100	40-60	a	p	4
30-100	40-60	p	p	4
30-100	60-100	p	a	4
30-100	60-100	p	p	4
30-100	60-100	a	p	4
30-100	60-100	p	p	4

3) Age Class Projections

Starting age classes derived from the Forest Operations Inventory (see inventory data section of this appendix) increment forward on an annual basis with the OPTIONS projections until regeneration harvest treatments reset the age. The ages under Alternative 3 should be treated as broad age groups since the yield curves and the progression of stands over time reflect multi storied stand conditions in which age becomes somewhat of a fuzzy measure.

4) OPTIONS Projections – Technical Paper

Northern Spotted Owl Habitat and Structural Stage Classification

Stand Table Habitat and Structural Stage Classification Data

The NSO dispersal habitat and structural stage classifications are based on a number of stand averages and stand table statistics. Stand height is an example of stand average information, the number of stems greater than a threshold diameter, or the number of snags of a particular decay class, are examples of stand table information. OPTIONS utilizes and reports stand average data but does not provide the detailed stand table information required in the dispersal habitat and structural stage classifications. To project habitat and structural stage conditions throughout the planning horizon ORGANON stand tables were required.

In the modeling environment each WOPR unit may receive a number of possible treatment combinations throughout the planning horizon. The number of possible treatments varies by management regime (a series of treatments), species group, site productivity and alternative. The actual sequence of treatments a WOPR unit receives is a dynamic modeling process, dependent upon stand and landscape level targets and rules; it cannot be forecast outside of the OPTIONS model. However, it is possible to describe all possible combinations of treatments, and from this all inclusive set, select the actual scenario of treatments as reported by OPTIONS. Thus, an ORGANON stand table was created for each possible unique combination of treatment, species group and site productivity, for each management regime and for each alternative. A crosswalk table was defined to provide a reference between the treatment combinations and the corresponding stand table.

Modeling Process

There are a number of stand attributes to be considered in the habitat and structural stage classification for an individual WOPR unit, at a particular point in time. The ORGANON treatment stand tables were pre-processed, and then further analyzed to calculate specific habitat and structural stage statistics. These statistics, referred to as 'index values', are reference values in a look-up table; the Index Table. The index values for every modeling group, stand group, site index and treatment are stored in the Index Table.

One of the key steps in the pre-processing of the stand tables for northern spotted owl habitat classification was to generate index values for snags and down woody debris (DWD). The CWDM model was used to generate this information based on input from the stand table dead trees. Together, the stand tables, snag and DWD information provided the detailed information necessary to complete the habitat. Information from the CWDM is also reported within the Index Table.

The OPTIONS model records for each WOPR unit and for all years in the planning horizon, all silvicultural and harvest treatments performed. Also recorded are details of the treatments such as: the area treated, the type of treatment, the volume removed, as well as stand attribute information after treatment. Based on this information it is possible to compile a complete history of activities for each WOPR unit for the entire planning horizon.

Based on the information from the WOPR unit activity history provided by OPTIONS, the appropriate stand table reference is identified in the crosswalk table. This stand table reference is used to locate the index values in the Index table that will be evaluated to define the NSO dispersal habitat and structural stage classification.

Methodology

The following methodology was applied to generate the NSO Habitat and Structural Stage Index Report.

Source Information:

NSO Dispersal Habitat Classification

An NSO Dispersal Habitat definition table was provided that defines the stand conditions required to meet dispersal habitat. These included:

- Diameter Range– average stand diameter as from summary table
- Canopy Closure – based on relative density as follows
  Canopy Closure = -12.298 + 2.375(RD) – 0.014(RD)^2

- Snag presence: 10 snags/acre greater than 10”
- DWD presence: 2% ground cover. The percent ground cover was approximated using a conversion factor and volume by retention plant zones – Volume (cu ft/ac)/X var = % cover.

Retention Plant Zone	DWD Volume (ft3/ac)
p. pine/d. fir	362.648
SW ore conifer	465.179
Westside conifer	62.771

Note: TanOak and DF = SW Oregon, and W. hemlock = West side conifer
Note: Species Group of P. Pine for the p.pine/d.fir in SW Oregon

- Canopy (single/multi-story): A diameter diversity index (DDI) of 60 was used to determine the distinction between single and multi-story canopy, with single-story canopy having a DDI greater than 60 and multi-story canopy having a DDI less than or equal to 60.

Structural Stage Classification

Structural Stage Classification definitions were provided based on the following stand characteristics:

- Age: stand age from summary table
- Height: average stand height from summary table
- TPA: number of trees per acre by diameter from the stand table
- Relative Density: average stand relative density from the summary table
- Legacy Presence: the presence of legacy as an initial condition (based on MircoStorms structure stage classification) as well as the future creation of legacy based on alternative harvest prescriptions.
- CVgt(10): from summary table coefficient of variation of tree diameters greater than 10” dbh.

All Possible Treatment Yield Curve Crosswalk Table (ACT2CVS_XWALK)

This table identifies which treatment yield curve to use for the required stand characteristics and index values to determine the NSO Dispersal Habitat and Structural Stage Classifications. The treatment yield curve is identified based on the current alternative, management regime, species, site productivity class, and treatment age. Below is an example of the crosswalk table.

Index Value Lookup Table (INDX_LKUP)

This table is an Alternative based lookup table containing projected stand characteristics and index values for each treatment yield curve. Some of the index values available include:

- Stand characteristics: age, basal area, TPA, QMD, height, volume, crown ratio, canopy closure, relative density, SDI, CV, DDI,
- TPA by 10” diameter classes: # of trees in 0” to 9”, 10” to 19”, 20” to 29”, 30” to 39”, greater than or equal to 40”
- Snags by 10” diameter classes: # of snag in 0” to 10”, 11” to 20”, 21” to 30”, 31” to 40”, greater than 40”
- Snag TPA: # of snags greater than 10” dbh
- CWD by 10” diameter classes: sum of volume in 0” to 10”, 11” to 20”, 21” to 30”, 31” to 40”, greater than 40”
- CWD vpa: sum of volume greater than 10”
- Calculated canopy closure: canopy closure calculated based on relative density
- Overstory stand characteristics: available for Alternative 3 blended curves, based on the untreated yield curve (basal area, tpa, qmd, height, volume relative density, tpa by 10” diameter class, CV, DDI)
- Understory stand characteristics: available for Alliterative 3 blended curves, based on the treated yield curve (basal area, tpa, qmd, height, volume relative density, tpa by 10” diameter class, CV, DDI)

OPTIONS Run Files

To post-process an OPTIONS run, the following OPTIONS run files are required:

- OPTIONS data files (.DBF, .DBS, .SPG, .SIC)
- OPTIONS run files (.DEF, .DEV, .RUN, .I, .II., .V)

Procedure:

For each Alternative:

1. Using ORGANON, generate the possible treatment stand tables based on the Alternative’s management regime definitions. Create the Crosswalk Table to identify which stand table to reference for a particular treatment combination.

2. Based on the Crosswalk Table, pre-process each treatment stand table to generate the index values that will be used to define the habitat and structural stage classifications. This includes projecting snag and CWD using stand table attributes. Create the Index Table to identify which index values to use for a particular treatment stand table.
3. Initialize a Habitat Report Table by listing for each WOPR unit the OPTIONS inventory values for forest type (forest, non-forest, road), initial management regime, species group, site productivity class and area.

For each forested WOPR unit in the Habitat Report Table.

4. Set initial conditions:
    - Initial Structural Stage and legacy (based on OPTIONS inventory structural stage)
    - Plant Series/Retention Zone (based on OPTIONS inventory)
    - NSO Variance: based on plant series, species group and habitat definition
    - Alternative 2 GTR (green tree retention) flag for MOCA and SHRUB areas
5. Based on the OPTIONS run results, build the WOPR unit Activity History Table including harvest activities and state of the forest years in chronological order. Also record the stand management regime, species group, site productivity and age at which these actives occur. This history table represents the changes in stand characteristics over time.

For each Activity in the Activity History:

6. Determine the current thinning treatment combination, partial harvest condition and legacy based on the type of activity completed.

    For Regeneration Harvest: reset thinning treatment combination, reset partial harvest conditions, re-evaluate legacy

    No Action Alternative (modeled tree retention), legacy is present (WL)

    Alternative 1 (no modeled tree retention), then legacy is not present (WOL)

    Alternative 2 (no modeled tree retention), then legacy is not present (WOL).

    Alternative 2 – MOCA and SHRUB area (modeled tree retention), then legacy is present (WL)

    Sub-Alternative 2 - Max Harvest (no modeled tree retention), then legacy is not present (WOL)

    Alternative 3 (modeled tree retention), legacy is present (WL)

For Selection Harvest: reset thinning treatment combination, set partial harvest condition, re-evaluate legacy

No Action Alternative, Alternative 1 and Alternative 2 there is no modeled selection harvest

Alternative 3 has modeled selection harvest, so legacy is present (WL)

For Commercial Thinning: set thinning treatment combination based on thinning age and thinning sequence, no change to partial harvest condition or legacy.

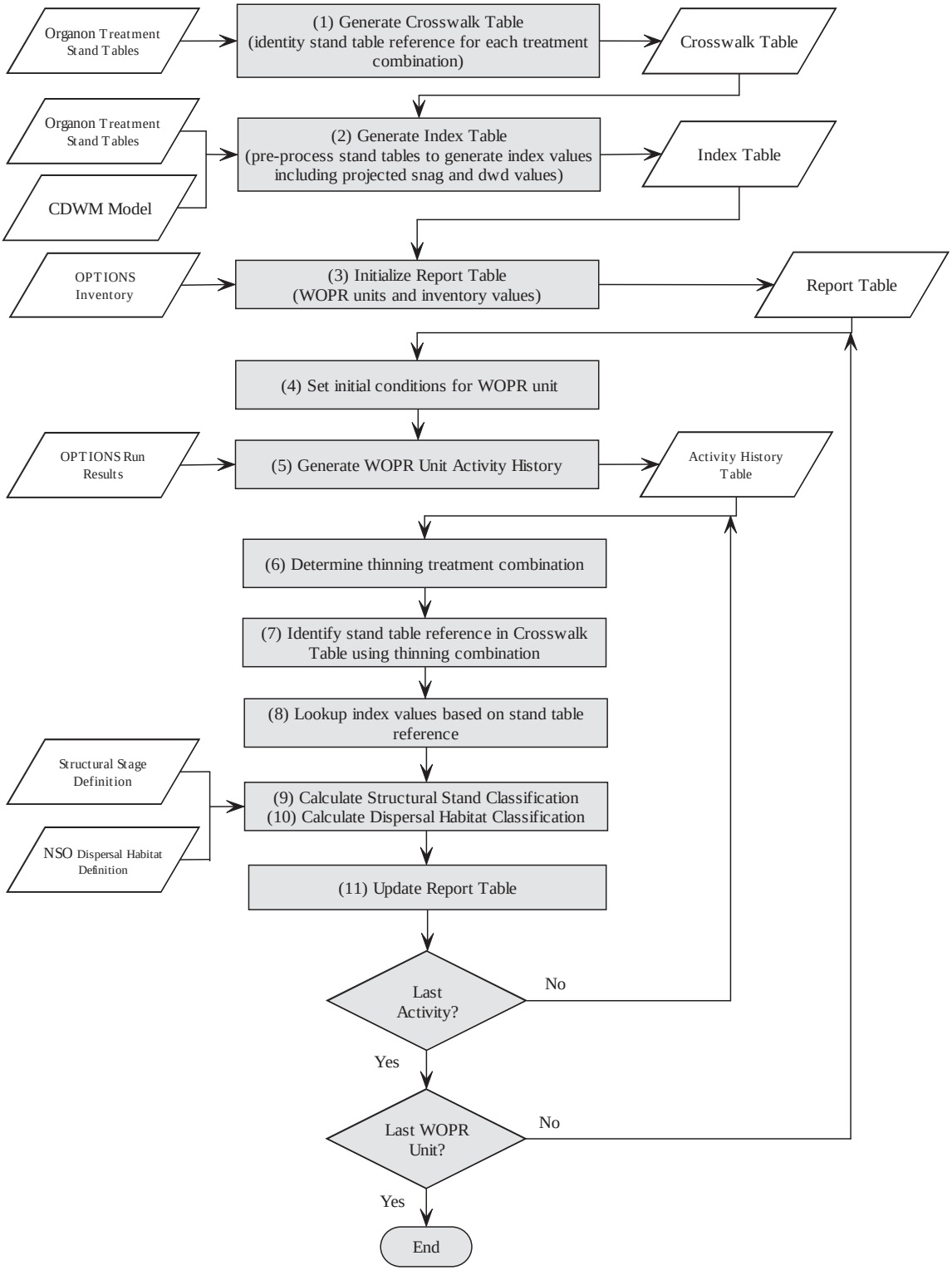
7. Set activity stand table reference from Crosswalk Table based on the treatment combination.
8. Retrieve stand characteristics and index values from Index Table based on stand table reference.
9. Calculate Structure Stage Classification based on index values and structural stage definition.

   For Alternative 3 with partial harvest conditions, if height is <50' Structural Stage is based on understory values. Otherwise Structural Stage is based on stand values.

   For Alternative 3 with partial harvest conditions, if Structural Stage is calculated as Mature-Single-Story, then canopy is reset to multi-story.
10. Calculate NSO Dispersal Habitat Classification based on index values and dispersal habitat definition.

    For Alternative 3 with partial harvest conditions, canopy is set to multi-story. Otherwise, canopy is set based on DDI values.
11. Update Report Table with Structural Stage and NSO Dispersal Habitat Classification values for reporting years

Figure 348. Data Flow Diagram for Owl Habitat and Structural Stage Classification.



Economic Analysis Data

Dave DeMoss (ID Team Forestry) identified data needed to support the economics analysis. Two inputs were provided to for post processing of the OPTIONS data for the calculation of timber harvest value.

- Costs necessary for harvesting were computed using an historical basis of timber sales from FY 1996 thru FY 2006 (part). Costs were brought to 2005 dollars and expressed in $/MBF. Thinning and partial harvest for alternative 3 were separated from regeneration harvests and costs averaged by harvest method for each district. See timber valuation appendix for additional information.
- A weighted pond value was calculated for each district for each structural stage and harvest method. This weighted pond value included both a weighting for the level of expected species from each district and additionally weighted for grades expected from each structural stage. See timber valuation appendix for additional information

OPTIONS post processing produced a report by each SYU with the attributes listed below. This data is in excel spreadsheet by sustained yield unit for the No Action alternative, Action alternatives, and the following sub alternatives; no regeneration harvest until thinning is exhausted, add NSO critical habitat to the LSMA in alternative 1, short rotation, and maximum harvest.

Projection year – Annual for first ten years.

Harvest Land Base – distinguish ASQ from non ASQ volume sources.

County Name

Resource Area

Harvest Type

Volume in MBF 16' scribner for the action

Weighted pond value of timber for action X (totvol)

Average stump to truck cost - falling, yarding and loading, $/MBF X totvol

Average road construction, improvement and renovation cost/MBF X totvol

Average hauling cost to mill, $/MBF X totvol

Average road maintenance and road use fees X totvol

Average misc. cost, includes slash disposal, special requirements, etc X tot vol

Sum (stump, roads, transport, maintain, misc.)

Revenue-(tot cost), estimate of value of action, (Stumpage in MBF X tot vol)

Time Slice Report

For 10 year increments, spanning 200 years, this report summarizes the acres and volume harvested for the combination of data elements listed below.

Sustained Yield Unit

County

Resource Area

Harvest Land Base – Distinguish ASQ from Non ASQ volume

Harvest type

Ten year age class at time of treatment

Treatment area

Harvest volume

This report was generated for the No Action and Action Alternatives. The data is compiled in Access databases.

State of the Forest

The state of the forest contains the attributes tracked in OPTIONS for each vegetation polygon record at the time of the projections periods – year 0, 10, 20, 50, and 100. These attributes include

Management regime

Species group

Volume

Trees per acre

Height

Basal Area

Area

Harvest Land Base

Age Class

Sustained Yield Unit.

This report was generated for the No Action and Action Alternatives. The data is compiled in Access databases.

Netdown

The netdown report is produced in the data preparation for the OPTIONS data. Every OPTIONS vegetation polygon record is assessed against the GIS rules for the alternative. A matrix of all of the GIS layers / rules by each vegetation record is produced showing which layers constrain harvest. A hierarchy is established for each alternative to determine which allocations take precedence in assigning how a vegetation record is given a land use allocation code for modeling purposes. In general Non forest takes top precedence followed by the fixed allocations such as Congressionally Reserved, National Monument, and then the specific allocations of each alternative. The net down hierarchy is unique to each alternative. Below are examples from the No Action alternative.

Harvest Land Base coding is also assigned for each vegetation record to distinguish the forested areas from non forest, those lands available or not available for harvest, and those lands which harvest counts towards the ASQ. Below is an example of the coding for the No Action Alternative.

Y = Harvest is modeled and contributes to ASQ

N = No harvest is modeled

X = Non forest

P = Harvest is modeled but does not contribute to ASQ (LSRs).

S = Simulated future MAMU sites – No harvest is modeled.

NL = No Land Use Allocation data was available.

NT = No TPCC data was available

This report was generated for the No Action and Action Alternatives. The data is compiled in Access databases. This data was linked in GIS to create harvest Land Base and Land Use Allocation map products.

Table 310. Hierarchy of allocations

Hierarchy Order (constr. pri)	Allocation Code (constr. type)	Allocation Description
1	ROADS	Roads
2	NF	Non Forest
3	CGRR	Congressionally Withdrawn
4	MON	Monument
5	LSR	Late-Successional Reserves
6	AMR	Adaptive Management Area and LSR
7	KOAC	Known Owl Activity Centers
8	OMMS	Occupied Marbled Murrelet Sites
9	RPA	Reserve Pair Area Suitable Habitat and Next Best Reserved Categories
10	DDR	District Defined Reserves
11	NW	TPCC Non Suitable Woodlands
12	SW	TPCC Suitable Woodlands
13	AW	Other Admin Withdrawn, Rec Sites etc.
14	FOI	District OI based Outs - Seed Orchards etc.
15	RIP	Riparian Reserves
16	AMA	Adaptive Management Areas
17	CONN	Connectivity Diversity Blocks
18	GFMA	General Forest Management Areas
19	SGFMA	Southern GFMA
20	EML	East Side Management Lands
21	NL	No Land Use Allocation

Attribute Data for GIS

A GIS input file was created for each alternative. This spatial analysis dissected the vegetation polygons by all of the GIS layers which formed an allocation, modeling rule, or reporting unit needed for the OPTIONS modeling. The OPTIONS data prep program utilized this GIS file to further classify and format the data for OPTIONS modeling. Harvest Land Base coding is an example for this reclassification of the data. The data from the OPTIONS data preparation program is returned to GIS so selected attributes can then be linked and used for subsequent spatial analysis. This provides a common data set used in both the OPTIONS analysis and the resulting GIS spatial analysis. Access databases with the data going to the OPTIONS model and data returned to GIS were generated for the No Action and Action Alternatives.

Vegetation Modeling Team Members

OPTIONS Team

Kristine Allen	OPTIONS Programming / Modeling Director of Operations D. R. Systems Inc.
Chris Cadwell	Forester / Vegetation Modeling Coordinator WOPR Core Team BLM Oregon State Office.
Joe Graham	Inventory Forester / Senior Modeling Specialist WOPR Core Team BLM Oregon State Office.
Mark Perdue	OPTIONS Modeling Manager of Consulting Services D. R. Systems Inc.
Don Reimer	OPTIONS Modeling CEO, D. R. Systems Inc.

Growth and Yield Team

Craig Kintop	Forester (Silviculturist) / Growth & Yield Modeling Coordinator BLM Roseburg District Office
Michael Oxford	Forester (Inventory Specialist) BLM Coos Bay District Office
Robert Pierle	Forester (Inventory Specialist) BLM Medford District Office
Steve Brownfield	Forester (Inventory Specialist) BLM Salem District Office
Robert Ohrn	Forester (Silviculturist) BLM Eugene District Office
Daniel Schlottmann	Forester (Silviculturist) BLM Salem District Office
Carolina Hooper	Forester BLM Salem District Office
Richard Kelly	Forester (Silviculturist) BLM Eugene District Office
Art Emmons	Forester (Inventory Specialist)

	BLM Eugene District Office
Kevin Carson	Forester (Silvicuturist) BLM Roseburg District Office
Walter Kastner	Forester (Silviculturist) BLM Salem District Office
Alan Bergstrom	Forester BLM Medford District Office
Douglas Stewart	Forester BLM Medford District Office
Mark Stephen	Forester BLM Eugene District Office
Frank Hoeper	Forester BLM Medford District Office
Mark Hanus	Biometrician ORGANON Shell Developer / ORGANON Advisor FORSight Resources, Vancouver Wa.
William Johnson	Forester (Silviculturist) BLM Lakeview District Office
Gregory Reddell	Forester (Inventory Specialist) BLM Lakeview District Office

CVS / Statistical Team

Carol Apple	Mathematical Statistician FS PNW Region Regional Office
Jim Alegria	Biometrician BLM Oregon State Office GIS Team
Duane Dippon	GIS Lead WOPR Core Team BLM Oregon State Office
Thomas Jackson	GIS Specialists Eugene District Office.
Arthur Miller	GIS Specialist BLM Oregon State Office

United States Department of the Interior
Bureau of Land Management
Oregon State Office
333 S.W. 1st Avenue
Portland, Oregon 97204

OFFICIAL BUSINESS
PENALTY FOR PRIVATE USE, $300

PRIORITY MAIL
POSTAGE AND FEES PAID
Bureau of Land Management
Permit No. G-76

BLM/OR/WA/PL-07/046+1792