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Environmental Assessment

Final

South Bend Hazardous Fuels Reduction Project

Bend/Ft. Rock Ranger District, Deschutes National Forest
Deschutes County, Oregon

Township 18 South, Range 11 East, Sections 26-28 and 33-35;
Township 18 South, Range 12 East, Sections 26-29 and 32-36;
Township 19 South, Range 11 East, Sections 1-4, 8-17, and 22-24;
Township 19 South, Range 12 East, Sections 2-8;
Willamette Meridian

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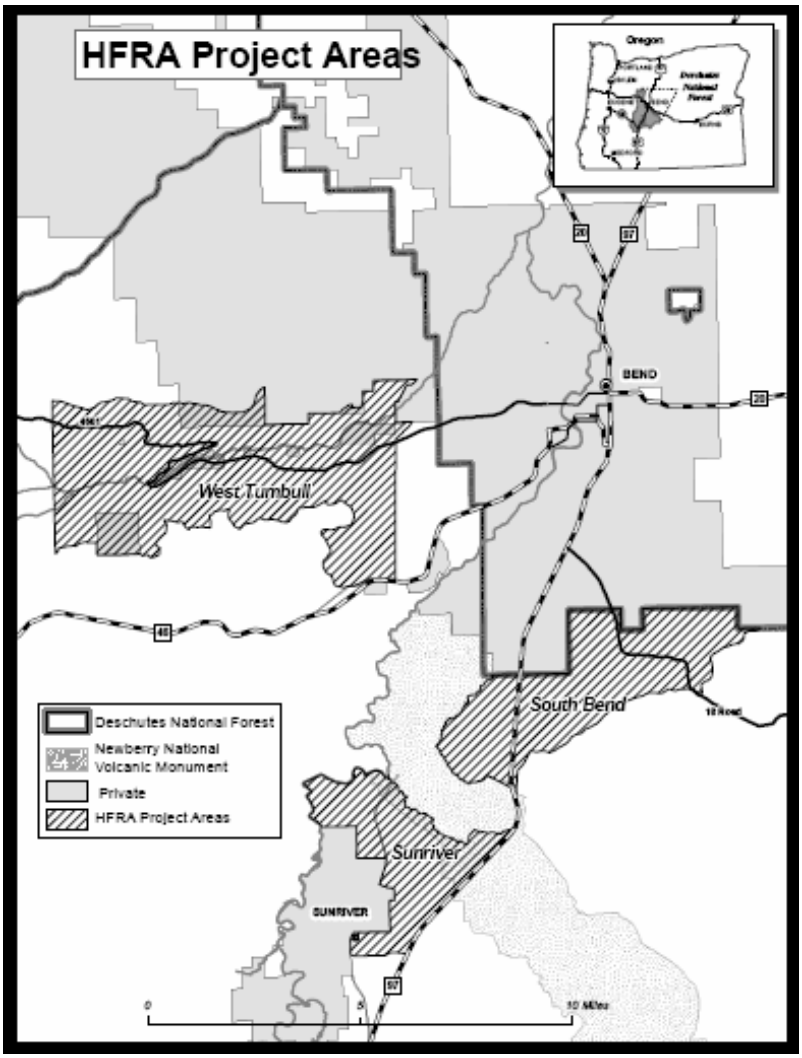
INTRODUCTION

The South Bend Hazardous Fuels Reduction Project is proposed to reduce flammable fuels within 1.5 miles of the forest boundary south of Bend, Oregon both east and west of Highway 97. The total number of acres within the project area is 8,811. All treatments are within the wildland urban interface (WUI) as defined in the Greater Bend Community Wildfire Protection Plan (GBCWPP). The project is planned under the Healthy Forests Restoration Act (HFRA).

The purpose of the project is to reduce fuel loadings, especially adjacent to private lands, while also providing for deer winter range habitat. Fuel reduction treatments would be done to reduce and provide discontinuous fuel load in surface fuels, ladder fuels and aerial (crown) fuels. Treatment prescriptions in the Scenic Views areas were designed to reduce fuels while also meeting scenic views standards and guidelines.

Figure 1: Locator Map for the South Bend Hazardous Fuels Reduction Project



HEALTHY FORESTS RESTORATION ACT

The Healthy Forests Restoration Act (HFRA) of 2003 was authorized by Congress to expedite fuel reduction activities on federal lands. Under this act, at-risk communities, such as Bend, are to prepare Community Wildfire Protection Plans (CWPPs) to identify priorities for treatment on both public and private lands. In addition, the CWPPs finalize Wildland Urban Interface boundaries within which activities can be completed. Bend has completed the "Greater Bend Community Wildfire Protection Plan" (GBCWPP). Copies of the plan are available at:

http://egov.oregon.gov/ODF/FIRE/BendCWPP.pdf

This plan was a collaborative effort by federal, state, and local governments as well as private entities and was signed May 16, 2006. It outlines the priorities, strategies, and action plans for fuels reduction treatments within the greater Bend wildland urban interface, including public lands adjacent to private lands. The plan addresses special areas of concern and makes recommendations for creating defensible spaces for at-risk communities and individual subdivisions. In particular, the GBCWPP places priority for treatments on lands within and adjacent to the subdivisions south and southwest of Bend. The overall goal of the plan is to treat federal land areas that are in Condition Class 2 or 3. Condition classes are used to characterize vegetation to identify the amount of departure from the natural fire cycle. In Condition Classes 2 or 3, at least one, but usually multiple, fire cycles has been missed and fuels have accumulated beyond levels associated with fire dependent ecosystems and so can contribute to uncharacteristic wildfire. The activities and areas proposed for treatment in the South Bend Hazardous Fuels Reduction Project are consistent with the recommendations in the GBCWPP.

PUBLIC INVOLVEMENT

Under the Healthy Forests Restoration Act, the proposal is to be developed and modified with information gathered during early public involvement and collaboration. Collaboration for potential treatments within the Wildland Urban Interface occurred during the development and finalization of the Greater Bend Community Wildfire Protection Plan (GBCWPP). The project is consistent with the GBCWPP.

Additionally, the proposed action for the South Bend Hazardous Fuels Reduction project was developed and adjusted after comments received during the open house, in response to scoping, and in meetings with State Officials and interested publics.

The following is a chronological order of events associated with the planning of the South Bend Hazardous Fuels Reduction Project:

Greater Bend Community Wildfire Protection Plan is signed – May 16, 2006.

The initial proposed action was presented to the Deschutes Provincial Advisory Committee on December 4, 2006 to gain their support and hear their concerns regarding the project. Thermal cover maintenance was discussed along with no removal of trees over 21 inches in diameter and retaining a portion of the proposed treatment units in an untreated condition. There was overall support of the project within the Wildland Urban Interface and an understanding that this was a priority project to pursue. Concerns were raised regarding the availability of utilizing the small diameter thinning for biomass, that thinning the second growth pine needed to be done to levels that would reduce the

threat of bark beetle attack, that a balance should be arrived at when looking at thermal cover levels and dense stands when adjacent to subdivisions because of the high level of risk for uncontrollable wildfire associated with these stands, and that these considerations also needed to be provided in the landscape context.

South Bend Hazardous Fuels Reduction Project appeared in the Schedule of Projects for first time – Winter 2007 (publish date January 1, 2007).

Oregon Department of Fish and Wildlife requests a meeting to review the South Bend project with Glen Ardt representing ODFW. On January 11, 2007 a meeting was held with discussion items focused primarily on maintaining hiding and thermal cover and improving winter forage conditions in winter range deer habitat.

On January 11, 2007, Gery Ferguson project IDT leader, attended the Deschutes County Community Wildfire Protection Planning meeting led by Kate Lighthall (Project Wildfire) and Joe Stutler (Deschutes County). A short presentation of the South Bend proposal was made with the objectives of the project stated as fuels reductions within the Wildland Urban Interface. A map was made available for the group of local homeowners' subdivision representatives to review. The proposal fit well with the objective of obtaining grant proposals for the private lands adjacent to the project area in the Southwest and Deschutes River Woods sections of the GBCWPP.

The Deschutes River Homeowners Associations president requested information to be provided at a homeowners' meeting on January 16, 2007. A letter (dated January 16, 2007 to the Deschutes River Homeowners Association and Judy and Stan Martineau) and map was provided at this evening meeting. No questions arose from the information provided.

On February 9, 2007, the local chapter of the Sierra Club and Blue Mountains Biodiversity Project requested to meet regarding concerns with the Sunriver and South Bend fuels reduction projects. Asante Riverwind, Karen Coulter, Marilyn Miller, and Fred Tanis attended the meeting. Because both projects were in the initial planning stages, the meeting consisted of presentations by Forest Service officials of what was being proposed and maps of the projects. Concerns were raised about commercial harvest of trees over 12 inches in diameter. The group was concerned about breeding bird impacts and requested a seasonal restriction of activities to protect breeding birds during the nesting season. The group wanted fewer treatments away from homes and more "feathering of treatments". A field trip was proposed to review stand conditions on the ground. The concerned citizens were to review the areas in the field and propose units to visit on the ground prior to the meeting date.

On February 16, 2007, a letter was sent to the District mailing list and adjacent landowners for the South Bend project offering an opportunity to attend an Open House on February 28, 2007 to obtain information on the project and to provide comments and suggestions for changes, support, or objections to this initial proposal.

On February 23, 2007, the Office of Communications for the Deschutes and Ochoco National Forest and Prineville District, Bureau of Land Management released a news bulletin announcing the Open House for the fuels reduction projects being planned on the Bend / Ft. Rock Ranger District. Time and location of the meeting and a short synopsis of the proposed actions was identified.

On February 23, 2007, Z21 provided information on the Open House and the proposed projects, repeating information from the news release.

On February 26, 2007, The Bulletin published an article regarding the proposed actions and locations for the fuels reductions and the announcement of the Open House on February 28, 2007 at the Bend / Ft. Rock Ranger District Office.

On February 28, 2007, the Bend / Ft. Rock Ranger District held an Open House from noon to 6pm to offer an opportunity for the public to provide comments on the proposed actions for South Bend and the Sunriver fuels reduction projects under development. Approximately 29 people attended the Open House. Comments received included concerns regarding smoke inundation with the proposed use of prescribed fire and they requested to be notified of burning activities because of health reasons. Most expressed support for the proposed action and appreciation of previous mowing activities adjacent to private land. Some worried about invasive plants invading the activity areas but provided the comment that previous areas treated did not result in increased invasive plant populations. Others expressed concerns about the prescribed fire treatments resulting in a controlled burn getting out of control and causing additional smoke. Some wanted areas closed to the public to reduce the risk of a human caused fire in certain areas. Others wanted early treatment of fuels adjacent to Woodside Ranch subdivision because topographically, the forest land is below the subdivision and with the propensity of fire to move uphill, wanted as much protection as early as possible. They also requested that road 1800-020 be closed because of its high use by the public and potential for a human caused fire. Most people attending the Open House provided comments of support and just needed information on the location of proposed units and timing of implementation of the projects.

During the Open House, Z21 provided TV coverage of the Open House meeting, providing additional coverage to the local area of the fuels reduction proposals. The Z21 reporter interviewed District and County personnel who provided information of the proposed projects and the importance for fuels reductions in the wildland urban interface.

On March 8, 2007 some local residents of Deschutes River Woods expressed concerns over log hauling on a recently paved road within their subdivision. District Ranger Phil Cruz and IDT leader Gery Ferguson met with three residents in the subdivision to discuss concerns.

On April 12, 2007, members of the interdisciplinary team and District Ranger Phil Cruz met with Asante Riverwind, Marilyn Miller, and Fred Tanis in the field to discuss concerns regarding 2 units (113 and 411) and a proposed temporary road within unit 411. Overall the group was supportive of the project but had suggestions for modifications.

On April 27, 2007, the District Ranger, Phil Cruz sent the proposed action for the South Bend Hazardous Fuels Reduction Project to the District mailing list, adjacent landowners for the project and all those that expressed interest at the February 28, 2007 Open House. Written comment letters were received from 7 agencies, organizations, and individuals. All were generally supportive of the project but did express specific concerns regarding timber harvest, temporary road construction and resource protection measures. See the Issues section for a listing of public issues considered during this environmental analysis.

On July 30, 2007, IDT leader Gery Ferguson met with Tim Lillebo of Oregon Wild (formerly Oregon Natural Resources Council) to review concerns with units 113 and 411. Tim suggested variable density thinning with openings, culturing around large residual trees, leaving unthinned dense patches, minimal impacts from temporary roads, retaining trees with "old growth characteristics such as large limbs, furrowed bark, and deformities."

PURPOSE AND NEED

The need for the reduction of fuels is arising because of the existing high level of fuel loadings adjacent to subdivisions and the current conditions that contribute to likelihood of a large fire that could not be controlled in a short time period. There have been several wildfires in this area, both south of Deschutes River Woods and east of Highway 97, necessitating the need to reduce fuels for the protection of both public and private land values and infrastructure. The Woodside Ranch Fire occurred on August 1, 2007 and was within 1.5 miles of the private land boundary. Because of the favorable winds during the first day of the fire, the wildfire caused no damage to private homes or private land. If winds had been from the south, the fire would have moved quickly into the Woodside Ranch subdivision. This fire grew to approximately 596 acres within a 24 hour burning period, indicating the need for reduced fuels to reduce the rate of spread of future wildfires. Only a small portion of one of the proposed units was burned through during this wildfire. The most recent wildfire, the Weigh Station Fire burned approximately 9 acres, occurred on July 15, 2008 and was approximately one mile south of Deschutes River Woods. This is the northern boundary of the project area on the west side of Highway 97.

The intent of the proposed treatments is to reduce the fuel continuity in surface, ladder and crown fuels thereby reducing the rate of spread and intensity of a wildfire should one start. In addition, it would be expected that fire suppression efforts would be more successful under conditions where fuels are reduced from current levels because of the reduced rates of fire spread and fire intensity.

DESIRED CONDITION

The desired condition in this project area for the short term is to create conditions where fuel loadings are at levels indicative of a fire adapted ecosystem. Fuels loadings would be consistent with those found in a system with low intensity surface fires with a frequent return interval. Surface and ladder fuels would be reduced so that if a wildfire started, the likelihood that it would remain on the ground would be higher than current conditions indicate. Aerial or crown fuels would also be at levels that if a fire occurred, a sustainable crown fire would be less likely to occur. Individual trees may torch during the fire, but fire spreading easily between crowns would not occur, except under severe wind, temperature and humidity conditions.

EXISTING CONDITION

The majority of the forested stands within the project area were previously harvested and clear-cut in the early 1900s when the land was owned by the Shevlin-Hixon and Brooks-Scanlon logging companies. The lands came under federal ownership in the 1940s and 1950s with most of the merchantable volume having been already removed from the land. The majority of the areas proposed for treatment are second growth ponderosa pine stands with average diameters at breast height (dbh) of 12 inches or smaller and an average age of 75 years. Most stands have been commercially or precommercially thinned in the last 20 years. Trees have increased in growth rates and are now approaching canopy closure levels that can contribute to sustainable crown fires during certain weather conditions. Understories consist of a continuous coverage of shrubs, including bitterbrush and manzanita, along with seedlings and saplings that contribute to surface and ladder fuel loadings that are well above desirable levels.

There are no streams or other surface water sources within or adjacent to the project area. The nearest water source is the Deschutes River, between 1.5 and 2.0 miles from the western portion of the project area. The nearest Inventoried Roadless Area (IRA) is approximately 12 miles south of the

project area. There are no areas that have not had road access for Forest management during sometime within the past approximate 80 years within the project area. There are no threatened or endangered species of mammal, plant, or fish within the project area.

The human and economic values protected in the Greater Bend Community Wildfire Protection Plan planning area are rated moderate to high with four communities at risk in the moderate category and six in the high category. These ratings are based on home density per ten acres and community infrastructure such as power substations, transportation corridors, water and fuel storage, etc. Both the Deschutes River Woods and southeast areas have been identified in the GBCWPP as being among the highest areas identified for fuel reductions with DRW as #1 and the southeast area as #3 out of ten areas identified in the plan.

Based on Deschutes County tax records from 2005, there are approximately 36,207 homes in the Greater Bend WUI, with an appraised value of $8.4 billion. In addition, 2,386 businesses operate in the Bend area, with an appraised value of $3.3 billion. Specific areas for this project are:

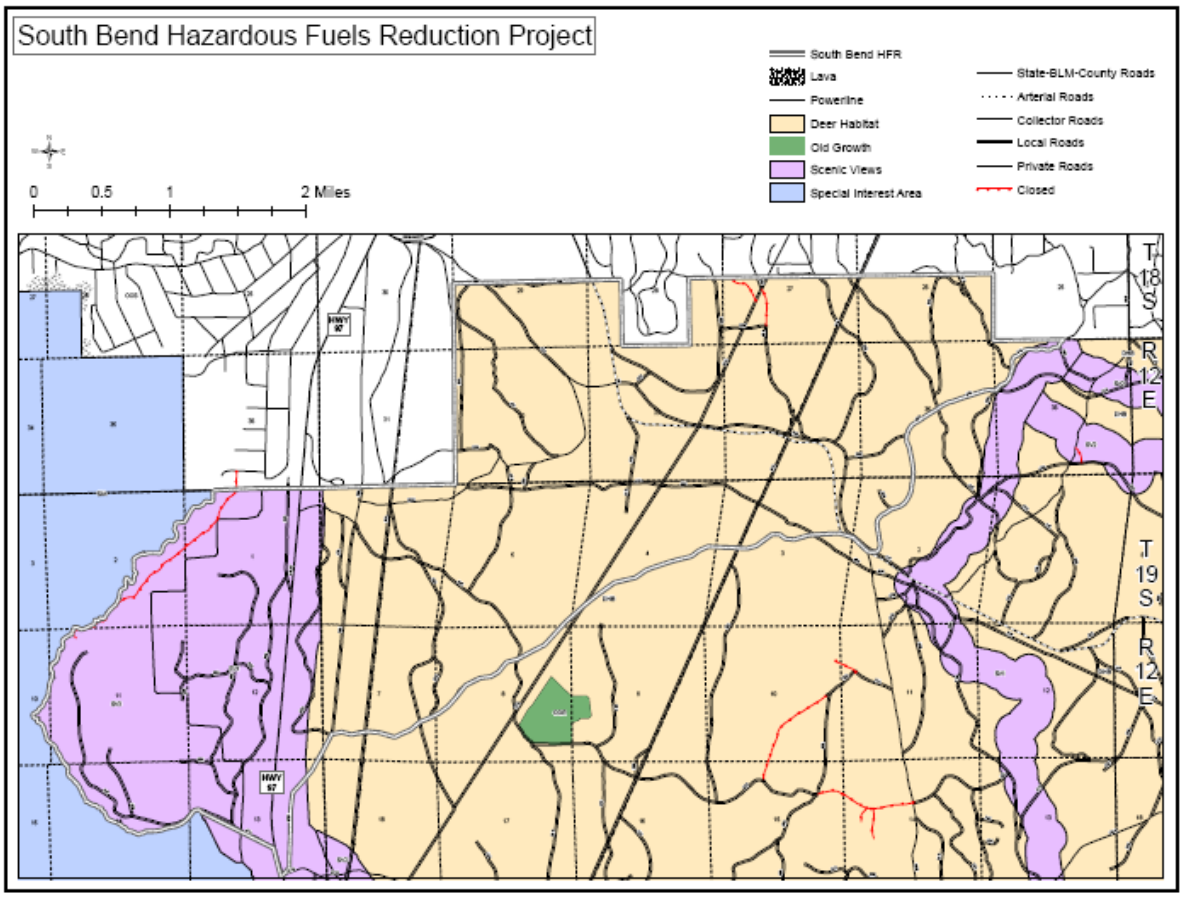
- **Deschutes River Woods (DRW)** – 3,534 acres, 2,022 structures, population 5,138
- **Southeast** – 36,148 acres, 2,252 structures, population 6,896

The essential infrastructure includes multiple webs of utilities, roads, water and sewer systems. The approximate replacement value for electrical transmission lines is $275,000 per mile; $150,000 per mile of electrical distribution lines; and $2 million per electrical sub-station. Loss to roads would be minimal because they are not flammable. Loss to water and sewer systems would be minimal because most are underground and not flammable.

PROPOSED ACTION

The Bend - Ft. Rock Ranger District is proposing to reduce forest surface, ladder and aerial fuels within 1 ½ miles of the Forest boundary south of Bend, Oregon and east and west of Highway 97. Treatments are proposed on 3,021 gross acres within stands dominated by ponderosa pine. Treatments include thinning trees less than 21 inches dbh, underburning, mechanical shrub treatment (mowing), and pruning. Separately or in combination, treatments are proposed within Deer Habitat (MA 7) and Scenic Views (MA 9).

Figure 2: Management Areas within the South Bend Project Area



MANAGEMENT DIRECTION

Deschutes National Forest Land and Resource Management Plan

The Deschutes National Forest Land and Resource Management Plan (LRMP) is utilized to formulate the desired conditions for the project area as determined from the applicable goals and objectives and standards and guidelines. Goals and Objectives provide long term management direction to provide desired conditions. Standards and guidelines provide direction for allowable activities within the forest-wide and individual management areas. Management area allocations (Figure 2, page 14) within the project area include:

- *Deer Habitat* – MA-7 (approximately 6,245 acres) emphasizes the management of vegetation to provide optimum habitat conditions on deer winter and transition ranges while providing some domestic livestock forage, wood products, visual quality and recreation opportunities. Vegetation will be managed to provide optimum habitat considering the inherent productivity of the land.
- *Scenic Views* – MA-9 (approximately 2,566 acres) emphasizes the high quality scenery that represents the natural character of Central Oregon. Landscapes seen from selected travel routes and use areas will be managed to maintain or enhance their appearance. The desired condition for ponderosa pine is to achieve and maintain visual diversity through variations of stand densities and size classes. Ponderosa pine in foreground retention areas (Highway 97) will be managed to maintain or create a visual mosaic of numerous, large diameter, yellow-barked trees with stands of younger trees offering visual diversity and a sense of depth in landscapes viewed

from travel routes (approximately 1,370 acres). Ponderosa pine in the middleground retention areas (south of Deschutes River Woods and west of Highway 97) will be managed so that they provide a strong textual element when viewed as middleground (approximately 1196 acres). The presence of a few individual large trees with full crowns is an important part of the desired visual condition. Immature stands are also important in middleground areas because they have a dramatic effect on color contrasts, and they eventually become replacements for the larger, old-growth trees that perpetuate the desired coarsely-textured character.

Greater Bend Community Wildfire Protection Plan

The Greater Bend Community Wildfire Protection Plan (GBCWPP) provides recommendations for fuel reduction in the area. This plan was developed in a collaborative manner over several years to address both private and public lands within the wildland urban interface for the at-risk community of Bend, Oregon. Development of the plan was fostered by leaders in the community, county planners, county and city fire officials, residents, Federal and State agency personnel, and other interested citizens. Forest Service personnel provided information on fire history, existing vegetation conditions and fire suppression forces and did not lead the planning for the GBCWPP. The GBCWPP was developed under the direction of the Healthy Forests Restoration Act.

The Greater Bend Community Wildfire Protection Plan describes the desired conditions for both public and private lands for the reduction of fuel loadings for the protection of private lands and infrastructure.

The standard of the Greater Bend CWPP is to decrease the risk of uncharacteristic wildland fire behavior by reducing fuel loads to that which can produce flame lengths of less than four feet. This enables safe and effective initial attack. The overall goal is to return the landscape to Condition Class 1 and provide for a healthy, fire resilient landscape that supports the social, economic and ecological values of greater Bend area residents and visitors.

DECIDING OFFICIAL AND DECISION TO BE MADE

The District Ranger for the Bend / Ft. Rock Ranger District will be the Deciding Official for this project. The Deciding Official will decide which alternative to implement and under what conditions including mitigation and monitoring measures the project will be implemented.

ISSUES

Normally issues identified through scoping activities are utilized to generate alternatives but under the Healthy Forests Restoration Act, projects planned under certain conditions only need to analyze one proposed action alternative. Projects need to be within 1 ½ miles of the at-risk community, within the wildland urban interface boundary as defined by the adopted Community Wildfire Protection Plan and activities are consistent with that plan (HFRA Title 1, section104(d)). The South Bend project was developed consistent with the direction provided within the collaboratively developed Greater Bend Community Wildfire Protection Plan.

The Interdisciplinary team considered all comments derived from collaborative and public involvement processes and provided recommendations to the Deciding official for changes to the proposed action, additional or adjustments to mitigation measures, or identified resource parameters for environmental analysis. Therefore there are two types of issues identified for this environmental assessment: 1) Design Issues – issues used to develop specific changes in the proposed action,

including mitigation measures, and 2) Analysis Issues – resource parameters that will be addressed in the environmental consequences section of this Environmental Assessment.

This section also identifies issues raised that were not considered further in this environmental analysis.

Design Issues

Variable density commercial thinning – the proposed action originally developed may not provide enough prescriptive design elements to provide for more random leave tree spacing. This would include areas of wider spacing and pockets of trees that would remain unthinned. This would result in the residual stand having the appearance of a more natural stand with variable density than a managed stand with regular leave tree spacing.

Retention of old growth characteristics in residual trees – the proposed action originally did not provide for prescriptive design elements for the retention of trees currently exhibiting old growth characteristics such as large limbs, larger diameters, furrowed bark, and fire resistant trees. This includes leaving trees exhibiting wildlife habitat such as cavities, broken limbs, some mistletoe brooming, and unique trees.

Minimize temporary road construction – the proposed action did not fully describe the level of construction for temporary roads. Normally some improvements for temporary road construction would be done with heavy equipment to scrap brush, duff, coarse woody debris and small trees out of the clearing area. Commenters felt that this would constitute more disturbance than is needed in this area of mostly flat ground, especially in Unit 411.

Road management – Road density reductions have been identified in the proposed action to reduce impacts of the vegetation treatments to deer and elk populations. Roads identified for closure or decommissioning have been identified through an area-wide Roads Analysis.

Minimize impacts to wildlife species - The proposed action could impact Threatened, Endangered, and Sensitive and other wildlife species, including breeding birds. Seasonal restrictions for breeding raptors have been included in the mitigation measures. However, not all breeding bird species are being protected by a seasonal restriction.

Too much prescribed fire results in smoke, causing problems with adjacent land owner's health – A few people were concerned and had individual health problems that are exacerbated by smoke from prescribed fire emissions. Prescribed fire prescriptions were eliminated in units 430 and 447.

The proposed action needs more treatment along the private land boundary in Section 26 adjacent to Woodside Ranch subdivision – An additional unit of mowing and prescribed burning (42 acres in Unit 456), was added to meet this concern. This area was considered to be Condition Class 2 and therefore met the criteria for treatment in the GBCWPP. Almost all National Forest System lands along the private land boundary are now being treated in some form to reduce fuel loadings.

Treatments proposed could lead to the spread and incidence of invasive plants within the project area – Ground disturbing activities associated with the proposed action could create conditions that could lead to new invasive plant populations and spreading of existing populations into new areas. Mitigation measures have been proposed to reduce the likelihood of spreading invasive species. Known sites of invasive plant populations have been identified.

Harvest activities that utilize heavy equipment could cause detrimental soil impacts – Logging operations such as skidding and decking could cause compaction and displacement impacts to soils. Mitigation and restoration measures have been identified to reduce the amount of impact and to restore compacted soils to meet regional policy direction.

Treatment activities in the Scenic Views Management Area could affect the quality of the scenery seen from major travel routes – vegetation management activities could result in degraded scenic quality objectives. Mitigation measures have been identified to reduce or eliminate the potential for scenery impacts.

Treatment activities could impact cultural resources – High probability areas have been surveyed and project design would either avoid known sites or provide protection measures through mitigations if an unknown site was discovered during project implementation.

Prescribed burning and pile burning would result in the production of smoke – Smoke from prescribed burning and pile burning could affect the southern portion of the City of Bend and southern subdivisions. Some members of the public have already provided comments on their concerns about smoke affecting their health. Mitigation measures have been identified that would reduce the amount of smoke intruding into southern Bend communities by conducting burning during conditions that would result in less smoke emissions. All burning would be conducted in compliance with Oregon Dep. of Environmental Quality and Oregon Forestry Department standards. Prescribed burning was eliminated from units 430 and 447 for a total of 195 acres of reduced underburning.

Analysis Issues

Breeding bird nest protection – Some people felt that the project could cause breeding bird nest abandonment and impacts to individuals because mowing and burning in the spring would affect nest sites on the ground and in the shrubs. Approximately 2507 acres would have the prescription of mow and / or prescribed burning. Approximately 65% of the project area would receive no treatment. The deciding official considered a variety of options but came to the conclusion that a seasonal restriction to limit project burning and mowing activities was not warranted. The rationale for this decision included: 1) not all acres would be treated within a specified year, implementation of the project would take several years to a decade to fully implement, 2) approximately 65% (5,721 acres) of the project area would not have any treatment leaving these areas available and undisturbed for nesting species, 3) some raptor species will have protection measures for nesting, 3) including a seasonal restriction for nesting birds in addition to other seasonal restrictions would leave a very narrow window of operating period each year of approximately 2-3 months, and 4) the potential for wildfires to grow rapidly (as evidenced by the 2007 Woodside Ranch Fire), necessitates the need to reduce fuels in a timely manner and not limit operating seasons. This issue will be analyzed in the wildlife section of this report under wildlife and breeding bird species.

Economic Analysis – Several members of the public wanted to see an economic analysis of the proposed action documented in the Environmental Assessment. This analysis is located in Chapter 3.

Unroaded Analysis – One organization was concerned about the affect of the proposed action, including temporary road construction, on an area with few roads. This mostly affected Unit 411 and the temporary road construction identified as a connected action to harvest this unit.

Forest health and susceptibility to bark beetle attack – Several individuals were concerned about the long-term sustainability of forested stands in the area and wanted prescription objectives to include stand density reductions. The effects of the proposed activities on stand density and forest health are discussed in the Vegetation section in Chapter 3 of the EA.

Issues Raised But Not Considered Further

Riparian resources - Some people expressed concerns about impacts to riparian areas or other water bodies. The project does not include nor is it adjacent to any water bodies, riparian areas or other water related resources. Therefore the project could not impact these resources.

Opposing Views Not Used in Analysis

- **Black, S.H. 2005. Logging to control insects: the science and myths behind managing forest insect "pests". A synthesis of independently reviewed research. The Xerces Society for Invertebrate Conservation, Portland, OR. 82p.**

This report includes three sections. Section One summarizes the studies Black reviewed pertaining to the management of insect pests in the temperate forests of western North America. Section Two lists the citations reviewed by topic. Section Three summarizes over 150 scientific papers and Forest Service documents.

Black reports the following key findings, the last two seemingly contrary to Fettig et al. (2007):
- Native forest pests have been part of our forests for millennia and function as nutrient recyclers; agents of disturbance; members of food chains; and regulators of productivity, diversity, and density.
- Fire suppression and logging have led to simplified forests that may increase the risk of insect outbreaks.
- Forests with diverse tree species and age classes are less likely to develop large insect outbreaks.
- There is no evidence that logging can control bark beetles or forest defoliators once an outbreak has started.
- Although thinning has been touted as a long-term solution to controlling bark beetles, the evidence is mixed as to its effectiveness.

Black concludes insects, including those that attack and sometimes kill patches of trees, are integral components of healthy forest ecosystems. He states there is no evidence that once an infestation has started we can log our way out of it. Black states thinning, which is widely promoted as a solution, has mixed results. He recommends caution be used when thinning for long-term pest suppression because of the potential for increasing the simplicity of a forest and thus its susceptibility to future infestation. Black, while acknowledging each forest will have site-specific issues, offers the following general guidelines to follow when considering pest insects and forest management:
- Maintain and restore high-quality late-successional and old-growth forest conditions.
- Ensure structural and species diversity when logging, including the retention of large trees and snags, downed wood, and canopy closure.
- Minimize soil compaction and harm to trees and tree roots when doing any thinning or logging.
- Utilize prescribed fire to promote more natural forest conditions. It was noted that fire should be used carefully, as there is some evidence that fires that damage tree cambium can potentially exacerbate insect problems.
- Reduce current road densities, particularly in ecologically significant areas.

In Black's summary of the research, no mention was made regarding diameter limits.

Rational for not using in analysis: In discussing Black's report, Forest Service forest entomologists (USDA Forest Service 2006) responded in part as follows:

> "…there are many statements … within the report, which are taken out of context, misleading, or simply not true. … [L]iterature is selectively cited, and opinions are extrapolated from research that often is inappropriately used to support the points being made. …Many of the cited examples of logging/bark beetle dynamics are from mixed –conifer coastal forests where bark beetle-caused tree mortality is often minor compared to beetle outbreaks in the drier eastside or interior forests of western North America. …[I]n several places throughout the manuscript, the author juxtaposes two unrelated statements or studies that lead a reader with no background in forest entomology or forestry to erroneous conclusions. … In conclusion, the Black report contains many examples of erroneous statements that are not even supported by the report's cited literature. …[T]his report may be viewed … as refuting hundreds of published papers on effectively managing forest insects and diseases, which it does not. …"

The Understory Response Model (http:/forest.moscofsl.wsu.edu/fuels/)

The Understory Response Model was developed by Steve Sutherland (USDA Forest Service) and Melanie Miller (USDI Bureau of Land Management) at the Fire Sciences Laboratory in Missoula, Montana. It is a species-specific computer model that qualitatively predicts change in total species biomass for grasses, forbs, and shrubs after thinning, prescribed fire, or wildfire. The model examines the effect of fuels management on plant survivorship (the survival, growth, and colonial growth of plants present at the site before treatment) and reproduction (establishment and growth of plants from seeds and onsite and offsite colonization). The intended use of the model is to predict the effect of alternative fuel treatments on understory plant survivorship and reproduction at 1, 5 and 10 years post treatment.

Rational for not using in analysis: Local monitoring information that provides quantitative data was considered to provide the best prediction of understory response to treatments.

- **Brian Sharp. 1996. *Avian Population Trends in the Pacific Northwest.* The Institute for Bird Populations - Bird Populations (3: 26-45).**

A paper by Brian Sharp entitled "Avian Population Trends" was referenced in a public scoping comment relating to neotropical bird protection. Although the complete citation was not given in the comment, it is assumed that this comment refers to the above reference. This paper has been reviewed and considered, but was not referenced in the wildlife analysis because since its publishing there has not only been more recent, more localized information published regarding neotropical and resident bird species; but also there has been updated legislation and land management practices enacted.

The Sharp paper references the entire Pacific Northwest which it identifies as "Oregon and Washington" (page 28 under Methods) and relies on Breeding Bird Survey (BBS) data from 1968-1994 which encompasses public lands as well as private lands. Since the data used for the analysis was collected (i.e. 1994), the Northwest Forest Plan was enacted on federal lands within the range of the northern spotted owl, the "Eastside Screens" were adopted and amended forest plans in this region outside of the range of the spotted owl. Both plans substantially elevated the protection and consideration of late and old habitat and riparian habitat that were indicated in Sharp's paper as the habitat types that bird species seeing the most declines prefer. In 2000 Partners in Flight Bird Conservation Planning (a group of international, governmental, and non-governmental agencies) in

conjunction with the more local Oregon-Washington Partners in Flight offices, published a series of conservation strategies addressing landbird declines and recommendations for conservation. These documents were developed for each regional habitat, and the one written for the East Slope of the Cascade Mts of Oregon and Washington was used in the analysis of this project (see references to Altman, 2000). In fact, the time range of BBS data that was used in Sharp's paper was also used in these documents with the exception that the conservation strategies incorporated data available after 1994.

In 2001, an Executive Order was signed (see Introduction of this report – page 1-2) to detail the responsibilities of federal agencies to protect migratory birds. Compliance with this order is attained by using the Partners in Flight Conservation Strategy most befitting of the project area. At least 11 of the species specifically referenced in the Sharp paper are also either focal species within the Conservation Strategies or Management Indicator Species within the forest plan.

- http://forest.moscowfsl.wsu.edu/fuels/urm/. This link is associated with the comment: *The agency must disclose conflicting scientific evidence that removing ground fuels and ladder fuels reduce fire hazards while removing canopy fuels cuts both ways. Removing canopy fuels can reduce crown-to-crown fire spread but the science clearly shows that removing canopy cover can also increase fire hazards by increasing solar insolation which causes fuels to warm and dry and increases wind speeds*.

Understory Response Model URM predicts qualitative changes in shrub, forbs, and grass biomass at 1, 5, and 10 year interval caused by fuels treatment activities, based on species-specific life history traits (life form, shade tolerance, etc) and site-specific effects (soil heating, bare mineral soil, etc.). URM is in Scientific Peer Review

The reference cited does not have the obvious or direct connection to the comment. Information contained in this reference has been considered, but will not be included as a cited reference in the South Bend Hazardous Fuels Project. Current science, "Influence of Forest Structure and Wildfire Behavior and the Severity of its Effects", supports the contention that thinning open stands to greater solar radiation and wind movement, resulting in warmer temperatures and drier fuels, it goes on to mention that thinning is most effective when followed by additional treatments such as prescribed fire to reduce surface fuels. The combination of treatments results in reduced flame lengths, fire spread and intensity. Where human values are threatened, these types of low-intensity fires are relatively easy to control and less likely to support a crown fire even under severe weather conditions.

Graham, R.T.; Harvey, A.E.; Jain, T.B.; Tonn, J.R. 1999. The effects of thinning and similar stand treatments on fire behavior in western forests. Gen. Tech. Rep. PNW-GTR-463. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 27p.

Omi, Philip N., Martinson, Erik J. 2002. Effectiveness of thinning and prescribed fire in reducing wildfire severity. Western Forest Fire Research Center, Colorado State University. Presented at Sierra Nevada Science Symposium, October 7-9, 2002, North Lake Tahoe, CA

- USDA Forest Service; Influence of Forest Structure on Wildfire Behavior and the Severity of its Effects, November 2003.m.

http://www.fs.fed.us/projects/hfi/2003/november/documents/forest-structure-wildfire.pdf. **Comment:** *Excessive thinning results in forest conditions more hazardous than doing nothing. Thinning opens stands to greater solar radiation and wind movement, resulting in warmer temperatures and drier fuels throughout fire season. This openness can encourage fire spread,…..*

Review: The year 2002 was the second largest fire season in almost 50 years. Four states had the largest areas burned in wildfire since at least the early 1900's. The publication goes on to read that more than 90 years of fire research shows that four factors working in concert can result in the type of catastrophic wildfires witnessed in 2000 and 2002: weather, an abundance of fuel (combustible forest material), lack of moisture, and terrain characteristics.

Consideration: Information contained in this reference has been considered, but will not be included as a cited reference in the South Bend Hazardous Fuels Project. This reference does not provide new or contradictory information on thinning open stands to greater solar radiation and wind movement. While the Forest Service acknowledges this fact, the commenter fails to mention that, while this openness can encourage a surface fire spread, such fires do little ecological damage. Furthermore, the publication explains that mechanical thinning, especially when directed at the smaller and medium size trees, can be quite effective in reducing the condition conducive to crown fire spread. Also, if thinning is used, it is most effective when followed by additional treatments such as prescribed fire to reduce surface fuels.

Graham, R.T.; Harvey, A.E.; Jain, T.B.; Tonn, J.R. 1999. The effects of thinning and similar stand treatments on fire behavior in western forests. Gen. Tech. Rep. PNW-GTR-463. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 27p.

Omi, Philip N., Martinson, Erik J. 2002. Effectiveness of thinning and prescribed fire in reducing wildfire severity. Western Forest Fire Research Center, Colorado State University. Presented at Sierra Nevada Science Symposium, October 7-9, 2002, North Lake Tahoe, CA

- Countryman 1955: **Comment:** *Opening up closed forests through selective logging can accelerate the spread of fire trough them because a physical principle of combustion is that reducing the bulk density of potential fuel, increases the velocity of the combustion reaction. Wind can flow more rapidly through the flaming zone*.

Information contained in this reference has been considered, but will not be included as a cited reference in the South Bend Hazardous Fuels Project. Depending on thinning intensity some regeneration is reasonably expected, however it's expected to be localized and discontinuous and does not meet Countryman conclusion. On thinning open stands to greater solar radiation and wind movement. Similar and more recent information is available from other references to be cited by the Forest Service.

Graham, R.T.; Harvey, A.E.; Jain, T.B.; Tonn, J.R. 1999. The effects of thinning and similar stand treatments on fire behavior in western forests. Gen. Tech. Rep. PNW-GTR-463. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 27p.

Omi, Philip N., Martinson, Erik J. 2002. Effectiveness of thinning and prescribed fire in reducing wildfire severity. Western Forest Fire Research Center, Colorado State University. Presented at Sierra Nevada Science Symposium, October 7-9, 2002, North Lake Tahoe, CA

Agee J.K.2002. Fire Behavior and Fire Resilient Forests. *In* Fire in Oregon's Forests: Risks, Effects, and Treatment Options, Fitzgerald S.A., ed. Oregon Forest Resources Institute.

- Countryman C.M. 1955. Forest stand conversion also converts fire climate. Fire Control Notes 17(4): 15-19. **Comment:** *Excessive thinning, with or without replanting will also result in the establishment dense growth of young trees that are one of the most hazardous types of forest structure because they provide a nearly continuous bed of resinous fuel close to the ground.*

The respondent fails to identify the link to the project area and proposed actions with the cited references. Countryman 1955 article, discusses excessive thinning resulting in nearly continuous fuelbed of regeneration. Depending on thinning intensity some regeneration is reasonably expected, however it's expected to be localized and discontinuous and does not meet Countryman conclusion. The second article also by Countryman, presents a discussion on Old Growth Conversion and its association to fire climate. That discussion of the conversion of an Old Growth to a second growth stands; the project area contains no "Old Growth" and no stand conversions are proposed that would result in conditions described by Countryman. Therefore neither reference will be included as a cited reference in South Bend Hazardous Fuels Project.

- Raymond Crystal L. 2004. The Effects of Fuel Treatments on Fire Severity in a Mixed-Evergreen Forest of Southwestern Oregon. MS Thesis. http://depts.washington.edu/nwfire/publication/Raymond2004.pdf

Comment: *Logging creates large amounts of hazardous slash that is never full treated. Incomplete treatment of logging slash results in increased fire hazard relative to no action.*

Raymond results show damage and mortality of overstory trees was greatest in thinned stands (80-100% mortality), followed by untreated stands (53-54% mortality) and least in stands that were both thinned and underburned (5% mortality). All thinned stands will be followed with a post harvest treatment (Mowing and/or Underburn). Although this study is limited in scope and duration it does support the effects of similar treatments in ponderosa pine. Similar results would be expected in thinned and mowed stands due to the reduction and re-arrangement of surface fuels, which results in decreased flame lengths and fire intensity. This results in reduce overstory mortality. This citation will not be referenced; other references are equally current and more relevant locally i.e. ponderosa pine forest.

Omi, Philip N., Martinson, Erik J. 2002. Effectiveness of thinning and prescribed fire in reducing wildfire severity. Western Forest Fire Research Center, Colorado State University. Presented at Sierra Nevada Science Symposium, October 7-9, 2002, North Lake Tahoe, CA

Peterson, D.L.; Agee, J.; Jain, T. [et al.]. 2003. Fuels planning managing forest structure to reduce fire hazard. In: Proceeding of the 2nd International Wildland Fire Ecology and Fire Management Congress Boston, MA: American Meteorological Society: http://ams.confex.com/ams/pdfpapers/74459.pdf (15 July 2004).

Agee, J.K., Skinner, C.N., in press. Basic Principles of Forest Fuel Reduction Treatments.

CHAPTER 2

ALTERNATIVES

CHAPTER 2 – ALTERNATIVES

INTRODUCTION

This chapter describes the alternatives and how they were formulated. It provides the deciding officer with an executive summary of the alternatives considered, including those eliminated from detailed study, the connected actions associated with the alternative and the mitigations and monitoring activities recommended for inclusion in the final decision.

ALTERNATIVE FORMULATION

Normally, issues derived from the initial scoping of the proposed action are utilized to adjust the proposed action, develop alternatives to the proposed action, and to develop mitigation measures. However, since this project was designed under the authorities stipulated in the Healthy Forests Restoration Act (HFRA), a second action alternative was not developed. Issues derived from public involvement and collaboration resulted in changes to the original proposed action including changing some prescriptions for unit treatments, adding areas for treatment, and adjusting and adding mitigation measures for resource protection.

Consistent with the direction found at Section 104(d)(2) in the HFRA, the project is within 1 ½ miles of the at-risk community, the project is consistent with the Greater Bend Community Wildfire Protection Plan and is within the identified wildland urban interface, therefore no additional alternative is required to be considered. This was done to expedite analysis in areas where fuels reduction activities are important and to streamline the analysis of the impacts of the proposed action. Issues were utilized to make minor adjustments in the original proposed action and to develop or modify mitigation measures designed to eliminate or reduce project activity impacts.

Although the HFRA does not require the development of the No Action alternative, the document describes the impacts of the no action alternative for most of the resources in order to provide the deciding official and the public with information to compare the proposed action impacts with the current condition.

ALTERNATIVES CONSIDERED, BUT ELIMINATED FROM DETAILED STUDY

Prior to the proposed action being sent to the public for comments, a variety of field meetings and office meetings occurred in order to refine the proposed action. Different haul routes were considered to avoid areas of high public concern. Thermal cover for wintering deer populations was considered very important in the Deer Habitat Management Area, east of Hwy. 97, therefore the proposed action was designed to avoid reductions in thermal cover. Areas of thermal cover were not considered for commercial harvest treatment. It was also decided to not harvest in stands meeting the definitions of late and old structured stands since these stands are not prevalent due to historical logging in the area in the 1930s and 40s.

There are no riparian areas, streams, intermittent streams or other sources of natural water within the project area. Therefore no special management prescriptions or mitigations needed to be developed to protect water or fisheries resources.

The original proposed action sent to the public on April 27, 2007 was adjusted in a variety of ways to meet public and Forest Service concerns. Additional mitigation measures were recommended. Prescribed fire treatments in units 447 and 430 were dropped because of scenic views concerns and public safety for motorists along Highway 97. Thinning and mowing are retained as treatments in those units. Additional area for fuels treatment were also added to the proposed action to meet concerns regarding fuels treatments along the private land boundary in the eastern portion of the project area (Unit 456).

An alternative that considered only treating surface and smaller ladder fuels in response to public concerns of commercial timber harvest was eliminated from detailed study. While fuels only treatment is prevalent in the east side of the project area, there is a need to reduce canopy fuels in areas where stand densities could promote a crown fire should wildfire conditions exist. Past wildfires within and adjacent to the project area have displayed severe fire behavior, especially in areas of dense stands of young trees. This problem necessitates the need to reduce stand densities and provided some space so that if a tree torched during a wildfire, the likelihood of it spreading to adjacent trees is lessened. It was recognized that even with treatments, the most extreme weather conditions could still promote crown fires.

ALTERNATIVES

Alternative 1 (No Action)

The no action alternative is described to provide a reference for the deciding official to compare against the proposed action. Under this alternative, no fuels treatments would take place. Trees, shrubs, grasses and forbs would continue to grow and dead material would continue to accumulate on the ground. Ladder fuels, such as shrubs and small trees would continue to be present and would increase in some areas currently with low levels of ladder fuels. Because stand densities are higher in some areas, some mortality would occur, normally in the suppressed and smaller diameter trees as they are unable to successfully compete for nutrients and resources. Larger diameter trees (above 16" in dbh) are also susceptible to bark beetle attack as evidenced in some of the stands south of the project area which could result in mortality in the larger diameter trees as opposed to the smaller diameter trees. Larger diameter trees would continue to grow and canopy cover would continue to increase and lead to a continuous canopy in much of the area to the west of Highway 97. Wildfires would continue to occur, as evidenced by the Woodside Ranch Fire, a human-caused fire that started within the project area on Forest Road 18 (China Hat Road). Winds were favorable on the day the fire burned, and drove the fire to the southeast, away from the residences 1 mile to the north.

Alternative 2 (Proposed Action)

Fuels and Large Fire Reduction Strategies

The following strategies were developed to move toward the desired future condition and to help direct treatment types and locations:

1) Defensible Space (fuel break/safety corridor): Road systems allow ground suppression forces (engines, crews and equipment) to access wildfires. When fuel conditions allow surface fires to get into the canopies of the trees (ladder fuels); contributing to extreme fire behavior (torching, crowning and long range spotting), direct attack by ground forces becomes ineffective. Wildland fires under these conditions would cross any system road with such intensity that suppression forces have little chance of containing the fire at the road. Retardant alone would only slow a wildfire for a short period of time.

Suppression forces need to quickly utilize the effects of the retardant to contain a wildfire. Roads provide a good area for retardant to be utilized by suppression forces. During recent wildfires on the forest, rural fire engines have responded to aid in the suppression effort. These large low-ground clearing pieces of equipment cannot operate on most local forest roads due to narrow road widths and uneven road surface conditions. Use of major roads in a defensible space (fuel break/safety corridor) strategy is recommended, especially in the WUI where public safety and evacuations is of high concern. Roads that provide defensible space (fuel break/safety corridor) also provide safe escape routes from for fire fighters and the public. The Wildland/Urban Interface is also an area in need of defensible space. Defensible space (fuel break/safety corridor) does not only provides a better chance of stopping intense wildfires from entering private grounds, it also aids in the suppression of fires that start on private and move toward federal ownership. By reducing crown densities through thinning and reduction of ground fuels and ladder fuels through either mechanical shrub treatment (mowing), pruning, underburning, piling slash and burning the piles, fire behavior would be reduced to primarily a surface fire that suppression forces would have better ability to control. Thinning of dense canopies allows retardant to be more effective by getting to ground fuels, not being caught in the canopy. In order to be effective, these treatments in general, need to be at least 500 feet wide in some cases. In the WUI, the width of treatment would vary depending on prevailing winds, resources at risk, fuel type, access and other resources objectives, but should be no less than those described above. Snags should not be retained near the roads (within one tree length) that remain open to the public and down wood or slash piles should not be retained within 200 feet of roads or boundaries with private ownership to limit ember production and spotting.

2) Restoration of historical fire regimes in ponderosa pine ecosystems: The absence of fire over the last 60-80 years combined with the development of shrubs and dense thickets of regeneration in the understory have placed the ponderosa pine stands at high risk of stand replacing wildfire Although some of the timber stands in the WUI have been thinned in the past, the shrub layer within the stands remain capable of producing extreme fire behavior. Reintroduction of fire in these ponderosa pine type stands would be used as needed to achieve the desired conditions. Prescriptions would be developed for low intensity prescribed fire to start a return to historic conditions, subsequent prescribed fire entries would be conducted through time to create a fire resistant stand condition that would help preserve the ponderosa pine. When prescribed fire is used every 8 to 15 years, depending on fuel accumulations, these areas should regenerate ponderosa pine slowly through time as they did historically (Agee 1993). Related prescribed burning should keep naturally regenerated lodgepole pine in low numbers through time. Mechanical shrub treatments may be used to or in lieu of burning if the shrub size and densities could cause sever scorch or mortality of residual stands.

3) Fuel reduction and discontinuous ground fuels: Areas with either, existing dead and down material, dense stands of trees, and shrubs, needle-cast, and activity created slash from illegal woodcutting can create extremely hazardous conditions. When these conditions exist over large areas a wildfire can be extremely difficult to control. Under unfavorable weather conditions, the fire would burn until it reached an area where fuels were lighter and control tactics are more likely to be achieved. Mark Finney (2001) published the paper *Design of Regular Landscapes Fuel Treatment Patterns for Modifying Fire Growth and Behavior* in Forest Science magazine. The paper presents the theory that strategically-placed fuel treatments could achieve much greater results at minimizing large fire growth than randomly placed fuel treatments, especially when only a percentage of the area could be treated. Fire spread modeling theoretically shows that strategic placement could significantly reduce large fire growth while the same percentage of randomly placed treatments would have little or no effect. It suggests that when treating just a percentage of the landscape, the juxtaposition of fuels treatment areas in relation to one another was more important than the total amount of area treated. At this time, there is no scientific evidence supporting a conjecture that treating a smaller amount of acres within a landscape, even when the treatments are strategically placed, would provide the same level of

protection or restoration effects as treating a majority of the landscape. According to Finney, treating in a spatially strategic pattern would increase effectiveness in minimizing large fire spread and buy time to complete treatments on additional areas before they burn.

4) Thinning to reduce crown fire susceptibility and long range spotting: Crowning fires are some of the most intense wildfires and usually produce long range spotting that hampers the control efforts. Dense stands of timber support independent crown fires allowing fire to burn through the canopy of the trees independent of the ground fire. Torching and crowning in conjunction with the ground fire is also a common problem during wildfires in dense stands of timber. Breaking up the connectivity of the timber canopy through thinning greatly decreases the chance of an independent crown fire, thinning also reduces the amount of torching and crowning that occurs with ground fire and thus reduces long range spotting potential. Thinning from below, leaving dominant and co-dominant trees with thick bark and high crowns, significantly changes the potential for fire to move from surface up into the tree crowns (Fitzgerald 2002).

Alternative 2 (Proposed Action)

The Forest Service proposes to reduce forest surface, ladder and aerial fuels within 1½ miles of the Forest boundary south of Bend, on both sides of Highway 97. Treatments are proposed on 3,021 gross acres (Appendix A and B) within stands dominated by ponderosa pine. Treatments include thinning trees less than 21 inches dbh, underburning, mechanical shrub treatment (mowing), and pruning. Treatments are proposed for use separately or in combination. Within most areas proposed for thinning, 10 percent would be retained in denser patches to provide wildlife habitat. An exception would be in unit 446, where 20 percent would be retained.

Treatments are proposed within Deer Habitat (MA 7) and Scenic Views (MA 9). Scenic view allocations include retention foreground (SV1) adjacent to Highway 97 and retention middleground (SV3) adjacent to the lava flow (Appendix B) within Newberry National Volcanic Monument that forms the western boundary of the project. Table 1 summarizes treatment combinations (Appendix A) by management allocations.

Table 1: Alternative 2 - Gross Treatment Acres (Treatment and Management Allocation

Treatment Combination	Deer Habitat	Scenic Views		Total
		SV1	SV3	
Thin	70	36	0	**106**
Thin, mow	0	514	24	**538**
Thin, mow, underburn	215	0	0	**215**
Thin, prune, mow	37	39	43	**119**
Thin, prune, mow, underburn	49	0	0	**49**
Mow	0	215	136	**351**
Underburn or Mow/Underburn	1,643	0	0	**1,643**
Total	**2,014**	**804**	**203**	**3,021**

Table 2: List of Proposed Units, Acres, and Prescriptions

Unit	Treatment	Allocation	Acres	
			Gross Treatment	Net Thinning
107	Thin/Hand pile/Mow	SV3	10	9
110	Thin/Prune/Hand pile/Mow	SV1/SV3	66[a]	59
113	Thin/Machine pile/Mow	SV1	61	55
114	Thin/Hand pile/Mow	SV1	47	42
115	Thin/Hand pile/Mow	SV1	65	58
116	Mow	SV1	28	---
119	Thin	DHB	70	63
120	Thin	SV1	36	32
131	Thin/Prune/Hand pile/Mow	DHB	37	33
132	Thin/Hand pile/Mow/Underburn	DHB	94	85
133	Mow/Underburn	DHB	63	---
134	Mow/Underburn	DHB	231	---
135	Mow/Underburn	DHB	110	---
136	Mow/Underburn	DHB	213	---
137	Mow/Underburn	DHB	239	---
138	Mow/Underburn	DHB	113	---
139	Mow/Underburn	DHB	224	---
141	Mow/Underburn	DHB	193	---
153	Underburn	DHB	44	---
221	Thin/Prune/Hand pile/Mow	SV3	16	14
222	Prune/Mow	SV3	61	---
251	Mow/Underburn	DHB	38	---
252	Underburn	DHB	34	---
254	Thin/Prune/Hand pile/Mow/Underburn	DHB	49	44
255	Underburn	DHB	99	---
411	Mow/Underburn	SV3	75	---
412	Thin/Hand pile/Mow	SV3/SV1	25[b]	22
430	Thin/Hand pile/Mow	SV1	100	90
446	Thin/Mow/Underburn	DHB	121	97
447	Thin/Mow	SV1	95	86
452	Mow	SV1	36	---
453	Mow	SV1	151	---
454	Thin/Hand pile/Mow	SV1	100	90
455	Thin/Hand pile/Mow	SV1	35	32
456	Mow/Underburn	DHB	42	---
TOTAL			**3,021**	**911**

DHB – Deer Habitat
SV1 – Scenic Views, Retention, Foreground
SV2 – Scenic Views, Retention, Middleground
[a] Unit 110: 39 acres in SV1; 27 acres in SV3
[b] Unit 412: 14 acres in SV3; 11 acres in SV1

Recent fires have adversely affected thermal cover within Deer Habitat and it is important to retain the existing thermal cover within the project area. This alternative has been designed to avoid impacts to wintering deer by retaining existing thermal cover levels in Deer Habitat (MA7) east of Highway 97. Fuels treatments were designed to surround existing large patches of thermal cover and to provide some protection by treating adjacent non-thermal cover areas. Unit 446 was also identified

to retain 20% of the unit area in an untreated condition to provide habitat for deer in this important area.

In addition, no late or old structured stands are proposed for harvest. Because the majority of the area was historically clearcut harvested when the lands were in private ownership, almost all of the stands proposed for treatment are less than 80 years of age. Most of the land was clearcut in the 1930s and 1940s. The lands came under Federal ownership in the 1950s when the logging companies disbanded and conveyed their lands.

Following public scoping for this project, the Woodside Ranch Fire (August 2007) burned approximately 596 acres within and adjacent to the South Bend project area boundary. The fire burned through 54 acres of the southeast portion of proposed Unit 141 within the project area. Unit 141 is proposed as a fuels treatment corridor along Forest Road 18 (China Hat road), a heavily used route within the project area. These 54 acres and an additional approximate 15 acres between this fire area and the powerline have been eliminated from proposed treatment.

Thinning and Other Fuels Treatments:

Thinning trees less than 21 inches diameter at breast height (dbh) would occur on approximately 1,102 gross acres, 979 net acres with the remaining acres untreated. Other treatments include mechanical shrub treatment, prescribed underburning, small diameter thinning, and pruning. Thinning units would leave approximately 10% in an untreated condition (20% in unit 446).

Thinning would be a combination of thinning from below and variable-density thinning. The best, most dominant trees with the least amount of dwarf mistletoe infection would be retained. The smallest diameter trees and/or the shortest trees would generally be priority for removal. Where removal of trees from the lower crown class would not reduce stocking to desired levels, trees from the dominant and co-dominant crown classes would be removed to favor the best trees of those same crown classes. Within most proposed thinning areas, 10 percent of the stand would be retained in denser patches to provide wildlife habitat. An exception would be in unit 446, where 20 percent would be retained.

A variety of methods would be used to reduce thinning and pruning slash. Treatment methods, used separately or in combination, would include whole tree yarding and hand or machine piling. Additional reduction of slash would occur during underburning and mechanical shrub treatment.

Mechanical shrub treatment (MST), also known as mowing, focuses on reducing ground and ladder fuels such as shrubs and small trees. In addition to shrubs and small trees, prescribed under burning (UBN) focuses on reducing forest litter, needles, and small limbs. Units identified for underburning were designed to use existing fuel breaks, such as roads and lava flows to reduce the need for the construction of hand fire lines. No machine fire lines would be constructed but there may be some constructed hand fire lines. In areas proposed for either mowing or underburning, or both, 30 percent of each unit would remain in an untreated condition following treatment.

Where the average stand tree diameter density is less than 8 inches in diameter at breast height (dbh)), spacing would be 16 to 22 feet between leave trees (approximately 90 to 170 trees per acre). This would result in a reduction of ladder fuels and create space between tree crowns to reduce the likelihood of crown fires being maintained during a wildfire event. There is the potential that the resulting slash could be removed as biomass. Otherwise, slash would be hand piled and burned or scattered (HPLS) in areas of low fuel loadings. Pruning (GPR) of lower limbs on larger leave trees is proposed in some stands to increase the distance between surface and crown fuels.

Merchantable timber products would be removed on a log truck. In stands with larger diameter trees, stands would be thinned to an approximate average of 30 to 75 trees per acre, focusing on removing the smaller diameter trees and leaving the larger and healthier trees. Residual tree density would vary, depending on local site conditions. Where openings occur naturally in the stand or where trees are unhealthy, fewer trees would be retained. In areas where more healthy trees are available, more trees would be left. The resulting stand would have both gaps and clumps of trees promoting stand diversity. No trees over 21 inches in diameter would be cut and removed. No commercial harvest is proposed in stands considered late successional or old growth. All harvesting would be done with ground based systems, likely using mechanical harvesters, forwarders, and / or rubber tired skidders on a designated skid trail system. Harvested trees would be whole tree yarded or yarded with tops attached (WTY) to the landing to minimize the amounts of slash left in the stand after harvest. All stands thinned with merchantable wood fiber would have the residual slash treated in some way. Most stands would be treated with additional slash disposal treatments such as underburning or hand piling of slash. In one unit, grapple piling with a machine (MP) would be necessary because of the high levels of slash expected to result from the commercial and precommercial thinning operation.

The removal of merchantable material would result in approximately 2.9 MMBF (5,900 CCF) of timber being harvested.

Changes to Proposed Action as a result of Collaboration and Public Involvement

Changes were made in response to comments received during the public open house meeting (February 28, 2007) and from the public scoping letter (sent April 27, 2007). These changes have been incorporated into the description of Alternative 2.

- Prescribed burning was eliminated from the prescription for treatment in units 430 and 447 along Highway 97 (195 acres total). This responded to comments to reduce the amount of prescribed fire to reduce the amount of smoke near residences.
- An additional unit was added to reflect an adjacent landowners request to treat an area that is in condition class 2. Unit 456 (42 acres) was added for mowing and underburning.
- Other project design incorporated into the project based on public input is described on page 36.

Additional Changes to Proposed Action following pre-decisional Objection Period

- Unit 411 will not be thinned. This eliminates the need for the use of Osage Road/Forest Road 017, Mohawk Dr., and Cheyenne through Deschutes River Woods.
- Priority for fuels reduction will be in units 221, 222, and 411. Piles of slash created from thinning and pruning will be burned within one year of activity.
- EA Wildlife mitigation #2 changed to include no mowing from May 20 through July 5.
- Basal Area, in stands to be thinned with commercial value sized trees, changed from 60-80 square feet per acre to 50-90 square feet per acre, averaging 70, to allow more within stand variability. Higher basal area will remain in areas such as rock outcrops that provide wildlife habitat.
- Retain all ponderosa pine with old growth characteristic, regardless of size.

Connected Actions

Temporary Road Construction

No permanent roads would be constructed. Approximately 1.3 miles of temporary road would be necessary to access units 113 and 119. Refer to Table 3 for miles of temporary road associated with each unit. These roads will be closed and subsoiled following harvest and associated activities.

Table 3: Units with Needed Temporary Road Access

Unit	Miles of Temporary Road
113	0.5 miles
119	0.8 miles

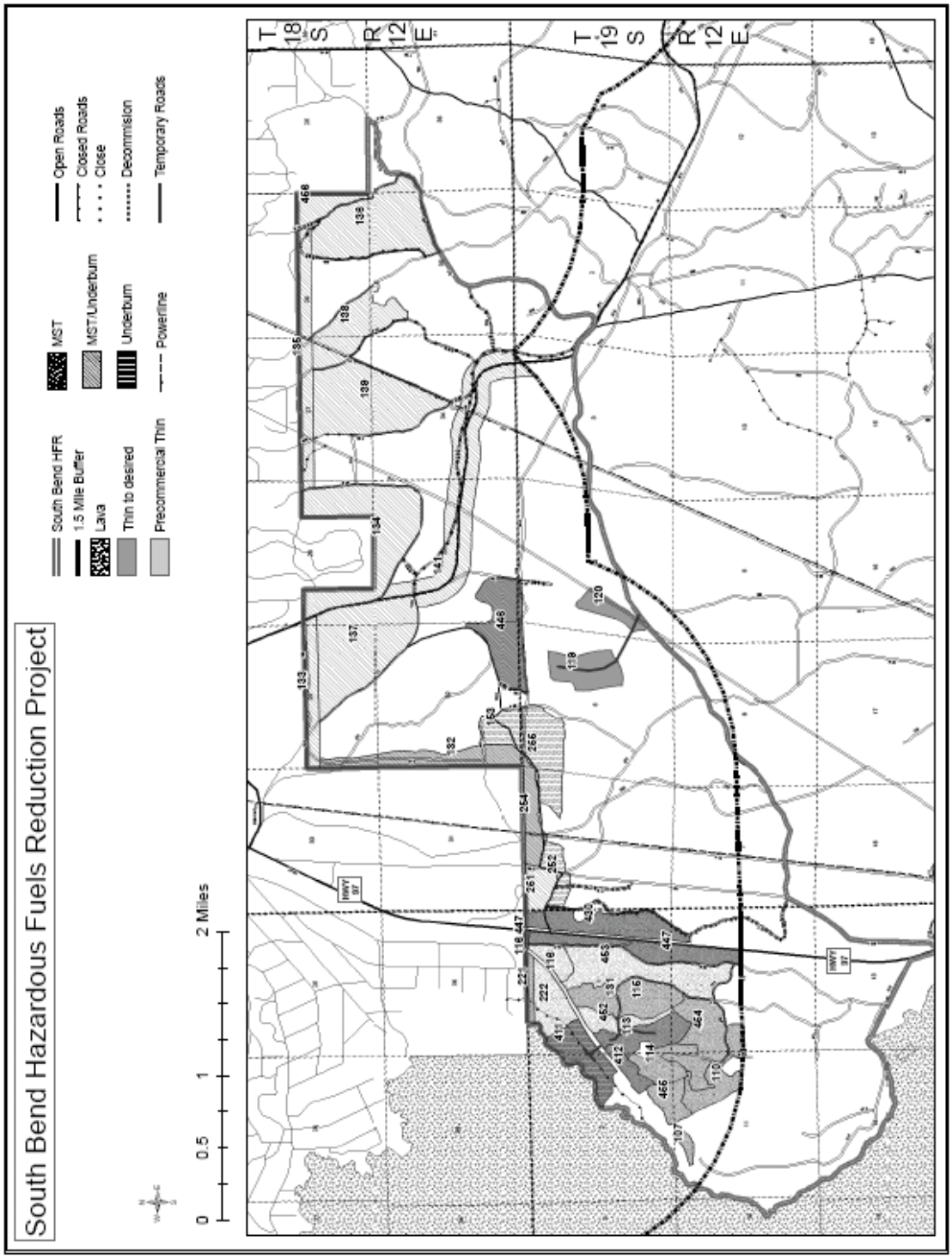
Road Closures and Decommissioning

Because the intent of the project is to reduce fuels, some of the activities would reduce stand densities (to reduce surface, ladder, and crown fuels) which would increase sight distances within treated stands. The increase in sight distances could lead to an increase in disturbance to big game, especially in the deer winter range (Deer Habitat Management Area). In order to decrease the impacts to big game, a roads analysis was completed (Project Record), identifying approximately 5.9 miles to be close (available for use for future administrative needs) and approximately 3.4 miles would be decommissioned (no longer available for future motorized use). Table 4 displays the mileage and type of closure for each identified road.

Table 4: Road closure and decommissioning

Road	Type of Closure	Miles of Road
1800 022	decommission	0.2
1800 030	close	2.7
1800 050	decommission	0.2
1800 063	close	1.1
1801 390	decommission	0.2
1801 440	close	0.2
1801 850	decommission	2.2
1815 236	close	0.5
1815 640	close	1.2
1815 643	close	0.2
9701 170	decommission	0.6
Total Closure/Decommissioning Road Miles		**9.3**

Figure 3: Proposed Units, Treatments, Temporary Roads, and Road Closures and Decommissioning



MITIGATIONS

Mitigations Measures[1] are an integral part of each of the action alternatives. The following would be applied to implementation of the action alternative to reduce or eliminate adverse or undesirable impacts that could occur from proposed activities. These mitigation measures are considered in the effects discussions of Chapter 3.

General

1. Marking guides, burn plans and / or contracts to be coordinated between resource specialists prior to implementation.

Wildlife

1. **Nest-1:** In the event that raptor nests are discovered during project preparation or implementation, active nest sites would be protected from disturbing activities within ¼ mile (1 mile for use of explosives) of the nest by restricting operations during the nestling period (Forest Plan WL-3). No known nest sites are currently present within proposed units.

   March 1 - August 31: red-tailed hawk & northern goshawk
   February 1 – July 31: golden eagle
   April 15 – August 31: Cooper's hawk & sharp-shinned hawk

2. **Migratory 1:** To minimize effects on nesting landbirds and air quality in Bend there would be no prescribed burning or mowing of shrubs from May 20 to July 5.

3. **Snag-1:** Retain all existing snags (including soft) as wildlife trees for roosting and foraging except where impractical because of human safety in all units, *Wildlife Tree and Log Implementation Strategy, LRMP WL-38, Eastside Screens*

4. **BG-1:** To provide stand diversity and big game hiding and thermal cover, all commercial harvest treatments would retain at least 10 percent of the unit treatment area in untreated clumps. Untreated clumps should be 0.5 to 6 acres, be the densest available, and distributed throughout the unit. As a general rule, untreated clumps would be located greater than 200 feet from open roads and be distributed approximately 600 to 1,200 feet apart (WL-59, M7-10, M7-15).

   Units 113, 119, 120, 412, 413, 430, 447
   Unit 446 – the above description applies except leave 20 percent retained for big game hiding and thermal cover.

5. **BG-2:** To provide a seed source for shrub re-establishment, habitat for shrub-nesting songbirds, bat prey (moths), chipmunk and ground squirrels, and to retain mule deer forage, 30 percent of the unit acreage would not be treated in prescribed burning and/or mechanically treated fuels units. The untreated acreage would be distributed in a mosaic of islands of untreated shrubs, varying size from 0.5 to 6 acres. Logs and rock outcrops should be included in untreated areas, such that these features retain treatment buffers of at least 25 to 30 feet (WL-74 & WL-75). Where thinning and fuels treatments occur in the same unit, the 10% or 20% (Unit 446) retention untreated with commercial harvest shall overlap with the 30% untreated with fuels treatments so that no more than 30% remains untreated in any unit. Applies to all units with mechanical shrub treatment and underburning.

[1] Mitigation Measures include: Mitigation Measures, Project Design Criteria, Best Management Practices, and Management Requirements. Each of these have been developed to reduce or eliminate potential adverse effects to the various resources, as described in this section.

6. **CWM-1:** Retain all existing logs (greater than 9 inches dbh at the large end) where practical for denning and foraging except where impractical because of human safety, or where removal is necessary for fuels reduction needs because of excessive concentrations. Within all commercial harvest and fuels treatment units develop harvest and fuels treatment prescriptions to retain at least the existing CWM in the following quantities as indicated by Eastside Screens minimum standards. More may be left if not presenting an excessive fuel hazard. *Wildlife Tree and Log Implementation Strategy, LRMP WL-38*.
7. **CWM-2:** Develop prescribed burn prescriptions to minimize charring of logs (LRMP WL-72). During prescribed burn operations, avoid direct ignition of CWM that is greater than 12 inches in diameter and 6 feet in length and snags. Fire prescription parameters would ensure that consumption would not exceed 3 inches total (1.5 inches per side) of diameter reduction in featured logs. Applies to prescribed burning units. *Eastside Screens*

Soils and Hydrology

Mitigations 1 through 9 apply to Units 107, 110, 113, 114, 115, 119, 120, 131, 132, 221, 254, 412, 430, 446, 447, 454, 455.

1. In all proposed activity areas, locations for new yarding and transportation systems would be designated prior to the logging operations. This includes temporary roads, spur roads, log landings, and primary (main) skid trail networks. Use existing log landings and skid trail networks whenever possible (LRMP SL-1 & SL-3; Timber Management BMP T-11, T-14 & T-16).
2. All temporary roads and skid trails will have water control structures (water bars) installed and maintained during management activities where concentrated water flows can occur. Access will be closed immediately following harvest operations. (Forest Plan SL-1); (Timber Management BMP T-16) *High*
3. Avoid operations during periods of excessive soil moisture or transitional thawing during winter harvest activities, as evidenced when deep rutting from machine tracks or tires occurs. Winter activities should operate equipment over frozen ground or a sufficient amount of compacted snow to protect mineral soil. Equipment operations should be discontinued when frozen ground begins to thaw or when there is too little compacted snow and equipment begins to cause rutting damage. *High*
4. Limit sharp turning and multiple passes during the mowing operation, to the extent possible, in order to minimize soil displacement. *High*
5. Restrict grapple skidders to designated areas (such as, roads, landings, designated skid trails) at all times, and limit the amount of traffic from other specialized equipment off designated areas. The use of harvester machines will make no more than two (2) equipment passes on any site-specific area to cut or accumulate materials.
6. Restrict operation of machinery used for piling to skid trails and landings created or used by harvest and yarding operations. *High*
7. Prevent additional soil impacts between skid trails and away from landings by machine piling and burning logging slash on existing log landings and skid trails that already have detrimental soil conditions (LRMP Standards and Guidelines (SL-1 and SL-3); Timber Management BMPs T-2, T-4, T-9, T-11 and T-12; Forest Service Soil and Water Conservation Practices Handbook (FSH 2509.22). *High*
8. Maintain spacing of 100 to 150 feet for all primary (main) skid trail routes, except where converging at landings, in order to minimize the extent of detrimental soil disturbance and

achieve soil management objectives. The Timber Sale Administrator must approve closer spacing due to complex terrain or the use of harvester/forwarding machinery in advance. *High*

9. Reclaim all log landings, and approximately 500 feet of all primary (main) skid trails that lead into log landings in units measured to exceed LRMP soil standards following harvest and fuels activities. Appropriate soil mitigation treatments to restore the hydrologic function and productivity on these disturbed sites include the use of subsoiling equipment to loosen compacted soils, redistribution of organic matter and topsoil in areas of displaced soil, and placement of available slash and woody materials over the treated surfaces. Forest Plan Standards and Guidelines for Soil, Water and Riparian Resources (SL-1 and SL-4); Watershed Management BMP W-1). *High*
10. Conduct regular preventive maintenance of haul roads during operations to avoid deterioration of the road surfaces and minimize the effects of erosion (Road BMP R-18, R-19). *Moderate to High*
11. Maintain duff layer: Strive to maintain existing sources of unburned or partially consumed, fine organic matter (organic materials less than 3 inches in diameter; commonly referred to as the duff layer), wherever possible, within planned activity areas. (LRMP SL-6; Fuels Management BMP F-2; Timber Management BMP T-13). *Moderate* Units 132, 133, 134, 135, 136, 137, 138, 139, 141, 153, 251, 252, 254, 255, 446
12. Include sensitive soil areas represented by SRI Landtypes 14 and 6G, or steep rocky pitches greater than 30 percent, in wildlife retention areas where possible, in order to minimize equipment impacts to soils in these areas. Utilize directional hand felling of trees toward skid trails and /or line pulling to yard trees if treatment is necessary in these areas. *High* Units 135, 137 and 141.
13. Reclaim all temporary roads with appropriate soil restoration treatments following use for harvest and fuels activities. Treatments to restore the hydrologic function and productivity on these disturbed sites include the use of subsoiling equipment to loosen compacted soils, redistribution of organic matter and topsoil in areas of displaced soil, and placement of available slash and woody materials over the treated surfaces. Forest Plan Standards and Guidelines for Soil, Water and Riparian Resources (SL-1 and SL-4); Watershed Management BMP W-1). *High*
Units 113 and 119.

Botany – Invasive Plants

1. The district botanist or representative would flag out the known weed populations (in or adjacent to units 221, 222, 116, 131, 452, 113, 412, 455, 447, 430, 252, 133, 137, 134, 141, 139, and 136) prior to project operations and they would be posted out of the units if they are harvest units.
2. All sites (almost all are dalmatian toadflax) located within the previously mentioned units would be avoided during mowing operations, but they would be mowed immediately adjacent to them so as to create a lower-intensity buffer, should underburning be also used in those units. Buffer width would be left up to the judgment of the mower, but with the objective of keeping fire at a low intensity within the weed site. The mower would be guided by the flagging (yellow with black stripes) that the district botanist or her representative uses to indicate a weed site is present. Maps of the units with the known weed sites would be made available to project implementers.
3. Clean all equipment before entering *and after leaving* National Forest System lands. Remove mud, dirt, and plant parts from project equipment before moving it into the project area and before proceeding to the next project.
4. The district botanist or representative would inspect any gravel or fill material before it is brought into the project for the presence of noxious weeds.

5. No landings, skid trails, or temporary roads would be placed on the known weed sites.
6. These units adjacent to Highway 97 would not have machinery in them within 30' of the edge of the road shoulder: 447, 430, and 251. This is to prevent the heavily weed-laden seedbank from entering newly-disturbed forest.
7. To prevent the spread of spotted knapweed from entering unit 411 the district botanist would evaluate whether additional preventative measures are necessary, especially the use of native plants at the site after the work is done. (The spotted knapweed site(s) along the road on the east side of the unit would be treated prior to project implementation).
8. Implementers need to consult with the district botanist to ensure that all weed populations are known to them. This is because there are numerous new sites found every year in this area of the district.
9. All weed sites present within units that do not have biocontrols present would be treated prior to project implementation. Sites with biocontrols would not be treated because treatment would eliminate the insects that were placed there to decimate the plants (Units 135 and 137).
10. Monitor the area for noxious weeds annually, if possible, after the project ends. If any noxious weeds are found they should be treated.
11. As far as is practicable, vehicles would not park at the flagged-out weed sites.

Forest Vegetation – Trees

1. **VEG-1:** To reduce potential for long-term growth loss and bark beetle induced mortality of ponderosa pine following proposed prescribed burning, conduct burns in a manner that would result in retention of at least 40 percent live crown ratio on dominant and co-dominant trees. This should generally result in crown scorch less than 50 percent. Measures will include: 1) initiating burns outside the time of ponderosa pine bud elongation (between mid-May to early June depending on weather conditions), 2) initiating burns when weather and fuel moisture conditions are favorable for meeting fuel reduction objectives and minimizing damage, and 3) utilizing lighting techniques expected to meet fuel reduction objectives while minimizing damage to residual trees. LRMP S&G TM-36.

   In developing burn prescriptions that will minimize damage to residual trees, recognize that portions of the following units were reforested between the years 1977 and 1987: Units 132, 133, 134, 137, 139, 141, 153, 254, and 446. Within reforested portions, dominant and codominant trees can consist of primarily immature, relatively full-crowned trees. Develop burn plans for these units in coordination with silviculturist and wildlife biologist (General Mitigation Measure #1) to assure fuel reduction objectives and other resource objectives, such as the protection of residual trees, can be acceptably met. *Low to Moderate*
2. **VEG-2:** Scorching would be limited to the lower 1/3 of the forest canopy in scenic views management area (Units 251, 252). (Deschutes LRMP S&G M9-90)

Range

1. Range fences should be protected to the extent segmenting, burial, bending of posts and dragging of components should be avoided as these activities would make removal and salvage more difficult (Units 132-136, 141, 153, 255, 446, and 456).

Cultural

Where proposed activities may impact eligible or unevaluated heritage resources, the following avoidance procedures will avert potential effects to either or both historic and prehistoric properties. The Oregon State Historic Preservation Office has agreed that with these avoidance measures, this project will have no effect on significant or potentially significant heritage resources.

1. In units to be underburned, avoid burning in eligible and unevaluated sites; and do not construct fireline or implement other ground disturbing activities in all eligible and unevaluated sites.
2. Do not locate slash piles for burning within either eligible or unevaluated sites.
3. Avoid mowing (MST) in eligible and unevaluated historic sites and minimize turning and maneuvering of the equipment in all eligible and unevaluated sites.
4. Mechanical thinning and machine piling should avoid all eligible and unevaluated sites.
5. Commercial thinning should avoid all eligible and unevaluated sites within treatment units, landings, temporary roads, and skid trails
6. Proposed road closure and decommissioning, or conversion to trails would avoid subsoiling, water barring, or other ground disturbance methods within the boundaries of eligible and unevaluated sites.

Scenic Resource

1. Flush cut stump to within 6 inches above the ground within 100 feet (minimum) of road corridor within Foreground Scenic View. *High*
   Retention foreground units (SV1): 110, 113, 114, 115, 116, 131, 251, 252, 430, 447, 452, 453, 454, 455
2. Paint on backsides of all leave trees (within 100 feet from road right-of-way). When possible, use cut tree marking to minimize painted trees left behind. Remove ribbons and other markers following completion of the project.
3. Slash treatment would be completed within one year for Retention.
4. Minimize ground disturbance within the foreground viewing areas to reduce soil contrast. Design and locate skid trail and landing area at least 300 feet away from primary travel corridors if possible.
5. Avoid fire scorch above 2/3 of live tree crown within the foreground landscape.

   Retention foreground units (SV1): 110, 113, 114, 115, 116, 131, 251, 252, 430, 447, 452, 453, 454, 455
   Retention middleground units (SV3): 107, 110, 113, 114, 221, 222, 412

Air Quality

1. Warning signs would be posted at prominent road junctions to inform the public of prescribed burning operations, and would remain in place until there is no visible smoke. If feasible, roads may be temporarily closed for the protection of public safety.
2. As part of the plan to inform the public, notify local businesses prior to the burning season and on the day of planned prescribed burning operations. Also, notify adjacent landowners of burning operations conducted in units within ¼ mile of their property.

Mitigation Measures Added to the Proposed Action as a Result of Public Involvement and Collaboration

Retain 3-4 clumps per acre of 4-8 trees in each clump in old growth and younger stands to promote diversity in stand structure and composition. Clumps should be identified where existing trees are already clumped and exhibit old growth characteristics including large limbs, larger diameter, deformities, furrowed bark and other characteristics for diversity in the trees.

- Adjust the basal area target for leave tree density to vary between 40-90 square feet to allow for variable density thinning. This would result in variability in the number of trees per acre left across the acreage so that a uniform appearance is not left in the treatment unit. The objective is to eliminate the appearance of a managed plantation.
- Include small openings in the treatment unit.
- Focus on retaining trees with older characteristics and that are fire resistant.
- Where site specifics warrant, incorporate "donut" thinning around larger diameter trees.
- retain wildlife character trees or trees that have limbs suitable for nesting, dead tops, mistletoe brooms lower in the canopy, etc. that provide valuable habitat.
- Minimize temporary road construction by doing the minimal necessary to prepare the road for haul. As an example, if just driving on the surface would create enough of a road for hauling purposes, then proceed. The intent is to lessen the amount of top soil disturbance, soil movement and compaction. Subsoiling would be done to reduce compaction on the landings and in the temporary road. Additionally, seed dispersal of grasses and herbaceous material would be done from the plants within the unit (just collecting seeds and sowing at the same time).
- In treatment units that may overlap user created motor bike / mountain bike trails, position residual slash on trails to discourage continued use.

Best Management Practice's (BMPs) for Soil and Water Mitigation

The following BMPs would be implemented to prevent water quality degradation, primarily from sediment delivery to aquatic ecosystems. BMPs should be selected and tailored for site-specific conditions to arrive at the project level BMPs for the protection of water quality. A complete explanation of the BMPs is found in *General Water Quality Best Management Practices* (USDA, 1988) and is available at the District Office or Supervisors Office.

Roads

R1- General guidelines for the location and design of roads minimize resource damage.
R2- Erosion control plan, to limit and mitigate erosion …
R3- Timing of construction activities, to minimize erosion by avoiding wet weather conditions.
R6- Dispersion of subsurface drainage associated with roads to minimize road failure.
R7- Control of surface road drainage associated with roads to minimize erosion …
R19- Road surface treatment to prevent loss of materials.
R20- Traffic control during wet periods to minimize erosion and rutting.

Timber

T1- Timber sale planning to introduce water quality and hydrologic considerations into the sale planning process.
T3- Use of erosion potential assessment for timber harvest unit design.
T5- Limiting the operating period of timber sale activities.
T9- Determining tractor loggable ground.
T11- Tractor skid trail location and design.
T13- Erosion prevention and control measures during timber sale operations.

Watershed Management

W5- Cumulative watershed effects to protect beneficial uses.

Vegetative Manipulations

VM4- Soil moisture limitations for tractor operation to avoid rutting and erosion.

MONITORING

Project monitoring includes "implementation monitoring" to assure the selected alternative and mitigation measures are implemented on the ground as designed and achieve the desired results. Monitoring also includes "effectiveness and validation monitoring" to confirm assumptions used for effects analysis.

Monitoring parameters include:

1. 1) Identification of areas where live crowns have either been reduced below 40 percent or have been reduced by 50 percent from pre-burn conditions, and 2) Monitoring survival of trees with greater than 50 percent crown scorch or less than 40 percent live crown for two years after burn. For more detail, refer to Project Record, Silviculture Report, page 8.
2. *Invasive species population monitoring:* Monitor the area for invasive weeds annually, if possible, after the project ends. If any noxious weeds are found they should be removed or identified for additional environmental analysis if necessary.

CHAPTER 3 – AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

INTRODUCTION

The Affected Environment refers to the existing biological, physical, and social conditions of an area that are subject to change, directly, indirectly, or cumulatively as a result of a proposed human action. Information on the affected environment is found in each resource section under "Existing Condition." The effects may be direct, indirect, or cumulative.

The Affected Environment (existing condition) and Environmental Consequences (Effects) section provides the scientific and analytical basis for alternative comparison. This chapter summarizes the various environments of the project area and the anticipated effects of implementing each alternative on that environment. Probable effects are discussed in terms of environmental changes from the existing condition and include qualitative as well as assessments of direct, indirect, and cumulative effects.

Direct effects: Effects that occur at the same time and in the same general location as the activity causing the effects.
Indirect effects: Effects that occur at a different time or different location than the activity to which the effects are related.
Cumulative effects: –Effects that result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions. Consideration of past actions follow guidance provided by the Council of Environmental Quality (June 24, 2005 Memorandum from James L. Connaughton, Project Record.)

Table 5 provides a list of ongoing and reasonably foreseeable activities which may have some cumulative effects for different resources. Effects are bound in time and space. For most resource analysis finished activities are considered in the existing condition and so are already considered in the effects. The space within which most activities have cumulative effects are at the watershed scale or at the scale of individual activity units, this may vary by resource. The following table identifies activities, their actions and whether they are in the Pilot Butte 5th field watershed or have any activities which overlap proposed units in the South Bend project.

Table 5: Ongoing and Reasonably Foreseeable Projects for Cumulative Effects Analysis for the South Bend Project Area

Project	Description	In Pilot Butte 5th Field Watershed	Within Unit Boundaries
Ongoing Actions			
Sunriver HFRA EA (2008)	Includes tree density reduction on approximately 685 acres, limiting removal to trees less than 21 inches dbh. Treatments include commercial thinning and precommercial thinning and may include mowing or underburning. Also includes an additional 988 acres where treatment would only include mowing, underburning or pruning, separately or in	yes	no

Project	Description	In Pilot Butte 5th Field Watershed	Within Unit Boundaries
	combination		
OZ CE (2008)	Tree density reduction on about 553 acres. Commercial thinning and uneven-aged management. Small group openings from 1 to 4 acres, removing all trees less than 21 inches dbh on about 34 acres. Followed by mowing and/or underburning.	yes	yes
Woodside Ranch Fire (2007)	Planting fire area; Firewood gathering area	yes	no
Opine Vegetation Management EA(2007)	Includes prescribed burning, mechanical shrub treatment, non-commercial thinning, commercial harvest, and associated activities	no	no
Lava Cast Vegetation Management EA (2007)	Includes prescribed burning, mechanical shrub treatment, non-commercial thinning, commercial harvest, and associated activities	yes	no
Fuzzy Vegetation Management EA (2001)	Prescribed burning and mechanical shrub treatment remaining. Included non-commercial thinning, commercial harvest, and associated activities. Approximately 3,665 treatment acres remaining.	yes	no
Cinder Hill Range Allotment EA (2004)	Reauthorized grazing on three (3) grazing allotments totaling approximately 89,210 acres	yes	yes
Kipuka (Lava Butte Zone of NNVM).	Includes tree density reduction on approximately 71 acres, limiting removal to trees less than 21 inches dbh. Sale under contract. Logging has yet to begin. Includes prescribed burning, mechanical shrub treatment	yes	yes
Danger Tree Removal (ongoing)	Removal of danger trees along the Forest road system for public safety	yes	yes
Reasonably Foreseeable Actions			
West Tumbull Planning Area (Planning in Progress)	Includes prescribed burning, mechanical shrub treatment, non-commercial thinning, commercial harvest, and associated activities.	no	no
Access Management (Planning In Progress)	Focus on motorized recreation including: 1) access on Forest roads and 2). development of designated OHV trail system, staging areas, and play areas	yes	planning
Oregon Department of Transportation (Planning in Progress)	1) Widening (2 to 4 lanes) Highway 97 from Sunriver north to existing 4-lane; 2) Upgrade Cottonwood Interchange; 3) Closing access to Lava River Cave from Hwy 97 and providing access from Cottonwood interchange and along old Hwy 97;	yes	no

Project	Description	In Pilot Butte 5th Field Watershed	Within Unit Boundaries
	4) Access to Lava Lands Visitor Center from the south would be: extend access of old Hwy 97 from Lava River Cave north and provide underpass or overpass for Hwy 97. Would require 60 acres of right-of-way clearing.		
Opine - Sage Grouse Habitat Enhancement (Planning in Progress)	Cutting encroaching trees, installing 3 guzzlers	no	no

In addition to the projects listed in Table 5, three area closures under forest protection orders are in effect within the planning area. These closure orders offer some protection to reduce human caused impacts to resources and reduce the risk of human caused fire starts.

- Lava Butte Area Closure: Signed in 1999, this order prohibits use of motorized vehicles (excluding snowmobiles) within the Lava Butte Geological Area and adjacent environs on the DNF in T19S, R11E, Sections 1, 2, and 11.
- 1801 Off-Highway Vehicle Play Area: Signed in 2001, this order prohibits motorized use off Forest development roads – roads that are signed with brown Carsonite markers. This off-highway closure order lies within T18S, R12E, Sections 27-29, 32-34 and T19S, R12E, Section 3. Bounded by the Forest boundary fence lines on the North and West, the fence line separating T18S, R12E, Sections 32 and 33 from T19S, R12E, Section 4 and 5 (paralleling Forest roads 1801-400 and 9701-900), and the powerline on the East (Forest roads 1800-012 and 1800-019.
- China Hat road Interface No Shooting Area: Signed in 2006, this order prohibits shooting firearms. This area is contained within the off-highway closure area, with the east boundary of this order being the gas line that is West of and parallels the power line.

"In order to understand the contribution of past actions to the cumulative effects of the proposed action and alternatives, this analysis relies on current environmental conditions as a proxy for the impacts of past actions. This is because existing conditions reflect the aggregate impact of all prior human actions and natural events that have affected the environment and might contribute to cumulative effects.

This cumulative effects analysis does not attempt to quantify the effects of past human actions by adding up all prior actions on an action-by-action basis. There are several reasons for not taking this approach. First, a catalog and analysis of all past actions would be impractical to compile and unduly costly to obtain. Current conditions have been impacted by innumerable actions over the last century (and beyond), and trying to isolate the individual actions that continue to have residual impacts would be nearly impossible. Second, providing the details of past actions on an individual basis would not be useful to predict the cumulative effects of the proposed action or alternatives. In fact, focusing on individual actions would be less accurate than looking at existing conditions, because there is limited information on the environmental impacts of individual past actions, and one can not reasonably identify each and every action over the last century that has contributed to current conditions. Additionally, focusing on the impacts of past human actions risks ignoring the important residual effects of past natural events, which may contribute to cumulative effects just as much as human actions. By looking at current conditions, we are sure to capture all the residual effects of past human actions and natural events, regardless of which particular action or event contributed those effects. Third, public scoping for this project did not identify any public interest

or need for detailed information on individual past actions. Finally, the Council on Environmental Quality issued an interpretive memorandum on June 24, 2005 regarding analysis of past actions, which states, "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."

The cumulative effects analysis in this (EA or EIS) is also consistent with Forest Service National Environmental Policy Act (NEPA) Regulations (36 CFR 220.4(f)) (July 24, 2008), which state, in part:

> "CEQ regulations do not require the consideration of the individual effects of all past actions to determine the present effects of past actions. Once the agency has identified those present effects of past actions that warrant consideration, the agency assesses the extent that the effects of the proposal for agency action or its alternatives will add to, modify, or mitigate those effects. The final analysis documents an agency assessment of the cumulative effects of the actions considered (including past, present, and reasonable foreseeable future actions) on the affected environment. With respect to past actions, during the scoping process and subsequent preparation of the analysis, the agency must determine what information regarding past actions is useful and relevant to the required analysis of cumulative effects. Cataloging past actions and specific information about the direct and indirect effects of their design and implementation could in some contexts be useful to predict the cumulative effects of the proposal. The CEQ regulations, however, do not require agencies to catalogue or exhaustively list and analyze all individual past actions. Simply because information about past actions may be available or obtained with reasonable effort does not mean that it is relevant and necessary to inform decisionmaking. (40 CFR 1508.7)"
>
> For these reasons, the analysis of past actions in this section is based on current environmental conditions.

Reports have been summarized for each resource, and hereby incorporated, in the following discussions. For more detailed and supporting documentation, and to incorporate by reference, refer to the specialist reports in the Project Record located at the Bend-Fort Rock District Office. Other supplemental and supporting documentation found in the Appendices of this EA, as listed in the Table of Contents.

- Fire and Fuels
- Forest Vegetation and Forest Health
- Wildlife Biological Evaluation and Wildlife Report
- Soils
- Botany Biological Evaluation and Botany Invasive Plant Report

Best available science was considered and used in analyzing the effects of proposed treatments. Scientific information relied on is incorporated and cited in the discussion of effects.

FIRE AND FUELS

DIRECTION

The Deschutes Land and Resource Management Plan (LRMP) (USDA1990) provides goals, objectives, and standards and guidelines (Table 6). Plan amendments and changes in fire management policy have modified management direction for fire and fuels management.

The National Fire Plan (2000) provides direction for hazardous fuels reduction, restoration, rehabilitation, monitoring, and applied research and technology transfer. The South Bend Hazardous Fuels Reduction Project responds to the hazardous fuel reduction and restoration elements of the National Fire Plan.

- **Hazardous Fuels Reduction** – Assign highest priority for fuels reduction to communities at risk, readily accessible municipal watersheds, threatened and endangered species habitat, and other important local features where conditions favor uncharacteristically intense fires.
- **Restoration** – Restore healthy, diverse, and resilient ecological systems to minimize uncharacteristically intense fire on a priority watershed basis. Methods would include removal of excess vegetation and dead fuels through thinning, prescribed fire, and other treatments.

The Healthy Forest Restoration Act (HFRA) emphasizes the need for federal agencies to work collaboratively with communities in developing hazardous fuel reduction projects, and it places priority on treatment areas identified by communities themselves in a Community Wildfire Protection Plan (CWPP). The CWPP's are intended to assist both local communities and federal partners in matching treatment priorities across jurisdictional boundaries so that treatments are more effective at controlling the spread of unwanted fires.

The Greater Bend CWPP describes the risk as high for the entire Bend area based on historical evidence of fire history as well as ready ignitions sources like dry lightning storms, debris burning, equipment use, campfires and arson. The CWPP utilizes two risk assessment methodologies: Oregon Department of Forestry Assessment of Risk Factors and a combined risk assessment that considers Fire Regime – Condition Class, Fire Starts and Large Fire History. Both assessments resulted in ranking Deschutes River Woods (DRW) as number one. The rankings are due in part to the fact that 75 percent of the acres in and around DRW are in Condition Class 2 and 3 (CWPP Pg. 16). Furthermore, since 2000, there have been 115 fire starts with one large fire greater than 100 acres (Awbrey Hall 1990) (CWPP Page 16).

Table 6 General Fire and Fuels Related Goals, Standards, Guidelines and Recommendations

Deschutes NF LRMP	Greater Bend Community Wildfire Protection Plan (2006)
Goal: To provide a well managed fire protection and prescribed fire program that is cost efficient, responsive to land stewardship needs, and resource management goals and objectives. **FF-1**: Prevention of human caused wildfire will focus on areas of high use and high risk. **M1-18**: Fuel loading should be low enough to eliminate the possibility of high intensity fires while maintaining the natural characteristics of the area.	**Goal:** To return the landscape to Condition Class 1 and provide for a healthy, fire resilient landscape that supports the social, economic and ecological values of greater Bend area residents and visitors. A) Within a ¼ mile buffer of adjacent communities at risk. Treatments should begin here and increase in ¼ mile increments until the WUI boundary is reached. B) Within 300 feet of any evacuation route from adjacent communities at risk.

Deschutes NF LRMP	Greater Bend Community Wildfire Protection Plan (2006)
M7-26: The prescribed use of fire will be necessary to maintain diversity within the plant communities. Burning prescriptions will provide for the reestablishment of bitterbrush within 20 years. **M8-25**: Prescribed fire may be use to protect, maintain and enhance timber and forage production. The broadcast application will occur in the ponderosa pine type. **M8-27**: Slash will be treated to reduce the chances of fire starts and rates of spread to acceptable levels.	

INTRODUCTION

Urban and suburban development in or near wildland vegetation posses risks for wildland fire managers in their ability to control threats to the natural resources and private structures. The WUI has received considerable attention because of recent increases in both the number of structures destroyed and the area burned annually by wildland fire. It is in the WUI where protection of structures from wildland fires is the most challenging and where human-caused fire ignitions are most common (Radeloff, Hammer et al, 2005).

The WUI definition in the Federal Register was developed to identify communities at risk in the vicinity of public lands. According to this definition, "the Wildand-Urban Interface is the area where houses meet or intermingle with undeveloped wildland vegetation", (USDA and USDI 2001). Areas where houses and wildland vegetation intermingle are referred to as intermix WUI. Developed areas that abut wildland vegetation are characterized as interface WUI. Although this definition was developed in conjunction with wildland fire policy, it does not explicitly account for differences in fire risk.

This WUI zone poses tremendous risk to life, property, and infrastructure in associated communities and is one of the most dangerous and complicated situations firefighters face (Preparing a CWPP 2004). Both the National Fire Plan and the Ten-Year Comprehensive Strategy for Reducing Wildland Fire Risks to Communities and the Environment place a priority on working collaboratively within communities in the WUI to reduce their risk from large-scale wildfire.

In portions of the lower elevation, there exists an interface between urban growth and the National Forest System lands. This area is known as the Wildland Urban Interface (WUI). The Bend CWPP Steering Committee has identified and mapped the WUI. The Deschutes National Forest lands which borders South Bend is categorized as WUI. The proposed project area overlaps the WUI boundary starting at the forest boundary and extending south to Forest Service Road 9711on the eastside of Highway 97 and to Forest Road 9702 on the westside of the highway.

DESIRED CONDITIONS

The landscape within the project area should display a mosaic of strategically placed areas that are based on the principles of Fire Resilient Forests, (Table 7) (Agee 2002), which are designed to reduce fire behavior potential, aide in the suppression of wildland fire (i.e. defensible space), and increase protection to valuable rsources on forest lands. Following the principles of Agee (2002) would improve fire-resilience in ponderosa pine ecosystems by: reducing surface fuels, removing ladder fuels, leaving large, fire resistant trees, and spacing tree crowns (in that order). These conditions can be achieved with a variety of methods including prescribed burning, mowing, pruning and thinning.

Table 7: Principles of Fire Resilient Forests

Principles	Effects	Advantage	Concerns
Reduce surface fuels	Reduces potential flame length	Control easier, less torching	Surface disturbance, less with fire than other techniques
Increase height to live crown	Requires longer flame length to begin torching	Less torching	Opens understory, may allow surface wind to increase
Decrease crown density	Makes tree-to-tree crown fire less probable	Reduces crown fire potential	Surface wind may increase and surface fuels may be drier
Keep larger trees	Thicker bark and taller crowns	Increases survivability of trees	Removing smaller trees is economically less profitable

Those areas managed for reduced fire behavior potential would include a number of associated desired conditions. The desired stand structure would be where the continuity of the forest canopy is reduced so that it could not sustain a crown fire occurrence. Trees within stands would have a height to live crown well enough above shrub cover in order to reduce potential for crown fire initiation. Surface fuels (Shrubs) would be maintained at a height that would reduce potential for crown fire initiation. In addition, shrub cover would be managed in order to keep flames under four foot agency standard for direct attack by hand-line. Within these areas across the landscape, defensible space of at least 500 feet wide on either side of access roads would be a working condition for suppression forces and may also serve as fuel breaks. Fuel models eight and nine are the timbered fuel models that exemplify fuel characteristics conducive to low fire behavior and suppression by direct attack of hand crews. These two fuel models are used to describe the desired condition of those areas. It is also a desired condition for these areas, that the Fire Regime Condition Class is returned to a Condition Class 1, where there is a return to a natural, or historical range of variability of vegetation characteristics.

Figure 4: Example of a Stand Condition that would not Support a High Intensity Wildfire

Figure 4 was taken in the early spring after a fall prescribed burn on the southern end of the Bend-Ft. Rock Ranger District. The photo illustrates an example of a stand condition that is desired, one that would not support a high intensity wildfire.

AFFECTED ENVIRONMENT

EXISTING STAND AND FIRE SUPPRESSION HISTORY

The dominant plant association group within the planning area is ponderosa pine *(Pinus ponderosa).* The understory plant association consists of greenleaf manzanita *(Acrtostaphylos pataula)* and antelope bitterbrush *(Purshia tridentata).*

Fire was the major disturbance mechanism in shaping the historic forest of Central Oregon. It was an important determinant of stand structure, size, arrangement, density, patch size, CWD and other organic matter (USDA 1994). According to the 1994 WEAVE (USDA 1994), wildfire was one of the primary forces that sustained vast, contiguous stands of old growth ponderosa pine. Fire intensities were usually low to moderate (Munger 1917) with fire return intervals of 7 to 38 years (Bork 1984).

Ponderosa pine forests have undergone great ecological change in the last 140 years since settlement (Fitzgerald 2005), and not for the better from a fire and forest health perspective. Heavy grazing in the late 1800s and early 1900s, clearcut logging in the 1930s and 1940s, active fire suppression after 1910,

and other land uses have disrupted the natural fire regime in ponderosa pine ecosystems. This has allowed succession to proceed unchecked resulting in above-normal fuel accumulations and abundant tree regeneration.

Fitzgerald further notes, these past land use activities have produced cascading ecological effects that are manifested today in altered ecological process. Forest stand structure has changed from open park-like stands that are more susceptible to crown fire and contain trees that are less likely to survive fire because of their smaller diameter, thinner bark and low hanging crowns.

Table 8: Fire Behavior Potential

Fire BehaviorPotential	Acres Within Project Area
Extreme/High	6,200 (70%)
Moderate	395 (5%)
Low	2,210 (25%)
Total Acres	**8,805**

Acres within the project area at a level of extreme/high or moderate fire behavior (Table 8) are considered in need of restoration and are at risk of large stand replacing fires. These acres account for approximately 75 percent of the project area. The ponderosa pine associated stands within the project area have higher stand densities, less grass cover and more shrub cover (Manzanita and Bitterbrush) than seen historically. Pockets of Beetle killed ponderosa pine, and the high stand densities with a well developed understory shrub layer have contributed to fuel loading throughout the project area. Dense stands of reproduction also add to the ladder fuels already present in the shrub layer and dead lower tree limbs that allow rapid crown fire development. Crown fire occur when surface fires create enough energy to preheat and combust fuels well above the surface. There are two stages to the crown-fire process: The first is torching, or movement of fire into the crown, and the second is active spread of the crown fire where fire moves from tree crown to tree crown through the canopy (Fitzgerald 2005). Dwarf mistletoe has infected some of the overstory trees; adding to crown fire susceptibility by collecting litter fall. Fire suppression and the lack of vegetation management to treat hazardous fuels in the area has allowed naturally occurring fuels to continue to increase and stands to become more dense. This condition does not allow fire to burn with low intensities that they historically had (Agee 1993); instead they burn with high intensities as evidenced in recent fires in the area (18 Fire 2003 and Woodside Ranch Fire 2007).

FlamMap, a fire behavior mapping and analysis program that computes fire behavior characteristics (spread rate, flame length, crown fire activity; etc.), currently estimates of 33 percent (2,921 acres) of the project area with the potential to support passive crown fire (torching – killing individual or small groups of trees, Table 21, page 71, and Figure 6, page 54).

Keeping wildfire on the surface is important for reducing fire intensity and excessive damage to vegetation and watersheds. Fitzgerald (2005) citing Agee (1993, 2000) notes that factors that affect a surfaces fire's transition to a crown fire include foliage moisture content, surface flame length and height to base of the canopy. He further notes that moisture content of foliage at the beginning of the summer can be as high as 300 percent in new foliage, but declines to less than 100 percent as the summer progresses and is more easily ignited by surface flames. In years of drought, foliage moisture content declines earlier in the season. We have no influences over foliage moisture.

The Wildland Urban Interface boundary along South Bend has dense stands of ponderosa with a well developed shrub layer predominantly bitterbrush. The bitterbrush shrub layer is capable of 5-7 foot flame heights under late spring conditions and displays even more extreme fire behavior under

summer conditions. These existing, conditions all lead to moderate to extreme fire behavior that would, under wildfire conditions, threaten private property adjacent to the project area and put recreational users at risk. According to research cited by Fitzgerald 2005 (page 213), removing accumulated surface fuels, or targeting the removal of specific fuels such as bitterbrush because of its high energy content, reduces flame lengths making it more difficult to initiate torching of tree crowns. In addition, the higher the base of tree crowns, the more difficult it is for surface flames to combust and torch tree crowns.

The human influences of fire suppression, inactive fuels management (prescribed burning and other fuels treatments), cessation of aboriginal burning and timber harvest activities are leading factors in converting large portions of the area from widely spaced ponderosa pine with little ground vegetation that were fire resistant to ponderosa pine stands that are not fire resistant due to dense stand structure, shrub densities, disease and ground fuel accumulations.

Figure 5: Representative Stand in the South Bend Project Area

Photo courtesy of Central Oregon Area Ecology Program

Current fuel loading (Figure 5) varies from 5 tons per acre to 30 plus tons per acre and with existing shrub conditions and stand densities, the potential exists for fire to spread into the tree canopy, allowing for high intensity, stand replacement crown fire and long distance spotting. The 2003 18 Fire which occurred under similar stand conditions (Figure 5) and moderate wildfire conditions provided a clear picture of the potential for high intensity wildfire behavior. The Woodside Ranch Fire in 2007 exhibited similar fire behavior until it ran into the old 18 Fire (refer to Figure 7 and Figure 8).

Although some timber stands adjacent to the WUI boundary have been treated in the past, with limited mowing and prescribed fire, those fuel treatments would no longer be effective.

One fuels treatment objective in the project area is to reduce fuels so they more closely approximate historical dead and down woody fuel loads. This is an important ecological concept because fuel

loads can significantly contribute to the effects of a fire disturbance that often exist in levels above pre-European settlement (Brown 2000; Everett et al. 2000). If lower and mid-elevations ecosystems are to experience a disturbance regime similar to that which they are adapted, the fuels must first be reduced to keep fire effects within an historical range.

Fire ignitions in the project area are associated with both natural and human caused fires. Due to population increases, combined with increasing human activity the number of human caused fire has been steadily increasing. Several fires in the project area over the past three years have threatened subdivisions including the Weigh Station Fire 2008, Woodside Ranch Fire 2007, and The Tongue Fire 2005, all human caused. Other miscellaneous fires have also occurred within the project area, either human or naturally caused.

The primary road system within the project area allows access to most areas for fire suppression. Fuel conditions adjacent to the primary road system do not provide adequate defensible space (fuel breaks/safe corridors) for suppression forces in the event of a high intensity wildfire. Secondary roads in most cases do not provide a safe ingress or egress route for suppression forces or the public, but are a major source of human-caused ignitions.

In April 2002, a national course-scale assessment was completed that quantified land conditions in the continental United States. The analysis describes the degree of fire regime departure from historic fire cycles due to fire exclusion and other influences (Schmidt et al. 2002). It also identifies changes to key ecosystem components such as species composition, structural stage,, stand age, and canopy closure. It characterizes the landscape by five "Fire Regime Groups" and three "Fire Condition Classes" (USDA and USDI, 2002).

FIRE REGIME CLASSIFICATION

Fire Regime is a generalized classification of the role fire would play across a landscape – characterized by fire frequency, predictability, seasonality, intensity, duration and scale (USDA and USDI 2002). The fire regime concept is an attempt to simplify and generalize extremely complex relationships that are not really fully understood, but it is a helpful way to discuss broad ideas about expected vegetative composition, structure, and ecosystem function.

Five natural (historical), fire regimes are classified based on average number of years between fires (fire frequency), combined with the severity (amount of replacement) of fire on the dominant overstory vegetation (Hann and Bunnell, 2001). The project area is 99% (8,805 acres) within Fire Regime I: 0-35 years, Low severity. Typical climax plant communities includes ponderosa pine, eastside/dry Douglas-fir, surface fires most common. Large stand-replacing fire can occur under certain weather conditions, but are rare events (i.e. every 200+ years). The remaining 1% of the project area is classified as non-vegetation (Lava Rock). The other fire regime classifications (II-V) are described in the Project Record, Appendix B, Fuels Report.

The present condition of vegetation and fuels within the analysis area provides an indication of potential fire effects that may or may not be characteristic of the fire regime. Areas with either existing dead and down material, dense stands of trees, shrubs, or needlecast, or any combination, can create extremely hazardous fuels conditions.

Fire exclusion over the last century in ponderosa pine forest has allowed fuels to build up on the forest floor (surface fuels), and shrub cover and tree regeneration to increase. This buildup has created "ladder fuels" where surface fuels are now connected to the overstory canopy by dense understory and mid-story saplings and medium-sized trees, making it easier for surface fires to move up and torch tree

crowns. Under the right weather conditions and topographic setting, these conditions support active crown to crown fire spread, similar to what occurred in the 18 Fire in 2003. The structure of the forest and the fuels contained within have a major influence on fire behavior and severity (Fitzgerald 2005).

FIRE CONDITION CLASS

Fire Condition Class is a landscape-level attribute which characterizes the degree of departure from historic reference conditions of vegetation composition and structure, and fire frequency and severity that currently exist inside the fire regime.

Condition Classes index the degree of departure from historic fire regimes resulting in alterations of key ecosystems components such as species composition, structural stage and canopy closure. One or more of the following activities may have caused this departure: fire exclusion, timber harvesting, introduction and establishment of exotic plant species, insects or disease (introduced or native), or other past management activities. Condition classes are assessed looking at the estimated departure on vegetation, fire frequency and fire severity. Refer to Table 9.

Table 9: Fire Condition Class Descriptions

Condition Class	Attributes	Example Management Options
Condition Class 1	▪ Fire regimes are within or near an historical range. ▪ The risk of losing key ecosystem components is low. ▪ Fire frequencies have departed from historical frequencies (either increased or decreased) by no more than one return interval. ▪ Vegetation attributes (species composition and structure) are intact and functioning within an historical range.	Where appropriate, these areas can be maintained within the historical fire regime by treatments such as fire use.
Condition Class 2	▪ Fire regimes have been moderately altered from their historical range. ▪ The risk of losing key ecosystem components has increased to moderate. ▪ Fire frequencies have departed (either increased or decreased) from historical frequencies by more than one return interval. This change results in moderate changes to one or more of the following: fire size, frequency, intensity, severity, or landscape patterns. ▪ Vegetation attributes have been moderately altered from their historical ranges.	Where appropriate, these areas may need moderate levels of restoration treatments, such as fire use and hand or mechanical treatments, to be restored to the historical fire regime.
Condition Class 3	▪ Fire regimes have been significantly altered from their historical range. ▪ The risk of losing key ecosystem components is high. ▪ Fire frequencies have departed (either increased or decreased) by multiple return intervals. This change results in dramatic changes to one or more of the following: fire size, frequency, intensity, severity, or landscape patterns. ▪ Vegetation attributes have been significantly altered from their historical ranges.	Where appropriate, these areas need high levels of restoration treatments, such as hand or mechanical treatments. These treatments may be necessary before fire is used to restore the historical fire regime.

STAND CONDITION

The existing Condition Class is displayed in Table 10 for the planning area at the stand level. To simplify the display of these rather complex concepts, the three classes were collapsed into two, with Condition Class 2 and 3 into one category called restoration and Condition Class 1 into a maintenance category. The term restoration is not meant to imply that every acre in this category must be restored to a condition consistent with projected conditions that historically existed. It is recognized that there are other management objectives that require some of those restoration areas to remain in or near their current condition. However, the decision to manage fire adapted ecosystems for objectives other than sustainability or resiliency is also a decision to accept some risk of loss in the event of a wildland fire. The restoration category is applied to those areas in Condition Class 2 or 3 with an elevated risk of loss of components that defines those systems as unique.

Areas in the maintenance category are assumed to be functioning within expected parameters when only considering the overstory. Managing maintenance areas through burning or other treatments would be a higher priority because none of the shrub layer has been treated. The expected fire behavior would likely be stand replacement due to the well developed shrub layer. Condition Class does not take into account the shrub layer and expected fire behavior (See discussion on expected fire behavior by fuel model). Table 10 shows the South Bend HFRA EA units that fall within Fire Regime I. The remaining acres are in restoration conditions. The uncharacteristic conditions associated with these areas of restoration include those resulting from fire suppression and other land uses that have disrupted the natural fire regime in ponderosa pine ecosystems.

Table 10: Fire Regime and Condition Class Summary for South Bend Treatment Units

Description of Fire Regime 1 [1]	Condition Class 1 Maintenance	Condition Class 2 & 3 Restoration
0-35 year return, low intensity fire (i.e. blackbark ponderosa pine)	793 Acres	2,228 Acres
Total Acres	**3,021**	

[1] 6 acres (less than 1% of the project area) is classified as Non-Vegetation (Lava Rock). No treatment is proposed in these areas.

Vegetation

Fire Regime I (Ponderosa pine): Fire regime I includes Wet and Dry ponderosa pine plant association groups (PAG), making up approximately 99% of the project area, dominated by second growth stands.

Historical Ranges of Variability (HRV) have been developed for the various seral/structural stages. The existing condition is characterized by a deficiency of areas dominated by large size ponderosa pine. The HRV for this structural stage is 30-90% (Table 37, page 27, Multi-story and single-story with large trees). Departure from historical reference condition is estimated to be about 46%, Condition Class 2. Ponderosa pine forests have undergone substantial structural changes since earlier this century due to fire exclusion and logging. Heavy fuel loads and ladder fuels make these stands more susceptible to crown fires. This may result in an increased risk of fire intensity and severity that could exceed the lethal limits of thick barked species (USDA 2000a; USDA 2000b). "Certain forest types (low elevation ponderosa pine, for example) may be susceptible to burning in ways that have not been seen in centuries (Beschta et al. 1995)." The type of fire behavior that can be exhibited by these changed stand condition can make conditions less safe for firefighting operations.

It has taken several decades of fire exclusion to create the conditions that currently exist in the planning area, and one treatment is not going to immediately return this forest to a condition to which

it would function under the historical low-severity fire regime (Brown 2000). The goal is not to completely return these forests to a historical range of variability with one treatment, but to prescribe treatments that would start to move them toward that range, which would allow a more natural fire regime to function.

A reduced fuel load would increase the variance of weather and fuel conditions under which prescribed fire could be applied. The amount of Coarse Woody Debris (CWD) that provides desirable biological benefits, without creating an unacceptable fire hazard is an optimum quantity that can be useful for guiding management actions. The optimum range of CWD for warm dry forest types is described as 5 to 20 tons per acre (Brown 2003). Hall (2003) suggests that the historical condition contained very little woody fuel averaging about 3 to 6 tons/acre. The desired fuel loadings are more in keeping with the historical range of variability as compared fuel loading for wildlife and soils objectives.

There are three types of fuels that affect fire behavior: fine fuels such as grass or forbs, small woody fuels less than three inches in diameter and large woody fuels greater than three inches in diameter. Fine fuels and small woody fuels are the major contributors to fire spread, carrying the ignition and flaming front of a fire (Rothermel 1983). Small woody fuels influence a fire's rate of spread and fire intensity, and small woody fuels lose their moisture faster, start easier and burn more readily (Agee 1993). Large fuels (greater than 3" diameter) do not contribute greatly to fire spread, and are not considered in the BEHAVE fire spread prediction model, though they do remain burning after the fire front has passed (Andrews 1986) and contribute to fire severity. Description of Fire Resilient stands only apply to the proposed treated stands within the project area and not across the entire landscape.

Fire Frequency and Severity

The Deschutes National Forest historical large fire record dating back to about 1904 indicates that few acres (5,008 acres) have burned within Fire Regime I in the planning area. The historical reference fire frequency ranges from about 7 to 35 years, indicating that most of the Fire Regime I area should have burned more than three times as opposed to only 5,008 acres since 1904.

Table 11 summarizes the elements of vegetation condition, fire frequency and severity in the determination of condition class for the South Bend planning area.

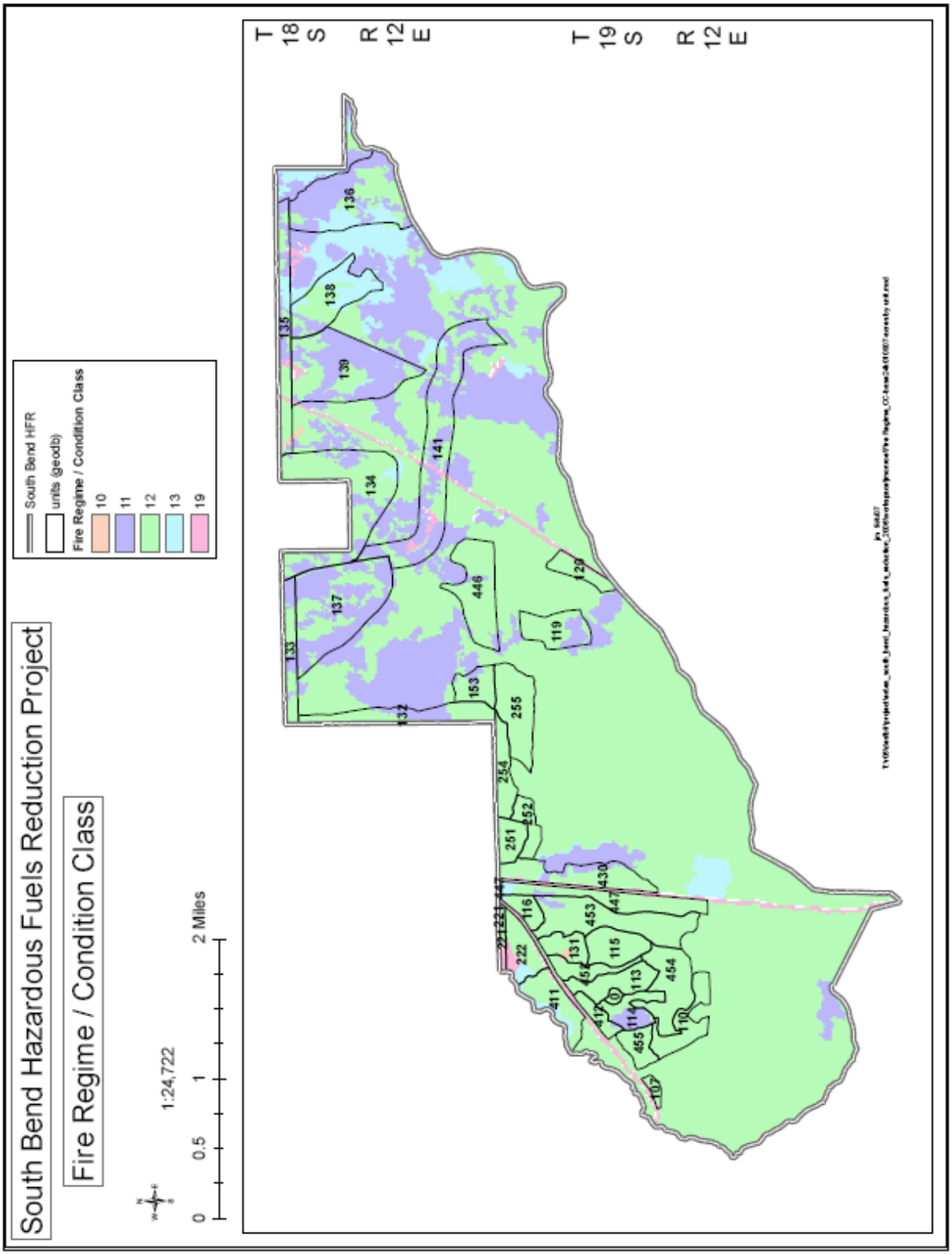
Table 11: South Bend HFRA Existing Fire Regime Elements

Fire Regime I	Vegetation Condition*	Fire Frequency *	Fire Severity *	Condition Class
Existing Condition	46%	90%	80%	2

* Departure from Reference Conditions

Fire Regime I which makes up the majority of the South Bend planning area is characterized as Condition Class 2, because of departure from reference conditions for vegetation, fire frequency and intensity. Under the proposed action, a gradual change would be expected in fire regime I, functioning more within the historical ranges.

Figure 6: Fire Regime/Condition Class - South Bend Planning Area



Concerns

Two concerns in the WUI areas are fire behavior and rate of spread. For example, ground forces can use direct attack tactics with flame lengths that are less than 4 feet. When flame lengths are greater than 4 feet indirect tactics such as, burning out from roads or hand and dozer line construction several hundred feet away from the fires edge could be required. By reducing fuel loads and modifying the fuels arrangements this would reduce fire behavior, fire spread, ground disturbance and give firefighters more options in fire suppression. Under current conditions fire spread rates are high and combined with the high fire intensities represent a high level of hazard to neighboring land values. The effect of the alternatives on the rate of fire spread is addressed by calculating fire arrival time using the FlamMap model (Refer to Project Record, Fuels Report, Map 8, page 42).

Treatments of natural fuels within and around developed areas are not sufficient to insure protection of neighborhoods and privately owned structures. During extreme burning conditions, firebrands may be carried long distances, and fires that start in or immediately around homes can ignite structures. The construction details and the materials used in homes, the removal of flammable material on and adjacent to homes, and the treatment of vegetation on the property itself is a major component of individual structure protection. Ideally, each homeowner would engage in this kind of protection for their homes, including inflammable roofs and other areas on which firebrands might collect and ignite flammable home materials (Cohen 1999).

Although treatment of natural fuels may not insure total protection of neighborhoods and privately owned structures, experience has shown thinning and prescribed fire targets different components of the fuelbed of a given forest stand and landscape (Peterson et al. 2003). Thinning is potentially effective at reducing the probability of crown-fire spread and is precise in that specific trees are targeted and removed from the fuelbed. Prescribed burning and mowing affects potential fire behavior by reducing fuel continuity on the forest floor, thereby slowing fire spread rate, reducing fire intensity, and reducing the likelihood of fire spreading into the ladder fuel and crown. Current research has recognized that thinning opens up the stand and changes the microclimate, allowing surface fuels to dry out and can increase the rates of spread. However, Fitzgerald (2005 pg. 215) states, the increased intensity and spread rates are why the original forest had frequent fires and the fact that thinning more than makes up for potential increases in fire spread and intensity. Furthermore, it makes suppression, when deemed necessary, more efficient. Prescribed burning also scorches and kills lower branches of trees which, in the long run, results in lifting the canopy much like pruning, increasing the height from the forest floor to the lower canopy and increasing fire resistance. Periodic burning can prevent the development of ladder fuels and can be used to maintain stands in a fire-resilient condition over time.

Experience has also shown that suppression options are increased and more highly effective where fuels treatments have occurred. The Spring River Butte Fire in 1999 (112 acres.) started in a 75-acre stand of un-thinned trees and was moving in the direction of Sunriver Resort. However, when the fire reached a 30-acre area that had been thinned, the fire dropped from the crowns of trees to the surface and firefighters were able to control the fire. Firefighters ultimately credited control of the fire to a previously thinned area (Sunriver CWPP 2005).

Local governments, including local fire departments, Oregon Department of Forestry, in conjunction with the Forest Service have programs in place such as “Fire Free” which encourage private landowners and those who live adjacent to public lands to improve fire protection around their homes by reducing the fuel loads (i.e., mowing brush, ladder fuels reduction; etc.). As mentioned above it’s the responsibility of the individual landowner to establish and maintain landscapes that are resilient to wildland fire.

EXPECTED FIRE BEHAVIOR BY FUEL MODEL

Current Fuel Models in Project Area

Predictions of fire behavior are important in making decisions about fire management. The generalized fuel models are a simple way to represent a complex fuels array in fire behavior models use information on fuels, weather and topography to estimate rate of spread and fireline intensity (e.g., flame length). While current models predict only surface fire behavior, they are expanding to predict the probability of a fire moving into the crown (torching) or active crown fire (burning the entire canopy – continuous crown fire – but dependent on heat from surface fuel combustion) behavior. The fire behavior modeling system most commonly in use in the Pacific Northwest is BEHAVE (Burgan and Rothermel 1984).

The 13 fire behavior fuel models (Rothermel 1972, Albini 1976) and their arrangement across the landscape interpret fire behavior potential. Fuel models 2, 6, 8, 9, and 10, are represented in the project area (Table 12). Fuel models 8 and 9 are desired.

Table 12: Current Fuel Model Acreage and Associated Fire Behavior Potential

Fuel Model	Acres	Fire BehaviorPotential
2 (short grasses in open pine stands)	276	Moderate
6 (dormant shrubs)	5,913	Extreme
8 (compact conifer litter layer with little to no undergrowth)	2,210	Low
9 (long-needle litter)	119	Moderate
10 (dead-down woody fuels)	287	High
Non-Vegetation	6	None

Acreage calculated in GIS using LANDSAT data and plant associations. Fire behavior potential based on surface fire potential flame length, rate of spread and fire line intensity using the BEHAVE fire spread model (Andrews 1986).

Fuel model 6 (dormant brush) accounts for all of the extreme fire behavior potential acreage and is mostly located in large blocks in the lower to mid elevations. The rest of the area in the lower elevation is comprised of fuel model 2 (short grass in open pine stands). These fuel models (2 and 6) adjacent to the WUI and continuous across the landscape are undesirable and create hazardous conditions to firefighters and the public. In the event of a wildland fire during hot and dry summers, experience has shown one should expect high Rates of Spread (ROS) from the herbaceous material (grasses), longer flame lengths coupled with high intensity fire from the shrub component.

Description of Fuel Models used in Fire Behavior

Fuel Model 2 (276 acres): Fire spread is primarily through fine herbaceous fuels. Herbaceous material dead stem wood from shrubs and timber overstory contributes to fire intensity.

Fuel Model 6 (5,913 acres): Fire carry through shrub layer. Moderate winds are usually required to carry fire. Shrubs are older but not tall averaging two and one-half feet.

Fuel Model 8 (2,210 acres): Slow burning surface fires with low flame lengths are represented. This model represented by the closed canopy stands of short needle conifers. Fire tends to travel through the needles, leaves and occasional twigs because little undergrowth is present.

Fuel Model 9 (119 acres): Fires run through the surface litter faster than fuel model 8 and have longer flame heights. This model represents closed stands of ponderosa pine.

Fuel Model 10 (287 acres): Fires burn in surface and ground fuels with greater fire intensity than models 8 and 9. Large down woody material is in greater quantity. Crowning, spotting and torching is more frequent leading to potential fire control difficulties.

Factors Used to Describe Effects of the Alternatives

Fire Behavior

Fire Behavior is the manner in which fire reacts to topography, weather, and fuels (DeBano et al. 1998; NWCG 1998). These three elements comprise the fire environment, the surrounding conditions, influences, and modifying forces that determine fire behavior (NWCG 1994). Modifying any one of these elements has a direct result on fire behavior, which is basically described by flame length and rate of spread. Favorable conditions for crown fires include heavy accumulations of dead and downed litter, conifer reproduction and other ladder fuels, and continuous conifer tree forest (Rothermel 1991).

The greater the fuel loading, the more intensely a fire is likely to burn (DeBano et al. 1998). Conversely, a reduction in fuel loading can limit the fires intensity. Fuel characteristics affecting fire behavior are vegetative density, species composition, amount of surface fuel, arrangement of fuels and moisture content (Rothermel 1983). Fuels contribute to the rate of spread of a fire, the intensity/flame length of the fire, how long a fire is held over in an area, and the size of the burned area (Rothermel 1983).

Treatments that reduce surface fuel loads have been shown to decrease fire behavior and severity (Graham et al. 1999, Pollet 1999, and Omi 1999). Van Wagtendonk (1996) found in fire simulations that a reduction in fuel loads decreased subsequent fire behavior, increased fire line control possibilities and decreased fire suppression costs. Fire line construction rates increase with decreased fuel loads, decreased fuel loads means a lower resistance to control.

Intensive forest management that involves the creation of activity fuels (slash) can indeed increase fire behavior parameters such as rate of spread and flame length. However, treatment of slash (e.g. burning, chipping, removal, isolation) would reduce fire behavior and fire intensity (Omi and Martinson 2002). Graham et al. (1999) reports that thinning from below and intermediate tree harvest can effectively alter fire behavior by reducing crown bulk density and ladder fuels, but would not reduce crown fire potential unless tree densities are substantially reduced. Graham et al. (1999) also states that all intermediate treatments should be accompanied by surface fuel modification, and the most success is achieved when using prescribed fire for such treatments.

There are three types of fuels that affect fire behavior; fine fuels such as grass or forbs, small woody fuels less than three inches in diameter and large woody fuels greater than three inches in diameter. Fine fuels are the major contributors to fire spread, carrying the ignition and flaming front of a fire (Rothermel 1983). Without these fine fuels, many fires would not get large, although there are exceptions. However, eliminating fine fuels (litter, duff, and grasses) is neither possible nor desirable. Small woody fuels influence a fire's rate of spread and fire intensity, and small woody fuels lose their moisture faster, start easier and burn more readily (Agee 1993).

Under a frequent fire regime it would be possible to maintain fine fuels at lower levels and various patch sizes than under a less frequent fire regime, but fine fuels will always exist. Aside from eliminating the fine fuels that contribute to fire spread, only the total amount and arrangement can be modified to benefit fire control efforts. From a firefighter's perspective, it is better to construct fire line through 2 inches of this small material to reach mineral soil (therefore stopping fire spread) than

to dig through 10 inches of fine fuels (refers to fuel bed depth) because the fire line construction would progress faster and the fire could potentially be contained at a smaller size. Fuel bed depth affects the porosity of the fuelbed and its ability to supply oxygen to feed a fire.

Expected Fire Behavior by Fuel Model and Fire Weather Parameters

Historical weather data was collected from the Lava Butte weather station via Kansas City and contains records from 1994 through 2004 (10 years). The station is located within a 0.5 mile E-NE of project area and best represents the area's weather conditions. A typical fire season on the Bend-Ft. Rock Ranger District is defined as May 15th– September 30th. Modeling was then run for the 55th, 90th and 97th percentile day weather observations. Weather percentiles are based on a scale of 0-100 and used to help measure the significance of National Fire Danger. Table 13 displays percentile weather output from Fire Family Plus.

Table 13: Fire Weather for Lava Butte Station (352618)

Fuel Moisture Conditions (%)	90th Percentile Weather[1]	97th Percentile Weather [2]
1-hour	3	2
10-hour	4	3
100-hour	7	6
1000-hour	9	8
Live Herbaceous	30	30
Live Woody	68	60
Temperature Maximum	89	96
Relative Humidity Min.	13	10
20ft. Windspeed (Mph)	12	16

[1] 90th percentile – 10% of the days would be warmer and drier than the fire weather which is represented at the 90th percentile.
[2] 97th percentile – 3% of the days would be warmer and drier and than that represented at the 97th percentile.

The Rating System (NFRDS) as it relate to levels of fire risk, fuel conditions, and fire danger. One hour, 10hr, 100hr, are time-lag fuel categories. These categories are based on fuel particles diameters, and represent the amount of time required to go from and initial moisture content to approximately 2/3 of the way to equilibrium with ambient air humidity. The 1-hour time-lag class is applied to particle between 0-1/4 inches in diameter. 10-hour fuels are those between ¼ and 1 inch. 100-hour fuels are 1 to 3 inches in diameter. The "herb" and "woody" categories express the moisture content of herbaceous and woody live fuels, respectively. It is a measurement of the relative weight of the water to total weight of the oven dry biomass.

The "wind" value is the windspeed measured at 20 feet above the tallest vegetation. For fire behavior calculation, a correction factor is applied to the 20 foot wind to account for the sheltering of vegetation at the mid flame level. The temperature, relative humidity, and windspeed are measured once a day in the afternoon.

To better understand percentile weather and fuel moistures:

- At the 90th percentile – 10% of the days would be warmer and drier than the fire weather which is represented at the 90th percentile.
- At the 97th percentile – 3% of the days would be warmer and drier and than the fire weather which is represented at the 97th percentile.

Fuel Modeling

Behave (Andrews 1986) was used to model the expected fire behavior for the 90th and 97th percentile weather.

Anderson describes 13 standard Fire Behavior Prediction models that are organized into four groups: grass, shrubs, timber and slash (Anderson 1982). The difference in fire behavior among these groups is related to the fuel loading and its distribution among the fuel size classes. Table 14 displays the representative surface fuels models within the analysis area and expected flame lengths and scorch heights.

Table 14: Expected Flame Length and Scorch Heights by Fuel Model

Flame Length & Scorch Height by Fuel Model & Fire Weather Percentile		Grass	Shrub		Timber	
		FM 2	FM 6	FM 8	FM 9	FM 10
90th Percentile Fire Weather	Flame Length (feet)	8	8	1	4	7
	Scorch Height (feet)	79	46	2	17	53
97th Percentile Fire Weather	Flame Length (feet)	9	8	2	4	7
	Scorch Height (feet)	106	90	3	24	72

Under 90th percentile weather, wildland fires greater than four feet generally requires mechanized equipment and/or retardant drop drops to be effective. Typically, fires are too intense for direct attack with suppression crews. Although, prescribed fire can be implemented under these conditions in certain fuel models (FM-8 and FM-9), we typically don't burn under these conditions because things are hotter, drier and it increase the potential for control problems and tree mortality. Also, down woody objectives are tougher too meet. Flame lengths for fuel model 6 which is the dominant fuel model in the planning area would be expected around 8 feet with scorch heights ranging around 46 feet.

Under the 97th percentile weather, flame lengths could be expected to reach as high as 8 feet with scorch heights as high as 90 feet in fuel model 6. Wildland fire present serious control problems such as high rates of spread, fire intensity, active crown fire and increased spotting distances. Generally, mechanized equipment in combination with aerial resources is the only method of attack. Because of summer conditions prescribed fire is not appropriate.

PROPOSED ACTION

Under Alternative 2 (Proposed Action), 3,021 acres (Table 15) within the project area has been identified for fuels treatment or 35% percent of the project area. Fuel treatments would consist of thinning, pruning, mechanical shrub treatment (mowing), and/or prescribed fire underburning to achieve a desired condition within the WUI.

Table 15: Hazardous Fuels Reduction Proposed Treatment Acres by Alternative

South Bend CWPP	Alternative 1	Alternative 2 (Proposed Action)
Total Acres (8,811)	0	3,021

In units that have mowing and underburning, up to 70% of those portions of each unit that have those prescriptions would be treated within the WUI. The remaining thirty-percent would remain untreated for screening cover and habitat for various other wildlife species. Treatments would be designed to create a mosaic across the landscape and break-up the fuel continuity. In addition, shrub cover would be managed in order to keep flame lengths under four foot agency standard for direct attack by hand crews. Surface fuels would be maintained much the same as shrub cover.

ENVIRONMENTAL CONSEQUENCES

SCOPE OF ANALYSIS

The scope of the analysis is focused on that portion of the South Bend Wildland Urban Interface (WUI) that is overlain by the South Bend HFRA project area. Only fire and fuels reduction activities that occurred within the project area during the proceeding 15 years were considered in the analysis of cumulative effects for the fire and fuels hazards reduction. District experience and field reviews have shown that vegetation management activities such as thinning followed by mowing and prescribed fire have the beneficial effect of reducing fire intensity and fire behavior for an average of 15 years, sometimes longer depending on location and treatment intensity. All fuel treatment activities that have occurred during the previous 15 years within the project area included a demonstration project adjacent to High Desert Museum used for an education tool and the Natural Fuels Mowing and Underburning Categorical Exclusion (1996).

For the fire and fuels modeling analysis for fire behavior, the analysis area was expanded to include areas adjacent to the South Bend project for a total of approximately 41,548 acres**.** Treatment effects assumed 100% coverage of the treatment area although 30% of the units where mowing and burning would occur would be left untreated. The attributes used to evaluate the analysis was Fire Behavior and Condition Class. The following measures were used in the analysis:

- 1: Percentage of project area rated as low for fire behavior potential;
- 2: Acres of prescribed burning and/or mowing;
- 3: Roadside evacuation/access miles treated;
- 4: Production of Particulate Matter (PM) 10 and 2.5.,
- 5: Crown Fire Potential.

ALTERNATIVE 1 (NO ACTION)

Direct and Indirect Effects

Measure # 1 and # 2 Acres of prescribed fire and/or mowing; percentage of project area rated as low for fire behavior potential.

No management activities would occur with the exception of fire suppression and already approved on-going projects. Forest succession, as we know it, would continue, as more acres would transition from low fire behavior potential towards high and extreme fire behavior potential. Currently an estimated 2,210 (25%) acres of low fire behavior potential in the project area would naturally transition over the next 20 years, due to trees and shrub growth, to either a moderate or high/extreme fire behavior category.

Over the long term (10-20 years), the percent in the low fire behavior class would become less effective at moderating fire behavior in the project area due to shrub and tree growth and accumulation of dead and down material, needle cast, limb cast and bark slough. An estimated 75 percent of the project area would be moderate to extreme for fire behavior potential and associated with the heavy fuel loadings within the area would be increased rates of wildfire spread and burn severity. The impacts on public and firefighter safety would continue to increase. Fuels reduction would only occur during a wildfire that, under the no action alternative would most likely be a large, very intense event that would be stand replacing over the majority of the fire, similar to the 18 Fire of 2003.

Fire Regime Condition Classes would continue to deviate further from the current condition with a steadily increasing vulnerability to a stand replacing wildfire. This continued change to an infrequent and intense fire regime would take place in a fire dependent ponderosa pine ecosystem that historically had frequent low intensity fire. Fire starts that escape initial suppression actions would cycle a high portion of the landscape to an early seral stage with high mortality of the over story trees regardless of tree size or species. In the ponderosa pine plant associations, fuels currently are at levels where if wildfire occurs with low relative humidity and low fuel moistures, it would be an intense stand replacing event as illustrated below. Figure 7 and Figure 8 provide before and after photos in the 18 Fire which occurred within similar stand conditions near the project area.

The percentage in the low fire behavior class would continue to transitions to the high and extreme fire behavior class as recent, proposed and reasonably foreseeable fuels reduction activities become less effective due to vegetative growth and the natural accumulation of fuels in the coming years. The Fire Regime Condition Class would further deviate from historic conditions with a increasing vulnerability to stand replacing wildfire. The trend of more frequent, intense fires that are larger in size and more difficult to control would continue as fuel loadings also continue to increase throughout the project area. The goal of altering the existing fuels arrangement in the WUI, reducing flame length in treated areas to less than 4 foot and reducing the rate of spread to increase effectiveness of suppression actions would not be meet.

Figure 7: Photo Point taken prior to 2003 18 Fire at the base of Bessie Butte

Photo courtesy of Central Oregon Area Ecology Program

Figure 8: Photo taken same location after 18 Fire

Photo courtesy of Central Oregon Area Ecology Program

Measure # 3 Roadside evacuation/access miles treated

The major roads within the project area would continue to be unavailable for either evacuation or access routes for direct attack in the event of a wildfire. The rapidly growing population of Central Oregon combined with ongoing fuels accumulation and high open road density means that the incidences of human caused ignition starts within the project area is likely to increase.

Suppression would continue to be extremely hazardous for firefighters and some suppression options would be eliminated due to the lack of escape routes and safety zones. No strategic fuels reduction activities would occur along major ingress and egress routes (ie., Forest Road 18). The WUI areas would continue to accumulate fuels over time under this alternative. The property line between Forest Service and the area identified as WUI is composed of mostly unthinned ponderosa pine stands that have not had any fuels reduction, with minor exceptions, for the last 10 years. These exceptions are 260 acres mowed in 1996 adjacent Woodside Ranch. The effectiveness of the previous treatment (mowing) no longer exists. Although fuels reduction treatments are currently being implemented on private lands to provide defensible space, around homes in Woodside Ranch, much of the existing fuels component adjacent to the urban interface is still capable of moderate to extreme fire behavior under summer wildfire conditions. Fuels breaks have been shown to be effective at saving structures when combined with suppression efforts. The lack of defensible space along access roads and escapes routes could compromise suppression activities and endanger firefighters as discussed above. Without suppression activities, fire breaks often fail. These current conditions, associated with no action could also compromise public safety due to limited evacuation routes and high probability of wildfire spotting into or near adjacent private subdivisions and residences.

Measure # 4 Production of Particulate Matter

The effects on air quality would occur when higher quantities of PM 10 and PM 2.5 are released when inevitable wildfire comes through the project area. These quantities of particulate matter are much higher than what would be released under prescribed fire conditions. This can be attributed to the fact that forest conditions are usually windy, hotter and drier under summer conditions and consume a greater amount of down woody material, as well as litter, duff and foliage components. During high intensity wildfire, smoke emissions of particulate matter could range from 800 lbs. to 900 lbs. depending upon the fuel loading and location. As shown in Table 16, this is at least 7-8 times the effects of mowing and prescribed underburning on the same acre. Where down woody fuels have accumulated or stands are dense; particulate matter production of PM 2.5 and PM 10 would exceed these estimates.

Table 16: Alternative 1 – Estimated Smoke Emissions from a Wildfire under Extreme Conditions

Total Tons PM<10	Total Tons PM < 2.5	Average Consumption Ton/Acre
900	810	30

Smoke from wildfires within the project area would impact the communities of Sunriver, Bend, and surrounding areas, because it would most likely occur under conditions not conducive to smoke dispersion. It is highly likely that the air quality within the Three Sisters Wilderness, a Class 1 Air-shed would be adversely affected. Sunriver Resort, Lava Lands Visitors Center and High Desert Museum could also be adversely impacted especially during the summer when tourism is at an all time high.

Higher quantities of PM 2.5 and PM 10 released when wildfire occurs within the project area due to higher burn intensity, and increasing fuels accumulation that would occur overtime, as compared with the Proposed Action. The deferral of treatments within the WUI would exacerbate the negative effects on air quality, when wildfire inevitably returns, for the Bend and Sunriver communities.

Measure # 5 Crown Fire Potential

Modeling shows that 33 percent of the project area would support a passive crown fire (torching). Beetle killed ponderosa pine, and the high stand densities with a well developed understory shrub layer have contributed to fuel loading throughout the project area. Dense stands of reproduction also have added to the ladder fuels already present in the shrub layer that allow rapid crown fire development. Dwarf mistletoe has infected some of the overstory trees; adding to crown fire susceptibility by collecting litter fall. Fire suppression and the lack of vegetation management to treat hazardous fuels in the area has allowed naturally occurring fuels to continue to increase and stands to become more dense. These existing, conditions all lead to moderate to extreme fire behavior that would, under wildfire conditions, threaten private property adjacent to the project area and put recreational users at risk. These conditions do not allow fire to burn with low intensities that they historically had (Agee 1993); instead they burn with high intensities as evidenced in recent fires in the area (18 Fire 2003 and Woodside Ranch Fire 2007). Under this alternative this process would continue because of no active management.

Fire Regime Condition Class would further deviate from current conditions, increasing vulnerability to stand replacing wildfire. Because crown fire is a key element of fire behavior that can affect forest vegetation, wildlife habitat functions, and protection of other values and firefighter and public safety, this trend would also continue.

ALTERNATIVE 2 (PROPOSED ACTION)

Direct and Indirect Effects

Measure # 1 and # 2 Acres of prescribed fire and/or mowing; Percentage of project area rated as low for fire behavior potential

Under this alternative, implementation of the proposed treatments would be integrated to reduce the risk of wildfires to recreational sites, wildlife habitat, ponderosa pine stands, and the WUI within the South Bend project area. An estimated 3,021 acres would have fuels reduction treatments within the WUI of these communities. Fuel treatments under this alternative include: Mechanical slash treatments, thinning trees, whole-tree-yard, prescribed underburning, pruning, mowing, hand and pile burning. More than one of these preparatory treatments may be used in a given EA unit to improve suppression actions, reduce the risk of escape, reduce damage to residual trees and significantly reduce the level of smoke production and effects on air quality and human health in nearby communities while moving towards a desired condition. An example of multiple treatments would be to thin to remove competing trees (ladder fuel)and reduce crown bulk density, mowing to reduce surface fuels and break-up shrub continuity, combined with prescribed fire to lessen the risk of damaging wildfire by reducing burnable material (ie. Needles-cast, bark slough, limb cast; etc.). Small woody fuels influence a fire's rate of spread and fire intensity, and small woody fuels lose their moisture faster, start easier and burn more readily (Agee 1993). The integrated treatments would ensure a reduction of both crown fire and surface fire potential. There would be multiple integrated treatments to meet specific objectives within the project area. Units where prescribed fire would be used to reduce fuels accumulations and/or natural fuels, it is anticipated that fire lines both mechanical and handlines

would be used in conjunction with existing roads and natural barriers to effectively control the spread of fire within treatments units. In locations where mechanical or handline are necessary control lines would be less than 3 feet to reduce soil impacts. These gross acres are included in Table 17.

Table 17: Fuel Treatment Acres - Alternative 2

Fuel Reduction Activity	Acres
Underburning/ Jackpot Burning	252
MST/(Mowing) Underburning	1,808
MST	2,640
Thinning	540
Hand Piling	540

Treatments listed in Table 17 would help fragment continuous ground and aerial fuels and move these acres toward a Condition Class 1, a desired condition. This in turn would lower resistance to control and average fire size, make a safer work environment for firefighters, reduce the risk of wildfire spreading on to private lands also, aid in the suppression of fires that start on private lands and move toward federal ownership by creating defensible space. Fire Intensity and the rate of spread would be reduced under extreme conditions and provide suppression forces an opportunity to control a wildfire near the WUI. The use of ladder fuels reduction, thinning, pruning, mechanical shrub treatment (mowing), and prescribed underburning, would also begin restoring the role of fire in the ponderosa pine ecosystem. In the first five to 10 years, the percentage in low fire behavior category would increase from 25 percent to approximately 60 percent of the project area as the 2,210 acres currently classified as low fire behavior potential combined with the 3,021 acres of restoration treatments.

Current fire behavior was modeled using FlamMap to calculate potential flame length (Table 18). Conditions for a problem fire were used for the analysis. A problem fire is one which burns under conditions that results in a threat to resource values within or adjacent to the project area. Problem fire condition areas are typically at or above what would normally be considered extreme fire conditions. Weather and fuel moistures for a problem fire were identified as 97th percentile weather conditions. Under existing conditions, the model shows that 75 percent of the project area would burn with a longer than 4 foot flame length.

The FlamMap model produces fire arrival time grids that indicate the wildfire rate of spread through the landscape. Effects on fire arrival time may be combined with the flame length potential to demonstrate areas where fire spread is slowed and intensity is reduced so that suppression actions may be more effective.

To display the effects of the alternatives flame length potential was determined using the conditions above. Flame length was chosen since it represents a good indicator of fire intensity. High intensity fire would be flame lengths greater than 4 feet.

The FlamMap model shows the amount of the project area that can be expected to have overall flame lengths of 4 feet or less increase from 27 percent to 51 percent (Table 18).

Table 18: Flame Length Output

Alternative and Conditions	Flame Length			
	Less Than 2 Feet	**2-4 Feet**	**4-8 Feet**	**Greater Than >8 Feet**
No Action Acres	2,268	56	2,951	3,532

Alternative and Conditions	Flame Length			
	Less Than 2 Feet	2-4 Feet	4-8 Feet	Greater Than >8 Feet
Percent of Project Area	26	1	34	40
Proposed Action				
Acres	4,525	36	1,929	2,317
Percent of Project Area	51	<1	22	26

The differences in flame length potential are determined by the fuel characteristics associated with each alternative. In the Proposed Action fuels conditions within treatment units would be changed so that potential fire intensities (flame length) are reduced. Maps 4 and 5, pages 35 and 36 of the Fuels Report, Project Record, display flame length potentials for each alternative.

Lower flame lengths reduce the potential for tree mortality, increasing the area where prescribed fire may be applied in the future, and increase the effectiveness of fire suppression actions.

The no burn areas are those within the South Bend area with a non-flammable fuel model; fuel models 97, 98, or 99.

The existing fire arrival time and the expected fire arrival time following the proposed treatments are displayed in Map 8 and Map 9, Fuels Report pages 42 and 43, Project Record.

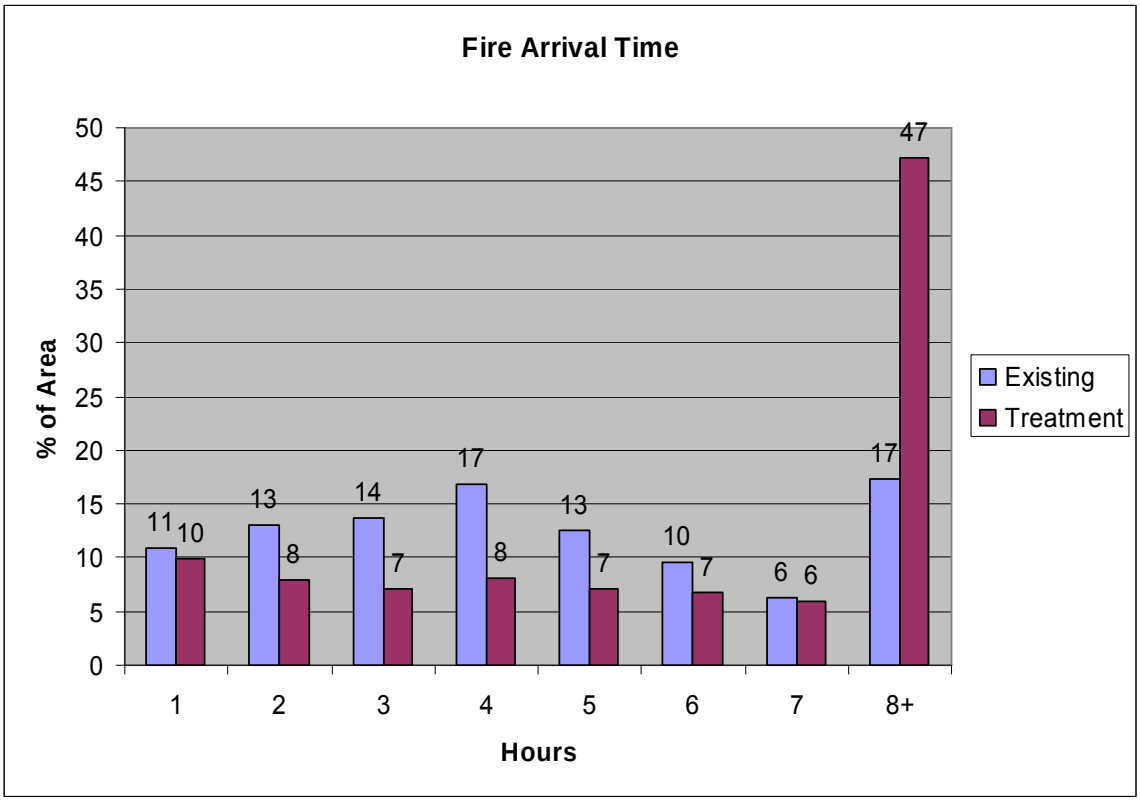
At the same time, the potential for fire spread is also a concern. Under current conditions fire spread rates are high and combined with the high fire intensities represent a high level of hazard to the neighboring land values. The effect of the alternatives on fire spread is addressed by calculating fire arrival time using the FlamMap model as well.

Fire arrival time (

Figure 9) is the time it takes for a wildfire to spread from one location to another. To calculate arrival time an ignition line was identified as shown in The model input for fire duration is 8 hours.

The amount of area within the South Bend Project Area in each arrival time category (hours) is displayed in the chart below. Under the proposed action the percentage of the project area with a fire arrival time of greater than 8 hours would increase from 17 percent to 47 percent.

Figure 9: Fire Arrival Time



The combined effect of Alternative 2 is lower fire intensity and slower fire spread rates from current conditions. These effects would reduce hazard to forest vegetation and wildlife habitat, and neighboring land values by allowing more time for fire suppression forces to respond and increasing the effectiveness of suppression actions.

Over the long-term (10 to 20 years), the percentage in the low fire behavior class would gradually decrease as fuel reduction activities become less effective due to vegetative re-growth. Based on local experience, the effectiveness of mowing and prescribed burning, would decline after 7-10 years and 10-15 years respectively. The majority of treated areas would become ineffective in 15- 20 years. Recent local examples of these patterns include: 1.) aggressive surface fuel treatments along Forest roads 18 and 25 in the Camp 2 area (southeast of project area); which have been effective. An example, would be the prescribed underburning conducted along the junction of Forest Roads 18/25 road in the Camp 2 area at moderating crown fire potential, intensity and rate of spread some 10 years later; and 2.); a mowing treatment completed in 1996 adjacent to Woodside Ranch, is currently ineffective and is proposed for re-treatment under this alternative (unit 134). The strategic placement of proposed units combined with the percentage of WUI identified for treatment would reduce the overall risk of a large stand replacement wildfire with the project area.

During the analysis using FlamMap, the model showed the proposed fuels reduction activities to be more effective at reducing fire behavior on the west side of Highway 97 than the eastside. This can be attributed to the fact that some areas were left untreated to meet other resource objectives. However, when compared to Alternative 1 the percentage of WUI being treated, would reduce the overall risk within the project area.

The use of prescribed fire would have direct and indirect effects on snags and CWD within the 2,060 acres of underburning. Underburning would burn down some existing snags as well as consume some of the existing CWD while also killing some of the existing overstory trees. Based on monitoring done in the East Tumbull project area of Fall burns in ponderosa pine (Table 19) on average approximately 1.2 standing green trees were killed per acre versus the loss of 0.2 snags per acre. The snags consumed, fell to the ground replaced the existing CWD that was consumed during underburning operations. Prescribed burning prescriptions, as well as lining snags and large CWD, was shown to be very effective in not only mitigating the loss of any snags and consumption of CWD but also in actually increasing the number of snags per acre. With the use of prescribed fire and because of the variables related to fuels, weather and topography occasionally, mortality would range from a single tree to patches of several trees.

Table 19: East Tumbull Ponderosa PAG Snag Levels for Completed Prescribed Burn Units

Snag DBH Diameter	8-9.9”	10-12.9”	13-15.9”	16-19.9”	20”+
# Snags/acre (range)	0.32-0.33	0.45-0.88	0.22-0.37	0.14-0.32	0.10-0.11
Average # snags/acre	0.33	0.69	0.30	0.24	0.10
Average # LP snags created /acre	0.11	0.31	0.06	0.03	0.00
Average # LP snags destroyed /acre	0.01	0.07	0.02	0.01	0.00
Average # PP snags created /acre	0.16	0.31	0.12	0.09	0.03
Average # PP snags destroyed /acre	0.01	0.04	0.01	0.01	0.01

PP = Ponderosa pine; LP = Lodgepole pine

Measure # 3 Roadside evacuation/access miles treated

Approximately three miles of fuel treatments to provide defensible space would occur adjacent to Deschutes River Woods, Woodside Ranch, Lost Tracks and High Desert Museum. Fuel treatments would also occur along Forest Road 18 and sections of Highway 97 to provide defensible space. Defensible space along roads would be created through vegetation management (such as Mowing, thinning, prescribed fire, pruning, and handpiling). This proposal would treat areas of hazardous fuels within 300 to 500 feet of the roads to reduce flame lengths to under 4 feet and provide access and evacuation routes for firefighters and the general public. Suppression action would be considerably less hazardous for firefighters, the effectiveness of aerial delivered retardants would be enhanced and the detrimental effects on soils from an intense wildfire and the need to construct all mechanical firelines would be reduced. All suppression options including the ability to construct handline would be improved with safe access and defensible space occurring along major access routes within project area.

Under this alternative, approximately 9.3 miles Forest roads would be closed or decommissioned in the project area. Under some situations, proposed road density reductions would have the potential to increase response time of ground based suppression resources to fire starts (especially lightning starts, as most human caused fires are in close proximity to open roads). This potential increase in response time could under certain weather and fuels moisture conditions lead to larger fires. However, an increase in response time is not anticipated within the project area because administrative access for fire suppression would still be permitted. Additionally, the fuels reduction activities proposed in the project area would give firefighters more time.

Measure # 4 Production of Particulate Matter

Smoke emission under this alternative is of concern due to project location to the City of Bend, Highway 97, and surrounding communities. As discussed in the Air Quality Report, underburning would be conducted under favorable conditions where smoke dispersion is optimal to avoid impacts to City of Bend, Sunriver, the Three Sisters Wilderness and surrounding communities. To minimize emissions and resistance to control approximately 1,808 of the 2,660 acres of underburning would be mowed before underburning. For example, 500 acres of mowing and underburning produce approximately six tons of PM 10 versus 16 tons when burning without mowing. In addition, landings piles produced from thinning would be utilized, where possible, for biomass. Smoke emissions vary with combustion efficiency and quantity of fuel consumed. Landing piles and handpiles tend to produce more smoke (per ton of fuel consumed) than other burns because much of the consumption occurs during the inefficient smoldering phase of combustion.

Table 20: Estimated Smoke Emissions for Fuel Treatments

Fuels Treatment	Total Tons < PM 10	Total Tons < PM 2.5
Prescribed Fire - Underburn/Jackpot	20	17
Pile and Burn (Landings)	81	71
MST(Mowing)/Underburn	52	46
Handpile and Burn	21	18
Comparison - Wildfire burning under severe conditions	900	810

Burning would be conducted in compliance with National Ambient Air Quality Standards and under the Oregon Smoke Management Plan. Burning would only be conducted when prevailing and predicted wind patterns would result in negligible effects to Sunriver, Bend and the Three Sisters Wilderness Class 1 Air-shed. Implementation of the action alternative, based on the measures included to reduce emissions and to disperse smoke during favorable conditions is expected to protect air quality to adjacent communities while having no visible effects to the Class 1 Air-shed (Three Sisters Wilderness). This is because the Three Sisters Wilderness area is higher in elevation and located 15 to 18 miles northwest of the South Bend project area. The prevailing wind patterns reflecting a westerly or northwest flow would result in minimal potential for impacts.

On burn days, persons responsible for burning operations modify ignitions patterns and mop-up procedures to consider the effects to Class 1 air-sheds and smoke sensitive areas. Monitoring is done by the State Forester to insure compliance with the smoke management program to determine effectiveness of smoke management procedures. Other monitoring techniques include posting personnel as lookouts (Lava Butte Lookout) on burn days. If certain threshold is reached where additional particulate release is undesired, firing operations are ceased and immediate mop-up procedures initiated. However, given the location and layout of the project area, some smoke into adjacent communities may be inevitable but not at a level to cause air quality concerns.

In contrast to Alternative 1, fuel treatments would reduce potential wildfire size per occurrence and emissions produced in the project area. Under extreme fire behavior conditions, the remaining dense stands and areas of excessive fuel loading could burn intensely and long range spotting may remain a problem. This concern is being addressed by the creation of defensible space under this alternative and the collaborative projects on private lands that would allow staging of suppression forces to protect private property and structures during a wildfire.

There would be some dust created from the proposed mechanical operations under this alternative, mainly from logging operations within project units. The amount of dust actually created would be minimal due to dust abatement which includes watering roads identified for hauling,

Measure #5 Crown Fire Potential

The proposed action reduces the area with potential to support passive crown fire (torching) from 2,921 acres (33%) to 1,983 (23%), with a corresponding increase in the acres of surface fire. The effect of the alternatives on crown fire potential is displayed in Table 17 (Also refer to Project Record, Fire and Fuels Report, Maps 6 and 7, pages 39 and 40).

Table 21: Acres of Crown Fire Potential

Alternative	No Burn	Surface Fire	Passive Crown Fire	Active Crown Fire
Alternative 1 (No Action)	14 acres	5,872 acres	2,921 acres	1 acre
Alternative 2 (Proposed Action)	14 acres	6,810 acres	1,983 acres	1 acre

Crowning fires are some of the most intense wildfires and usually produce long range spotting that hampers control efforts. Dense stands of timber support crown fires allowing fire to burn through the canopy of trees independent of a surface fire. Torching and crowning in conjunction with the surface fire is also a common problem during wildfires in dense stands of timber. Breaking up the connectivity of the timber canopy through thinning greatly decreases the chance of an independent crown fire. Thinning also reduces the amount of torching and crowning that occurs with surface fire and thus reduces long range spotting potential.

Keeping wildfire on the surface is important for reducing fire intensity and excessive damage to vegetation, neighboring land values and watersheds. Keeping wildfires on the surface also provide an opportunity for firefighters to use direct attack and also decrease the resistance to control. It should be noted, the reduction in crown fire potential and effects is associated with stands that would be thinned before mowing and underburning.

Changes in Fire Behavior Potential

The following table reflects changes in expected fire behavior potential acreage following implementation of Alternatives 2. Under Alternative 2, approximately 3,021 acres would move from high/extreme to low within the project area as shown in Table 18.

Table 22: Acreage Totals for Fire Behavior Potential - Current and Post Treatment

Fire Behavior Potential	Alternative 1 (No Action)	Alternative 2 (Proposed Action)
Extreme/High	6,200	3,179
Moderate	395	395
Low	2,210	5,231
Total	**8,805**	**8,805**

Effects of Alternatives to Fire Intensity and Spread

This portion of the analysis addresses the effects of the proposed action on fire behavior elements including fire spread and intensity which are dependent on the characteristics such as surface, ladder and crown fuel loadings. Departure from historic conditions is best represented by an analysis of fire regime and condition class, discussed previously.

A landscape approach was employed to address fire behavior potential. The FlamMap model was used to calculate potential fire intensity (flame length) and fire spread (fire arrival time). Conditions

for a problem fire were used for the analysis. A problem fire is one which burns under conditions that result in a threat to resource values within or adjacent to the project area. Problem fire conditions are typically at or above what would normally be considered extreme fire conditions. Weather and fuel moistures for a problem fire were identified as 97th percentile conditions.

Percent fuel moistures for 97th percent conditions are:

1 hour: 2%
10 hour: 3%
100 hour: 6%
Live herbaceous: 30%
Live woody: 55%

The most likely wind direction is from the Southwest. For the problem fire analysis a wind direction of SW was chosen and a wind speed of 25 miles per hour. Sustained wind speeds at this level are relatively rare based on historical weather records, though wind gusts are more common, but they represent a clear threat to the area adjacent to the project area.

Fuel characteristics are represented by fuel models (Anderson, 1982) and (Scott and Burgan, 2005). Table 23 displays acres by fuel model for existing condition and after the treatments in the proposed action. The spatial distribution of fuel models for the South Bend Area is displayed in Map 2 (Existing Fuels) and Map 3 (Proposed Action Fuels) of the fuels report in the Project Record, pages 32 and 33. For this fire and fuels analysis the analysis area is expanded to include areas adjacent to the South Bend project, total area is about 41,548 acres.

Table 23: Fuel Models

South Bend Fuel Models (Acres) by Alternative										
Alternative	**FM1**	**FM2**	**FM6**	**FM8**	**FM9**	**FM10**	**FM11**	**FM81**	**FM98**	**FM97&99**
No Action	4,613	876	2,5293	2,274	505	302	1	0	72	7,610
Proposed Action	4,613	806	2,3204	2,345	505	232	0	2,161	72	7,610

Shaded cells in Table 19 indicate fuel model changes due to the treatment proposed in the Proposed Action. Fuel model change assumptions are shown below:

FM 8, 9, 97, 98, and 99 – No change due to treatment

FM 1, 2, 6, 10 – Changed to FM 181 within treatment units.

A design element for the proposed action includes 30% of each unit would be retained in an untreated manner to create a mosaic of tree, shrub, and size/structure conditions within the units and across the landscape.

For the analysis documented here, the effect of treatment is assumed to cover 100% of the treatment area. There is no way to spatially represent the 30% untreated area. Leaving 30% of units, with either or both mowing and burning, untreated would likely reduce the amount of hazard reduction indicated in this analysis, the extent is unknown.

Some fuel treatments are being done on private lands adjacent to the South Bend area, such as Woodside Ranch. Conversations with Stu Otto (ODF) indicate that most of the treatments are done within 30 feet of existing structures and do not cover a large area spatially. These treatments are not

considered in this landscape level analysis, but would offer protection to site specific structures of value.

Cumulative Effects

Measure # 1 and # 2 Acres of prescribed fire and/or mowing; Percentage of project area rated as low for fire behavior potential

All mechanical fuel reduction activities create measurable amounts of dead and down woody residue. Alternative 2, includes integrated fuel treatments which disposes of the residues created by vegetation management as well as natural accumulation of fuels.

There would be no negative short-term or long-term cumulative effects on fuel loadings from the combination of Alternative 2 and ongoing activities occurring in the surrounding location of the South Bend project area on federal lands because all mechanical removal requires whole tree removal. Hand thinning and piling would be done concurrently. Mowing in itself does not reduce fuels. Its value is in rearranging fuels to make ground fuels less flammable while lowering flame heights and expediting decomposition of forest residues. There would be a significant cumulative trend in the amount of decreased fuel loading and fire risk if Alternative 2 was implemented. According to the Greater Bend CWPP Oregon Department of Forestry (ODF) is currently engaged in multiple projects including a defensible space project in Woodside Ranch to help individual land owners comply with the Oregon Forestland-Urban Interface Protection Act of 1997 also known as Senate Bill 360. Oregon Department of Forestry (ODF) has indicated that most of the treatments are done within 30 feet of existing structures and do not cover a large area spatially. These treatments are not considered in this landscape level analysis, but would offer protection to site specific structures of value.

Past, Ongoing and Reasonably Foreseeable projects would affect the South Bend project area in a variety of ways. For example, the Fuzzy Project, located just east of the project area would continue to treat acres categorized as high and extreme. Fuels reduction work would include thinning, mowing and prescribed fire which would alter the current fuels arrangement and contribute to overall landscape approach of breaking-up fuels continuity, reducing crown fire potential. This WUI project in its entirety would treat approximately 16,000 acres. There would be no negative short term or long term cumulative effects on fuels loading within the project area from the combination of Alternative 2 and the 200 acres of reasonably foreseeable activity associated with the OZ CE because all mechanical removal requires whole tree removal. Hand thinning and piling would be done concurrently.

Due to the special area closure enacted since the 18 Fire (2003) and Woodside Ranch Fire (2007) one can reasonably assume there would be a reduced risk of human caused starts in the closure because of unauthorized travel.

The percentage in low fire behavior category (FRCC1) on Federal lands would increase from 25 percent to approximately 60 percent of the project area as the 2,210 acres currently classified as low fire behavior potential combined with the 3,021 acres of restoration treatments.

Alternative 2 when combined with existing and planned fuel treatments on both federal and private lands would meet or exceed 50 percent of the project area in the low fire behavior class for the next 10-15 years, providing a level or protection adjacent to private lands, present and future forest values.

Measure # 3 Roadside evacuation/access miles treated

Approximately three to four miles of fuel treatments to provide defensible space would occur adjacent to Deschutes River Woods, Woodside Ranch, Lost Tracks Golf Course, and High Desert Museum. Fuel treatments would also occur along Forest Road 18 and sections of Highway 97 to provide defensible space. Cumulatively, suppression, evacuation and access for both firefighters and the public would be less hazardous.

Measure # 4 Production of Particulate Matter

The cumulative effects on air quality from prescribed burning included in Alternative 2 would be negligible. A study of cumulative effects of emissions in the Central Oregon areas shows that slash burning contributes less than 1 percent (.34 percent) of Particulate Matter (PM). The same study found that slash burning also produce less than 1 percent (0.64 percent) of carbon monoxide in Central Oregon (Clean Air Committee, 1997). As mentioned previously, burning would be conducted in compliance with National Ambient Air Quality Standards and Oregon Department of Environmental Quality regulations and restrictions to ensure that there would be no cumulative effects on air quality. In areas where restoration of historic fire regimes is planned, prescribed fire would likely need to occur every 8 to 15 years although the actual frequency is speculative and not foreseeable. The additional 200 acres of prescribed underburning within the project area included in the OZ CE is also subject to the same restrictions requirements and regulations and would not have an additive negative effect to air quality within Central Oregon communities.

Preparatory fuel treatments, such as mowing, pruning, and thinning would have a cumulative effect in the project area by improving fire control and safety, reducing the risk of escape, reducing damage to residual trees, and significantly reducing the level of smoke production and effects on air quality and human health in nearby communities.

Measure #5 Crown Fire Potential

The effect of the proposed action reduces the potential to support passive crown fire (torching) from 33% percent to 23% percent. Alternative 2, when combined with the reasonably foreseeable fuels reduction activities included in the OZ CE, approximately 12% of the project area would see a reduction in crown fire potential. Some fuel treatments are being implemented on private lands adjacent to the South Bend project, such as in the Woodside Ranch development. Treatments are being done within 30 feet of existing structures and do not cover a large area spatially. These treatments were not considered in this landscape level analysis, but would offer protection to site specific structures of value.

AIR QUALITY

INTRODUCTION

Smoke contains pollutants including tiny particles called particulate matter (PM). Particulate matter can cause significant health problems, especially for people suffering from respiratory illness. Based on recent research, the Environmental Protection Agency (EPA) revised the air quality standards to provide better health and visibility protection. Under the new standards, land managers must consider using techniques that minimize smoke emissions and impact of smoke on public health and environment.

Smoke Management would be regulated by The Oregon Department of Forestry according to the Oregon Smoke Management Plan Oregon revised statues 477.013. The policy of the plan is to improve the management of prescribed burning as a forest management and protection practice; and to minimize emissions from prescribed burning consistent with the air quality objective of the Interim Air Quality Policy on Wildland and Prescribed Fires, Federal Clean Air Act, and the State of Oregon Clean Air Act Implementation Plan developed by the Department of Environmental Quality under ORS 468A.035 (1989 c.920 s.2).

Federal Land Management agencies (USDA Forest Service, USFS) are required by law to follow the direction of the Forester for the protection of air quality in conducting prescribed burning operations. They will follow the smoke management weather forecasts and smoke management instructions, as provided by the Oregon Smoke Management Plan and the Operational Guidance for the Oregon Smoke Management Program, (Directive 1-4-1-601).

PRESCRIBED FIRE

The critical pollutants thought to affect human health include particulate matter emitted in smoke that is less than 10 microns in diameter (PM10). Particulates less than 10 microns are able to traverse the nose and mouth and enter the upper airways starting with the trachea. Due to their small size and weight, PM10 can remain airborne for weeks. Over ninety percent of smoke particles are less than 10 microns. Wood smoke has been documented to be mutagenic, though no direct studies have proven it carcinogenic to humans. Mutagenic compounds cause changes to structure of a cell in ways that can be transmitted during cellular division. This is of primary concern because mutation can be precursors for cancer (Boutcher 1992). Exposure to PM10 aggravates chronic respiratory disease such as asthma, bronchitis and emphysema.

Burning debris will release carbon dioxide and water (making up about 90% of total mass emitted from the combustion process), criteria pollutants (those pollutants regulated by the EPA under the clean air act), including carbon monoxide and sulphur/nitrogen oxide, and hazardous air pollutants (also known as "air toxins." Air toxins include several hundred known substances including the class of compounds known as aldehydes (formaldehyde's, acetaldehyde and acrolin) and polynuclear aromatic hydrocarbons (PAHs), several of which are known to be carcinogenic.

SMOKE EXPOSURE

Research to date has yet to determine if levels/durations of exposure to these pollutants from prescribed fire operations are significantly affecting human health. However, according to sources at

the EPA, particulate matter that exceeds human health standards have been measured up to three miles downwind of prescribed burns. Also, according to studies conducted by the California Department of Health Services, John Hopkins University and the National Institute for Occupational Safety and Health, small but significant changes in pulmonary function occur when wildland firefighters are tested before and after a single fire season. Wildland firefighters exposure to CO over a full shift are generally well below occupational health limits, but there were some brief (1-minute) peak exposures that exceed short-term ceiling limits (not to be exceeded for any amount of time) of 200 parts per million.

PREVENTION OF SIGNIFICANT DETERIORATION

The prevention of Significant Deterioration (PSD) provisions of the Clean Air Act requires measures, to preserve, protect, and enhance the air quality in national parks, national wilderness areas, national monuments, national seashores, and other areas of special national or regional natural recreation, scenic, or historic values." Stringent requirements are therefore established for areas designated as "Class 1" areas (42 U.S.C. 7475(d)(2)(B). Designation as a Class 1 area allows only very small increments of new pollution above already existing air pollution levels.

The South Bend planning area is within 100 kilometers of the Three Sisters Wilderness. This Class 1 air-shed is 15 to 18 miles northwest of the northern end of the project area. Bend, Oregon is the closet Designated Area (DA). Implementation of the action alternative is designed to reduce emissions and to disperse smoke during favorable conditions also, is expected to protect are quality in Bend, Sunriver and adjacent communities while having no visible effects to the Three Sisters Wilderness Area. There are two nephelometers located in Bend (Bend Pine Nursery and Bend Pump Station).

METEOROLOGICAL PATTERNS

The project boarders Deschutes River Woods subdivision along the northwest flank and Woodside Ranch, High Desert Museum, Lost Track, and Sundance Subdivisions to the northeast. Forest Road 18 (China Hat) and Highway 97 are two primary access routes through the project area. Weather patterns are primarily from the west and northwest. Airborne particulates matter is generally dispersed to the east and southeast during the fall and winter months. During the summer months we experience a southerly flow; however, overall the wind pattern is generally west and northwest.

Temperature changes throughout the day affect how particulate matter and other pollutants are dispersed. Daytime heating causes pollutants to rise along with heated air. Surface cooling at night can create down slope winds that carry pollutants from higher elevations to lower lying areas. Pollutants may pool in the lower regions or exit north following the Deschutes River.

ENVIRONMENTAL CONSEQUENCES

Private debris burning, agriculture burning and wood stove burning all contribute to smoke.

On the Deschutes National Forest, prescribed burning is accomplished during the, spring and early summer when dilution, dispersal, and mixing conditions are generally good to excellent. Prescribed burning also occurs during the winter when conditions are more restrictive. The Deschutes National Forest requires a public notification to be conducted. This is accomplished using local and regional media outlets, Forest Service public affairs offices, and websites and occasional door to door announcements when appropriate in affected neighborhoods prior to burning operations. Also, signs

are posted, which include maps, for local residents which we post at entrances to subdivisions and mail centers.

Air quality would be affected primarily by smoke produced during prescribed fire and pile burning proposed in Alternatives 2. Under Alternative 1, no prescribed fire or pile burning is proposed though there would be smoke production with future wildfires. The principle impacts of burning forest residues, whether by prescribed fire or wildfire, related to temporary visibility reductions and effects on human health. Emissions from fire (smoke) results in the release of particulates into the atmosphere, possibly affecting the health of forest workers, visitors and residents south of Bend, Oregon, Sunriver and surrounding areas. According to the Clean Air Act of 1977 and 1990, Federal Land Managers will attempt to "protect and enhance the quality of Nation's air resources so as to promote the public health and welfare……"

All prescribed burning would be conducted under the State of Oregon Smoke Management System to track smoke produced and would be coordinated through Oregon Department of Forestry.

Alternative 1 (No Action)

Direct and Indirect Effects: The potential for future wildland fire within the project area exists regardless of the alternative selected, but would be greater under Alternative 1, 'No Action" in the absence of fuels reduction activities. The "No Action" Alternative does not provide any opportunities to reduce existing forest fuels and the hazard they pose in the future on wildland fires. Heavier fuel loading in the event of future wildland fire could result in greater smoke and debris emissions, which could adversely affect human health and visibility.

Alternative 2 (Proposed Action)

Thinning slash produced from harvest activities will first be looked at for utilization, where possible (ie., Biomass). Products deemed unfeasible for utilization would be piled and burned. Mechanical Shrub Treatment (mowing) will also be implemented prior to prescribed fire where feasible to further reduce emission and smoke impacts to sensitive areas. Smoke emissions vary with combustion efficiency and quantity of fuel consumed. Machine and handpiles tend to produce more smoke (per ton of fuel consumed) than other burns because much of the consumption occurs during inefficient smoldering phase of combustion. The overall factor in the amount of emissions produced lies solely in the amount of fuel consumed.

Direct and Indirect Effects: Prescribed burning would be conducted under favorable smoke dispersal conditions, avoiding impacts to the Class 1 air-shed and urban areas. Ideally, burns in this location will occur under west or northwest to northeast wind patterns and/or whatever weather conditions the Burn Boss feels will provide the best success with out impacting sensitive areas. Inversions, could increase the potential for smoke pooling into smoke sensitive locations, would be avoided or mitigated during prescribed fire operations as much as possible to not impact those areas of concern.

Daily particulate matter standards should be met following the Oregon Smoke Management Plan. Smoke from prescribed burning could cause short-term impacts to the southern end of Bend and surrounding area (i.e., High Dessert Museum, Deschutes River Woods, Lost Track). However, burning would only occur on days when smoke dispersion is most favorable.

The location of proposed fuels treatments units is shown on alternative maps. Table 24 displays the type of burning proposed and an estimate of smoke emissions using an estimate of tons per acre of fuel consumed during the burning operations.

Air quality would be affected primarily by smoke produced during pile burning and prescribed underburning.

Table 24: Estimated Smoke Emissions from Fuels Treatments

Fuels Treatment	PM<10 Pounds per Acre	PM<2.5 Pounds per Acre	Average Consumption Tons per Acre
Prescribed Fire Underburn/Jackpot	158	139	7
Pile and Burn (Landings)	167	146	15
MST(Mowing)/Underburn	90	79	4
Handpile and Burn	78	68	7
Wildfire burning under severe conditions	900	810	30

The effects of Alternative 2 on smoke emissions are primarily related to the amount and type of fuels treatment proposed. Table 25 displays the estimated smoke emissions for the alternatives.

Table 25: Smoke Emissions by Alternative

Alternative	Acres Treated	Total Tons PM 10 (Microns)	Total Tons PM 2.5 (Microns)
Alternative 1 (No Action)	0	0	0
Alternative 2 (Proposed Action)			
Underburn/Jackpot	252	20	17
MST (Mow)/Underburn	1808	81	71
Pile and Burn (WTY)	632	52	46
Handpile and Burn	540	21	18
Total		174	152

Fuel Treatments proposed **MST** = Mow, **HP** = Hand-piles, **W-T-Y** = Whole Tree Yard. Acres indicated units with multiple treatments across the project area.

Visual Effects: Visual effects to Class 1 air-sheds would be minimal since these air-sheds are in higher elevation than the project area. The Three Sisters Wilderness is located approximately 15 to 18 miles west and north of the South Bend project area. The prevailing wind patterns reflecting a westerly or northwest flow would result in minimal potential for impacts. Because of measures designed to disperse smoke during favorable conditions, implementation of action alternatives are expected to protect air quality related values and have minimal visibility impacts to the wilderness areas. On burn days, persons responsible for burning operations modify ignition pattern and mop-up procedures to consider the effects to Class 1 air-sheds and smoke sensitive areas. Monitoring is done by the State Forester to insure compliance with the smoke management program to the determine effectiveness of smoke management procedures. Other monitoring techniques will include posting personnel as lookouts (Lava Butte Lookout) on burn day. Given the uncertainty associated with prescribed fire weather forecasts, if a certain threshold is reached where particular release is undesired, such as impacting a sensitive area, firing operations are ceased and immediate mop-up procedures will be initiated. However, given the location and layout of the project area, some smoke into urban areas may be inevitable.

Dust: Dust would be created from proposed operations under all action alternatives, such as log haul on roads and operations of machinery within treatments areas. Dust abatement and signing would be conducted on haul

Cumulative Effects: Deschutes National Forest policy dictates that prescribed burning be accomplished during periods of optimal smoke dispersion; however, there may still be some cumulative smoke impacts from concurrent Forest Service, private and other federal agency prescribed burning operations.

The cumulative effects on air quality from the prescribed burning of landings piles and prescribed burning are negligible. Burning of residues piles would only occur if existing and forecasted conditions are favorable. Again, all prescribed burning would be implemented in full compliance with Oregon State Smoke Management. A study of emissions in the Central Oregon area found slash burning to contribute less than 1 percent (.34 percent) of Particulate Matter (PM). The same study found that slash burning also produced less than 1 percent (.64 percent) of the carbon monoxide in Central Oregon (CAB, 1997).

FOREST VEGETATION and FOREST HEALTH

EXISTING CONDITION

Areas proposed for treatment are on generally level to rolling ground, with some areas having lava outcrops. Treatments are proposed in the ponderosa pine dry plant association group. Stand conditions are variable, ranging from variably stocked multi-story ponderosa pine stands to moderately stocked single-story ponderosa pine stands. Variable stand conditions reflect past treatment history (EA Appendix A). In all units an understory of antelope bitterbrush (*Purshia tridentata*) is present and in some units, particularly those around Green Mountain, greenleaf manzanita (*Arctostaphylos patula*) is also present.

Areas proposed for thinning are generally classified as either single-story or a combination of single and multi-story stand structures (EA Appendix A, Groups 1 and 2). Only two areas proposed for thinning have a mosaic of structural conditions that includes shrub dominated aggregations (EA Appendix A, Unit 132 and 221, Group 3). The predominantly single-story ponderosa pine stands proposed for treatment have generally been previously thinned and have an average stand age of approximately 80 years.

The majority (82 percent) of area where prescribed fire is proposed (2,051 acres) is classified as having a mosaic of structural conditions (EA Appendix A; Units 132, 133, 134, 135, 136, 137, 138, 139, 141, 153, 254, and 456; Groups 2 and 3). Varying proportions of these structurally diverse units, with the exception of units 135, 136, 138 and 456, have been reforested within the past 30 years (EA Appendix A). Remaining areas proposed for prescribed fire (18 percent) are classified as being primarily single-story (EA Appendix A; Units 251, 252, 255, 411, and 446; Group 1). While predominately single-story, portions of 446 has also been reforested within the past 30 years. Tree stocking in reforested areas can consist primarily of immature ponderosa pine with relatively full crowns and correspondingly low crown base heights.

Mountain pine beetle and dwarf mistletoe are the primary insect and disease agents, respectively, affecting forest health. Between 2006 and 2007, mountain pine beetle caused light mortality within and adjacent to the project (USDA Forest Service 2007b). Affected patches are relatively small and scattered.

EFFECTS ANALYSIS – FOREST VEGETATION

Best available science was considered and used in analyzing the effects of proposed treatments. Scientific information relied on is incorporated and cited in the discussion of effects. A listing of the science can be found in the section of this report titled “List of Citations”.

For cumulative effects analysis, consideration of past actions follow guidance provided by the Council of Environmental Quality (June 24, 2005 Memorandum from James L Connaughton, Project Record). Ongoing and reasonably foreseeable future actions considered in this analysis are listed in EA Table 5, page 40.

Reference Condition

Based on three study areas, Youngblood et al. (2004) describe the historic (pre-1900) stand structure present in pumice-dominated eastside old-growth ponderosa pine forests (Table 26). A generalization made by Youngblood et al. (2004) was that trees alive and in the upper canopy at the beginning of the study were present in 1900 and represent "old growth" trees.

The South Bend HFRA project is within the range of ponderosa pine sampled by Youngblood et al. (2004). The Eastside old-growth ponderosa pine reference condition of upper canopy live trees (Table 26) described by Youngblood et al. (2004) is used in this analysis as a reference condition for evaluating effects of the proposed treatments.

Table 26: Pumice-Dominated Eastside Ponderosa Pine Size Structure Old-Growth Reference Condition (From Youngblood Et Al. 2004).

Location	Upper Canopy Live Tree Density		Upper Canopy Live Tree Size	
	Trees/Hectare[1]	Trees/Acre[1]	DBH (cm)	DBH (inches)[1]
Metolious Study Area	34 - 94	14 - 38	12.0 – 133.1	4.7 – 52.4
Pringle Butte Study Area	35 - 79	14 - 32	16.0 – 121.9	6.3 – 48.0
Blacks Mountain Study Area	15 - 73	6 - 30	29.5 – 129.8	11.6 – 51.1
Eastside Old-Growth Ponderosa pine Forests Reference Condition[4]	50 $\pm$ 3.5	20 $\pm$ 1.4	60.0 $\pm$ 1.55	23.6 + 0.61

[1] English equivalents of the reported metric measurements using the following conversions:
(Trees/Hectare) * (0.405) = Tree/Acre
(Centimeters) * (0.394) = Inches

The Region 6 Interim Old Growth Definition (Hopkins et al. 1993) for ponderosa pine provides another reference condition for evaluating effects. Density and size conditions described this definition are similar to those described by Youngblood et al. (2004). According to the Region 6 definition, old growth ponderosa stands had an age of at least 150 years and a minimum of 13 trees per acre greater than 21 inches dbh and typically ranged from 18 to 40 trees per acre. Gap size is described as being at least one-half acre in size.

Munger (1917) gives an indication of the average number of trees per acre and the distribution of diameter classes in representative stands in various parts of the state of Oregon. The site conditions associated with the stand located near Lapine may be most representative of the conditions present within the project area. Table 27 displays tree densities by size measured in the Lapine stand. Munger (1917) notes "yellow-pine forests are so irregular in density that figures for the average stand per acre or per quarter section are apt to be misleading. Though the volume of timber may be very high on an area of an acre or so, there are usually openings in the forest, groups of young growth, glades, or barren spots, which reduce the average per acre volume of any large tract."

Table 27: Tree Densities By Size Class Measured In Early 1900's In A Representative Ponderosa Pine Stand Near Lapine (From Munger 1917).

Size Class (Diameter at Breast Height)	Number of Ponderosa Pine per acre
2 to 10 inches	2.04
12 to 14 inches	0.60
16 to 20 inches	1.32
22 inches and larger	9.95
Total	**13.91**

Measured Attributes

Four attributes of forest vegetation are measured to analyze effects of treatments: 1) stand density, 2) diameter distribution, 3) canopy structure, and 4) stand structure. Canopy structure describes canopy components such as crown base height and crown bulk density, characteristics useful for assessing resistance to fire. Stand structure describes stage of stand development, considering such components as tree size and number of age classes (cohorts), and is used to compare existing conditions to the historic range of variability (HRV).

To describe some of these attributes, treatment areas have been grouped (Appendix C) as follows based on existing size/structure as classified from remotely sensed satellite imagery data (2004) and past activities (Appendix C):

Group 1: Stands classified as forested and having either: a) greater than 50 percent in single-story structure or b) a history of prior thinning treatments.

Group 2: Stands classified as predominantly forested and generally having less than 50 percent in single-story structure. Stands are a mosaic of single and multi-story structure with a relatively small proportion of each stand classified as shrub (20 percent or less).

Group 3: Stands with greater than 20 percent of the area classified as shrub, rock or sparse vegetation and remainder classified as forested with a mixture of single or multi-story structure.

Scope and Scale of Analysis

For all but stand structure, the scale of analysis is the area proposed for treatment. Treatments would have no effect on stand density, diameter distribution, species composition, and canopy structure outside of the treatment area. Stand structure is analyzed on a broader landscape scale.

Methods

Stand exams are available for characterizing stand conditions within areas proposed for treatment. Where the analysis describes a "sample size", it refers to the number of stand exams used to characterize stand conditions. Exams date primarily from 1995 to 1998, with a couple dating from 2008. Available exams adequately sample the range of stand conditions within areas proposed for treatment. To estimate the relative change in stand conditions from time of measurement and as a result of proposed thinning treatments, inventory data from stand exams was analyzed using the:

1) The Forest Vegetation Simulator (FVS) Growth and Yield Model (Version 6.21), South Central Oregon/Northeast California (SORNEC) variant,
2) Fire and Fuels Extension (FFE) to the Forest Vegetation Simulator (Version 1.0), and
3) Stand Visualization System (SVS) (Version 3.36).

The Forest Vegetation Simulator (FVS) is a computer model that can be used to predict forest vegetation dynamics (Dixon 2002). Since its initial development in 1973, it has become a system of highly integrated analytical tools (USDA Forest Service 2007a). These tools are based upon a body of scientific knowledge developed from decades of natural resources research (USDA Forest Service 2007a). The Fire and Fuels Extension (FFE) simulates fuel dynamics and potential fire behavior over time, in the context of stand development and management (Reinhardt and Crookston 2003). The Stand Visualization System (SVS) generates images depicting stand conditions represented by a list of individual stand components such as trees, shrubs, and down material (McGaughey undated). The images produced by SVS, while somewhat abstract, provide a readily understood representation of stand conditions and help communicate silvicultural treatments and forest management alternatives (McGaughey undated).

FVS was used to analyze existing stand conditions and to predict future stand conditions under various management actions. FFE was used to measure fire hazard and predict how it changes in response to thinning treatments. SVS was used in this analysis to provide a visual image of how thinning treatments could change stand conditions relative to the no action alternative. Outputs from FVS, FFE, and SVS are considered useful in estimating relative changes between the no action and the action alternatives.

For additional details on the use of FVS for this analysis, refer to the Project Record, Silviculture Report, Appendix F, pages 52 and 53.

FOREST VEGETATION MEASURE #1 – STAND DENSITY

Introduction

Stand density measures how thickly trees grow (Davis and Johnson 1987). Stand density is expressed either in absolute or relative terms (Ernst and Knapp 1985). Absolute stand density is the absolute or measured quantity per unit area. The following description of relative density is taken from Ernst and Knapp (1985).

> The concept of relative stand density has been developed to provide meaningful comparisons among stands that differ in average tree size, age, site, and associated characteristics. Relative density is the ratio of the measured absolute density of a given stand to some reference level specific to that forest type. It describes the "degree of crowding" in the stand. When the evaluation of two stands results in the same relative stand density, they can be thought of as being at the same degree of crowding, even though they may differ in age, stand size, of species composition.

Cochran et al. (1994) describe the following concepts for use in estimating density limits. Upper density limits or upper management zones (UMZs) often are determined by establishing the density level at which a suppressed class of trees begins to develop. For ponderosa pine, mortality due to mountain pine beetle is not confined to intermediate and suppressed trees. Emperical stocking level curves for ponderosa pine suggest that tree mortality due to mountain pine beetle remains at a low level until a critical stand density is reached. Upper management zones for ponderosa pine can be established at those stand densities above which mortality from mountain pine beetle can become serious. The lower density limits of management zones (LMZs) often are set at 67 percent of the UMZ. This lower limit or zone maintains enough stocking to capture a significant portion of the site resources in tree growth.

Measures

Measures of absolute density within the short term (2011) include trees per acre and basal area. The measure of relative density used is stand density index (Reineke 1933).

Methods

Upper management zones were determined using the procedure described by Booser and White (undated) for calculating maximum stand density indexes for Deschutes National Forest plant associations (Volland 1985). This procedure adapts for use on stands in the Deschutes National Forest the method described by Cochran et al. (1994) for setting upper management zones. Upper management zones appropriate for site conditions found in the South Bend HFRA (Table 28) were

determined using plant association or local measures of site productivity in the equations described by Cochran et al. (1994). Local measures of site productivity included growth basal area (Hall 1987) and site index. Upper management zones derived using the local GBA measurements are higher than upper management zones determined by Booser and White (undated) using GBA information from the plant association guide (Volland 1985).

Lower management zones were set at 65 percent of the upper management zone. The minimum stocking level is based on the level identified for ponderosa pine stands managed on the Deschutes National Forest (36.5 SDI) using the uneven-aged harvesting method (USDA Forest Service 1994a).

Table 28: Measures of site productivity and estimated density limits for plant associations found within South Bend HFRA treatment areas.

Plant Association (Volland 1985)	Growth Basal Area (GBA)	Site Index[3]	Management Zone SDI		
			Upper[4] (UMZ)	Lower[5] (LMZ)	Minimum[6]
Ponderosa pine/bitterbrush/fescue (CPS2-11)	150[1]	84	160	110	40
Ponderosa pine/bitterbrush/needlegrass (CPS2-12)	89[2]	89	110	70	40
Ponderosa pine/bitterbrush-manzanita/needlegrass (CPS2-13)	130[1]	84	140	90	40
Ponderosa pine/bitterbrush-manzanita/fescue (CPS2-17)	115[1]	78	130	90	40

[1] Measured from stands in the vicinity of the South Bend HFRA.
[2] Plant association average GBA.
[3] Plant association site index (Volland 1985) adjusted to Barrett's site index (Booser and White, undated).
[4] Calculated using formulas from Cochran et al. (1994). Upper management zone values are higher than those calculated by Booser and White (undated) for CPS2-11 (115 SDI), CPS2-13 (92 SDI), and CPS2-17 (124 SDI) using average plant association conditions reported by Volland (1985) for the central Oregon pumice zone.
[5] (Upper management zone) * (.65) = LMZ
[6] Derived from minimum stocking guidelines for uneven-aged management on the Deschutes (USDA Forest Service 1994).

Existing Condition

Figure 10 displays the existing condition, as projected by the Forest Vegetation Simulator (FVS) and the Stand Vegetation Simulator (SVS) of selected stands within the three stand structure groupings. Stands were selected that show the general characteristics of each group. As depicted in these SVS representations, stands in Group 1 are primarily single story stands with relatively uniform stand density. Stands in Group 2 are a mosaic of single-story and multi-story stand structures. Stand densities in Group 2 are quite variable, with the selected stand in Figure 10 depicting one of the lower density stands in this group. Stands in Group 3 are a mosaic of shrub and forest aggregations. Forest aggregations include single-story and multi-story stand structures. Stands in Group 3 can have shrubs as the dominant vegetation type on 20 to 60 percent of the stand area. The selected stand in Figure 10 depicts the relatively low density of trees characteristic of many stands in Group 3, which is a mosaic of shrubs and single and multi-story stand structures, as well as the scattered and clumped arrangement of these trees. The areas of bare ground depicted in Figure 10 are representative of the areas where shrub is the dominant vegetative cover.

Figure 10. Stand Vegetation Simulator (SVS) representation of existing condition (2008) of selected stands in Groups 1, 2 and 3.

Group 1 - Unit 447 Stand Attributes: 139 trees per acre; 99 square feet basal area per acre; 172 Stand Density Index; 11.4" quadratic mean diameter; 0.050 kg/m^3 crown bulk density; and 25 foot crown base height.

Group 2 - Unit 115 Stand Attributes: 352 trees per acre; 88 square feet basal area per acre; 189 Stand Density Index; 6.8" quadratic mean diameter; 0.065 kg/m^3 crown bulk density; and 7 foot crown base height.

Group 3 - Unit 141 Stand Attributes: 65 trees per acre; 9 square feet basal area per acre; 22 Stand Density Index; 5.1" quadratic mean diameter; 0.029 kg/m^3 crown bulk density; and 3 foot crown base height.

Stand density, as measured by trees per acre, is most uniform in the grouping classified as primarily single-story (Group 1). Average stand density ranges from approximately 60 to 200 trees per acre, with past thinning contributing to the relatively uniform density. Average stand densities are more variable in the other groups. Highest densities, found in Group 2, range from approximately 300 to 1,100 trees per acre. Lowest densities, found in Group 3, range from approximately 20 to 300 trees per acre. Lower densities in Group 3 reflect the shrub dominated patches which can total 20 to 60 percent of each stand. Higher densities measured in Group 3 reflect clumps of dense regeneration, either natural or planted.

Majority of stands proposed for treatment are within the ponderosa pine/bitterbrush-manzanita/needlegrass (CPS2-13) and Ponderosa pine/bitterbrush-manzanita/fescue (CPS2-17) plant associations (Appendix C). All groups include stands that can exceed the upper management zone, as measured by stand density index (Table 29).

Table 29: Existing (2008) Stand Density within all Areas Proposed for Treatment

Structural Condition	Trees per Acre[1]		Basal Area[2] per Acre (Square Feet)		Stand Density Index	
	Average	Range	Average	Range	Average	Range
Single-story structure (Group 1) (Sample size = 8)	120	60 - 180	100	60 - 110	160	100 - 200
Single and multi-story structure (Group 2) (Sample size = 6)	590	280 - 1,140	120	80 - 180	270	160 - 430
Mosaic of shrubs and single and multi-story stand structures. (Group 3) (Sample size = 9)	80	20 - 340	30	0 - 140	50	10 - 280

[1] Trees taller than 4.5 feet.

[2] Basal Area (Definition): The cross-sectional area of a single stem, including the bark measured at breast height (4.5 feet above the ground) (Helms 1998). In this table it is expressed as the cross-sectional area of all stems in the stand and is expressed on a per acre basis.

Environmental Consequences – Measure #1

Alternative 1 (No Action)

Direct and Indirect Effects: Within the next 10 years, there would be little reduction in stand density levels in the absence of thinning treatments, fire, bark beetle attacks or other disturbances that would kill trees. Self-thinning generally does not occur on the dry sites associated with the project. Emmingham et al. (2005) describe on very dry sites, dense sapling and pole-size stands tend to stagnate and on dry, climax ponderosa pine sites, the dominant and co-dominant trees within dense, even-aged groups of trees tend to stagnate and grow very slowly, if at all.

Alternative 2 (Proposed Action)

Direct and Indirect Effects: Proposed thinning and use of prescribed fire would reduce stand densities to varying levels. The majority of thinning is proposed within stands that have been classified as being either single-story or a mix of single and multi-story stand structure (Groups 2 and 3). For visual depictions of selected stands in the year 2011 refer to Figure 11 and Figure 12. Reductions in stand density and the removal of trees from the lower canopy levels would occur. In

some cases, multi-story stand structures would remain even with the removal of trees from the lower canopy levels.

Figure 11: SVS Representation of Selected Stand in Group 1 with and without thinning, year 2011

Without Thin - Unit 447 stand attributes: 138 trees per acre; 103 square feet basal area per acre; 178 Stand Density Index; 11.7" quadratic mean diameter; 0.051 kg/m^3 crown bulk density; and 26 foot crown base height.

With Thin - Unit 447 stand attributes: 66 trees per acre; 70 square feet basal area per acre; 112 Stand Density Index; 13.9" quadratic mean diameter; 0.029 kg/m^3 crown bulk density; and 29 foot crown base height.

Figure 12. SVS representation of a selected stand in Group 2 with and without thinning, Year 2011.

Without Thin - Unit 115 stand attributes: 350 trees per acre; 96 square feet basal area per acre; 202 Stand Density Index; 7.1" quadratic mean diameter; 0.066 kg/m^3 crown bulk density; and 6 foot crown base height.

With Thin - Unit 115 stand attributes: 85 trees per acre; 56 square feet basal area per acre; 98 Stand Density Index; 11.0" quadratic mean diameter; 0.030 kg/m^3 crown bulk density; and 21 foot crown base height.

Projections indicate thinning would reduce relative stand densities by approximately 40 to 70 percent (Table 30, average stand density index). Greatest reduction would occur where there's been little to no prior thinning (Groups 2 and 3). Projections indicate relative densities would average between 90 and 120 SDI (Table 30). These densities are above minimum stocking levels (Table 28, 40 SDI) and within the lower and upper management zones for the dominant plant association (Table 28, 90 -140 SDI). In some cases, the relative density could be below the lower management zone (Table 30, minimum stand density index, 70 SDI). Growth loss associated with lower stocking levels would be minimal. In discussing stand response to new growing space, Cochran et al. (1994) indicate once stands adjust to additional growing space, total cubic volume growth is fairly similar over a fairly wide range of densities. For this reason, Cochran et al. (1994) conclude it may be better to err by retaining leave-tree densities that are too low, relative to the management zones, rather than too high.

In terms of trees per acre, thinning would retain densities at levels higher than the 20 trees per acre present in the Eastside Old-Growth reference condition (Table 26) and the representative conditions found by Munger in the early 1900s (Table 27).

Table 30: Projected Stand Density In 2011 Within Areas Proposed For Thinning.

Structural Condition	Trees per Acre		Basal Area per Acre (Square Feet)		Stand Density Index	
	Average	Range	Average	Range	Average	Range
Single-story (Group 1) (Sample size =5)						
• No Action	150	100 to 200	100	80 to 120	180	150 to 210
• Proposed Action	60	50 to 70	70	60 to 70	110	90 to 110
• Change	-60%	-50% to -65%	-30%	-25% to -42%	-39%	-40% to -48%
Single and multi-story (Group 2) (Sample size = 5)						
• No Action	590	290 to 1,050	130	60 to 180	280	130 to 420
• Proposed Action	80	70 to 90	50	40 to 60	90	70 to 110
• Change	-86%	-76% to -91%	-62%	-33% to -67%	-68%	-46% to -74%
Mosaic of shrubs and single/multi-story. (Group 3) (Sample size = 1)						
• No Action	1,040	---	170	---	390	---
• Proposed Action	110	---	60	---	120	---
• Change	-89%	---	-65%	---	-69%	---

Use of prescribed fire has the potential to reduce stand densities to varying degrees by either killing trees directly or indirectly. Effectiveness of VEG-1 Mitigation Measure in limiting mortality will depend, in part, on stand structure at time of burn.

Where proposed in primarily single-story stands (Appendix A, Units 251, 252, 255, and 411), use of prescribed fire would generally have little effect on stand density. Pre-burn stand stocking would primarily be in larger diameter trees in the upper canopy level. VEG-1 Mitigation would be moderately effective in minimizing fire damage to dominant and codominant trees in the upper canopy level of these single-story stands, with most mortality being small trees in the lowest canopy level.

Prescribed fire has potential to cause the greatest reduction in stand density in those units which include a mosaic of structural conditions, groups 2 and 3). Reductions in density would be patchy, with greatest potential for reductions being in aggregations with prior reforestation treatments (Units 132, 133, 134, 137, 139, 141, 153, 254, and 446) and areas with multi-story structures and/or no prior treatment (Units 135, 136, 138, and 456). In all these units, with the exception of unit 153 (primarily single-story), prescribed fire is proposed in conjunction with mowing. Additionally, within units 132, 254 and 446, thinning would be done prior to the use of prescribed fire. VEG-1 Mitigation, in combination with mowing and thinning, could have a low to moderate effectiveness in minimizing fire damage to dominant and codominant tree that are immature and relatively full crowned. Relatively

low crown base heights on immature trees, physical limitations in mowing close to trees, and variable fuel condition and changing weather condition, separately or in combination, could result in high intensity burning. This could result in crown scorch in excess of 50 percent and in some cases complete killing of foliage.

Monitoring of prescribed burns in single and multi-story structural conditions on the district has shown prescribed fire can reduce stocking in some areas below minimum levels. Monitoring has shown mortality patch size can exceed 2 to 3 acres. Areas where scorch exceeds stated limits (VEG-1 Mitigation) would be monitored (Underburn Monitoring Item) for mortality resulting directly from the fire or indirectly from bark beetle attack. Where mortality levels reduce stocking below minimum levels, plans would be made for reforesting the area. This would be consistent with Forest Service policy to identify and report all reforestation needs resulting from forest fires (Holtrop 2005).

Cumulative Effects: None of the actions that could contribute to cumulative effects overlap areas proposed for treatment. There would be no cumulative effects.

FOREST VEGETATION MEASURE #2 – DIAMETER DISTRIBUTION

Measures

The following measures are used to describe the existing diameter distributions within stands being evaluated for treatment:

1) Existing quadratic mean diameter of all live trees greater than 4.5 feet tall, and
2) Existing number of trees greater than or equal to 21 inches dbh.

Existing number of trees greater than 21 inches dbh allows for a comparison with one of the attributes described in Hopkins et al. (1993) definition for ponderosa old growth conditions.

The following measures are used to evaluate the effects of thinning on diameter distribution:

1) Projected quadratic mean diameter of all live trees greater than 4.5 feet tall at the following times:
   a) following thinning (assumed to be year 2011), and
   b) when older stands are at the reference age for ponderosa pine old growth (assumed to be 150 years (Hopkins et al. 1993), which would be met in the older stands by the year 2081).
2) Projected quadratic mean diameter of the 20 largest trees (at year 2011 and 2081), allowing for a comparison to the Eastside Old-Growth reference conditions (Table 28).

Existing Condition

The largest quadratic mean diameters are found in stands classified as having a single story stand structure (Table 31, page 91, Group 1). Many stands with this structure have had prior thinning treatments which removed trees in the smaller diameter classes. Quadratic mean diameters average 12 inches and range from 10 to 14 inches (Table 31, Group 1). The remaining stands proposed for treatment include areas with multi-story stand structures (Table 31, Groups 2 and 3). Smaller diameter trees are typically present in these multi-story stands. This is reflected in the comparatively small quadratic mean diameters associated with these multi-story stand structures. Quadratic mean diameters average 7 inches and range from 4 to 9 inches (Table 31, Groups 2 and 3)

There are relatively few trees larger then 21 inches dbh within the stands being proposed for treatment (Table 31). Density of trees greater or equal to 21 inches dbh ranges from 0 to 6 trees per acre (Table 31, low and high values in either Groups 1, 2, and 3). These values are less than the 13 trees per acre described in the reference condition for ponderosa pine old growth (Hopkins et al. 1993).

Table 31: Existing (2008) Quadratic Mean Diameter and Large Tree Stocking within all Areas Proposed for Treatment

Structural Condition	Quadratic Mean Diameter [1] (Inches) of all trees greater than 4.5 feet tall		Number of Trees per Acre Less than or equal to 21" dbh	
	Average	Range	Average	Range
Single-story (Group 1) (Sample size = 8)	12	10 to 14	2	0 to 6
Single and multi-story (Group 2) (Sample size = 6)	7	5 to 9	2	1 to 4
Mosaic of shrubs and single and multi-story stand structures. (Group 3) (Sample size = 9)	7	4 to 9	0	0 to 2

[1] Quadratic Mean Diameter (Definition): the diameter corresponding to a group of trees (stand) mean basal area (Helms 1998); the diameter of a tree of average basal area in a stand (Powell 1999).

Environmental Consequences – Measure #2

Alternative 1 (No Action)

Direct and Indirect Effects: Using the relationship between diameter growth and percent GBA described by Hall (1987), diameter growth of dominant trees for the next decade would be projected to average 1.4 inches and range from 0.6 to 2.2 inches. More rapid growth rates would be associated with areas having lower stocking levels, which primarily would be those areas that have been recently thinned or reforested. Growth would slow in the coming decades as stand stocking increases.

I both the short (2011) and long (2081) term, within the subset of units proposed for thinning, the largest average quadratic mean diameters (considering all trees taller than 4.5 feet) would continue to be found within the stands classified as single storied (Short Term: Table 32, Group 1, No Action; Long Term, Table 33, Group 1, No Action). When considering the quadratic mean diameter of the 20 largest trees, differences are less pronounced between the structural groups. With no treatment, FVS projections suggest the quadratic mean diameter of the 20 largest trees in 2011 (Table 32, Groups 1, 2, and 3, No Action) could average 16 to 17 inches and range from 16 to 20 inches. In 2080 (Table 33, Groups 1, 2, and 3, No Action), diameters of the 20 largest trees could average 22 to 24 inches and range from 21 to 25 inches. While not pronounced, quadratic mean diameters of the 20 largest trees at both points in time would generally be associated with previously thinned Stands (Group 1).

In the absence of stand disturbing events, such as stand replacing fires or bark beetle outbreaks, the best potential to develop the number and size of upper canopy level trees associated with old-growth reference conditions described by Youngblood et al. (2004) (Table 26, 23.6 inches dbh) would be in previously thinned stands (Table 33, No Action, Group 1, Quadratic Mean Diameter of 20 largest trees). Potential for developing old-growth reference conditions would be lowest in densely stocked stand. Given the crown-fire hazard (see Forest Vegetation Measure #3 section of this report) and bark beetle hazard (see Forest Health Measure #1 section of this report) associated with the more densely stocked stands, there would be a high likelihood of a stand disturbing event occurring at some time in the future. In discussing the results of a 35-year study on ponderosa pine response to thinning and understory removal, Cochran and Barrett (1999b) state the reduction of growth rates of even the largest trees with increasing stand densities indicates that unmanaged stand that escape thinning through fire or other disturbances will progress very slowly toward mid- or late-seral conditions.

Table 32: Quadratic Mean Diameter In 2011 Within Areas Proposed For Thinning.

Initial Structural Condition	Quadratic Mean Diameter (inches) in 2011 of:

	All trees taller than 4.5 feet		20 largest ponderosa pine per acre	
	Average	**Range**	**Average**	**Range**
Single-story (Group 1) (Sample size =5)				
• With No Action	11	10 to 13	17	16 to 20
• Following Proposed Action	14	13 to 17	17	16 to 20
• Change from No Action	+27%	+30% to +31%	No change	No change
Single and multi-story (Group 2) (Sample size = 5)				
• With No Action	7	6 to 9	16	15 to 18
• Following Proposed Action	11	10 to 13	16	14 to 17
• Change from No Action	+57%	+67% to +44%	No change	-16% to -6%
Mosaic of shrubs and single/multi-story structure. (Group 3) (Sample size = 1)				
• With No Action	5	---	17	---
• Following Proposed Action	10	---	17	---
• Change from No Action	+100%	---	No change	---

Table 33: Quadratic mean diameter in 2081 within areas proposed for thinning.

Structural Condition	Quadratic Mean Diameter (inches) in 2081 of:			
	All trees taller than 4.5 feet		20 largest ponderosa pine per acre	
	Average	**Range**	**Average**	**Range**
Single-story (Group 1) (Sample size =5)				
• No Action	18	16 to 20	24	23 to 25
• Proposed Action	22	22 to 24	26	24 to 27
• Change from No Action	+22%	+38% to +20%	+8%	+4% to +8%
Single and multi-story (Group 2) (Sample size =5)				
• No Action	14	12 to 16	22	21 to 23
• Proposed Action	22	18 to 26	26	24 to 28
• Change from No Action	+57%	+50% to +62%	+18%	+14% to +22%
Mosaic of shrubs and single/multi-story. (Group 3) (Sample size =1)				
• No Action	12	---	22	---
• Proposed Action	19	--- ---	25	---
• Change from No Action	+58%	---	+14%	---

Alternative 2 (Proposed Action)

Direct and Indirect Effects: Thinning from below, which generally removes trees from the lower canopy levels, would increase the average quadratic mean diameter (of all trees taller than 4.5 feet) by approximately 27 to 100 percent as compared to no action alternative conditions in 2011 (Table 32, Change from No Action, Groups 1, 2, and 3). Greatest gains would be realized in those stands with no recent thinning (Groups 2 and 3). Thinning would not change the average quadratic mean diameter of the 20 largest trees (Table 32, Change from No Action). Efforts to leave trees with the least amount of dwarf mistletoe could result in removal of trees from the upper canopy and retention of trees in the lower canopy. In the short term this could reduce the quadratic mean diameter of the 20 largest trees in some cases (Table 32, Group 2, Range of Changes from No Action). With thinning being limited to trees less than 21 inches dbh, there would be no decrease in the number of trees greater than or equal to 21 inches dbh.

Thinning treatments would reduce stand basal area to an average of 48 percent of GBA and range from approximately 35 to 55 percent of GBA. Using the relationship between diameter growth and percent GBA described by Hall (1987), diameter growth of dominant trees for the decade following thinning would be projected to average 2.0 inches and range from 1.7 to 2.4 inches. Compared to the No Action Alternative, thinning would increase average diameter by 43 percent. Growth would slow in the coming decades as stand stocking increases.

With thinning, FVS projections suggest in the year 2080, the quadratic mean diameter of the 20 largest trees could average 25 to 26 inches dbh and range from 24 to 28 inches dbh (Table 33, Proposed Action, Groups 1, 2, and 3). Average conditions would be an 8 to 18 percent increase from the no action alternative. In the cases where thinning reduced quadratic mean diameter of the 20 largest trees (Table 32, Group 2, Range of Change fro No Action), gains in diameter growth would offset the reductions. In all cases in the long term, the diameter of the 20 largest trees would be larger compared to the No Action Alternative (Table 33, Proposed Action, Groups 1, 2, and 3, range of Changes from No Action). Differences between the structural groups would not be pronounced. Projections suggest with thinning there would be potential for stands in all groups to develop the number and size of upper canopy level trees associated with the old growth reference conditions described by Youngblood et al. (Project Record, Silviculture Report, Table 2, page 12, 23.6 inches dbh). This is a difference from the No Action Alternative where this potential exists primarily in previously thinned stands (Table 33, Group 1). Thinning, in combination with mowing or burning, would reduce crown fire hazard (see Forest Vegetation Measure #4 section of this section) increasing the likelihood of the reference conditions being achieved compared to the No Action Alternative.

FVS projections showing comparatively larger diameters in thinned stands compared to unthinned stands are consistent with a local study evaluating ponderosa pine growth response to thinning. Cochran and Barrett (1999) reported 30-year results of ponderosa pine thinned to different stocking levels in Central Oregon. They reported a curvilinear decrease in quadratic mean diameter periodic annual increments with increasing stand density. From the study results, they conclude (with longer rotations and increased individual tree growth in thinned stands, much larger trees would be produced than in unthinned stands."

FOREST VEGETATION MEASURE #3 – CANOPY STRUCTURE

Measures

Measures of canopy structure in the short term (2011) focus on the following key components of canopy structure identified by Peterson et al. (2005) as being related to crown-fire hazard: canopy base height and canopy bulk density.

Existing Condition

Highest crown base heights and lowest crown bulk densities are associated with those units or portions of units that have been previously thinned (Table 34, Group 1). Past thinning treatments have generally reduced crown-fire hazard by raising crown base height and reducing crown bulk density.

Under certain weather conditions, existing crown bulk densities may exceed thresholds above which stands would be more vulnerable to active crown fire. Fitzgerald (2005) indicates dense, even-aged ponderosa pine stands with crown bulk densities above 0.10 kg/m^3 are more vulnerable to active crown fire because fire can easily spread from tree crown to tree crown under weather and topographic conditions conducive to crown fire initiation and spread. Most areas considered for treatment are below this level, although some areas are approaching this level (Table 34, Group 2). Agee (1996) describes crown bulk density thresholds assuming three rates of spread. At the upper rate of spread analyzed by Agee (1996), crown bulk densities above .037 kg/m^3 were vulnerable to crown fire spread. With the South Bend HFRA project, average crown bulk densities are above this crown bulk density threshold within forest dominated stands (Table 34, Groups 1 and 2). Only within stands with shrub dominated aggregations (Table 34, Group 3) are average crown bulk densities less than this threshold.

Table 34: Canopy Structure In 2008 Within All Areas Proposed For Treatment.

Structural Condition	Crown Base Height (Feet)			Crown Bulk Density (kg/m^3)		
	Avg	Range		Avg	Range	
Single-story (Group 1) (Sample size = 8)	26	18	38	0.046	0.022	0.062
Single and multi-story (Group 2) (Sample size = 6)	10	6	21	0.074	0.044	0.094
Mosaic of shrubs and single and multi-story stand structures. Some areas with past reforestation. (Group 3) (Sample size = 9)	12	3	21	0.020	0.004	0.076

Environmental Consequences – Measure #3

Alternative 1 (No Action)

Direct and Indirect Effects: In areas with lower stand densities, existing shrubs in the understory may provide favorable microsites for the recruitment of ponderosa seedlings. This could result in a decrease in crown base heights during the next 10 to 20 years within currently single-story stands (Table 34, Group 1). Crown base heights could trend towards those present in stands with multi-story stand structures (Table 34, Groups 2 and 3).

Keyes and Maguire (2005) reviewed the results of regeneration field studies located in central Oregon which analyzed the relationship of shrubs to ponderosa pine regeneration. Summarizing the study

findings, Keyes and Maguire (2005) indicate understory shrubs help in securing natural regeneration of ponderosa pine. They state "dense shrub understories are likely to continue to contributing to the development of ladder fuels by their positive effect on seedling recruitment."

Alternative 2 (Proposed Action)

Direct and Indirect Effects: Thinning would increase the height to live crown and decrease crown bulk density (Table 35). Least gain in height to live crown would be in those previously thinned areas (Table 35, Group 1). Additional increase in crown base height would be realized where pruning is proposed. Pruning is proposed in areas with prior planting (Appendix C, Unit 110, 131 and 254) and within an area with no prior treatment located adjacent to private property (Appendix C, Unit 221). As discussed by Fitzgerald (2005) pruning removes the lower branches of trees and lifts the crown, creating more distance between potential surface flames and the bottom of the tree canopy. According to Fitzgerald, pruning is particularly useful in young stands where crowns are low and close to surface fuels (grass/shrubs).

Table 35: Canopy Structure In 2011 Within Areas Proposed For Thinning.

Structural Condition	Crown Base Height (Feet)		Crown Bulk Density (kg/m^3)	
	Average	Range	Average	Range
Single-story (Group 1) (Sample size =5)				
• No Action	24	19 to 28	0.052	0.045 to 0.063
• Proposed Action	29	20 to 30	0.026	0.022 to 0.029
• Change	+21%	+5% to +7%	-50%	-51% to -54%
Single and multi-story (Group 2) (Sample size = 5)				
• No Action	9	6 to 13	0.077	0.058 to 0.092
• Proposed Action	23	10 to 30	0.028	0.024 to 0.029
• Change	+156%	+67% to +131%	-64%	-59% to -68%
Mosaic of shrubs and single/multi-story. (Group 3) (Sample size = 1)				
• No Action	6	---	0.101	---
• Proposed Action	25	---	0.041	---
• Change	+317%	---	-59%	---

Thinning and pruning treatments, in combination with mowing and prescribed fire, follow the principles for creating fire-resilient forests. These principles include in the order listed: reducing surface fuels, increasing height to live crown, keeping larger trees, and decreasing crown density (Fitzgerald 2005).

Mason et al. (2003) modeled four harvest treatments to compare relative effects on fire risk:
1) Remove 9" and under trees *(9 and under)*. All trees less than or equal 9" dbh were harvested.
2) Remove 50% BA, from below *(Half BA)*. Basal area was reduced by half by removing the smallest trees (thinning from below).
3) Leave 45 sq. ft. of BA, from below *(BA 45)*. This treatment was intended to simulate restoration of savannah-like conditions.

4) Remove 12" and greater, from above *(12 and over)*. This treatment was intended to simulate harvest designed to maximize economic return by taking the largest and most valuable trees that are 12" dbh and larger.

For both harvest treatments with a basal area target (Half BA and BA 45), thinning was from below with the smallest trees being removed. An upper diameter limit for harvest was not specified. Modeling results from the Fremont (Mason et al. 2003) would be most applicable to conditions on the Deschutes National Forest. As stated by Mason et al. (2003), "treatment simulation results indicate the thinning treatment Half BA and BA 45, may be the most effective in reducing fire risk in high and moderate risk forests." Greatest reduction of risk occurred with the BA 45 treatment.

Thinning treatments as proposed with the South Bend HFRA project are most similar to the two thinning from below treatments (Half BA and BA 45) modeled by Mason et al. (2003). South Bend HFRA treatments would reduce average basal areas by 30 to 65 percent (Table 30). Average residual basal areas would range from 50 to 70 square feet of basal area per acre (Table 30). While the South Bend HFRA project would remove trees greater than 12 inches dbh, trees in this size class would not be removed in the manner modeled (12 and over) by Mason et al. (2003).

Thinning, underburning and mowing will create conditions favorable for the re-establishment of understory vegetation. Reduced canopy cover together with seedbeds created by prescribed burning could create conditions favorable for germination of ponderosa pine seeds. Low precipitation common for the area together with low shrub cover would limit survival of germinants. Reduced tree canopy cover would also favor the re-establishment of bitterbrush and greenleaf manzanita. Where stands have been thinned and mowed, shrubs will likely grow to pre-treatment levels (approximately 30 percent canopy cover) within 10 to 13 years. Growth of shrubs will likely be slower where thinning is followed by burning, with shrubs canopy cover growing to approximately 10 to 15 percent within 10 to 13 years of burning.

Shrub response to thinning and underburning has been measured in a long-term study evaluating the effects of prescribed fire and thinning in central Oregon ponderosa pine forests. This study includes plots in site and stand conditions similar to those found in the South Bend HFRA project. In reporting fifteen year results from the study, Busse and Riegel (2005) indicate shrub cover increased more than 200 percent due to thinning. Antelope bitterbrush, in particular, responded to thinning. Busse and Riegel (2005) report average cover of bitterbrush after 13 years was 7 percent on unthinned plots compared to 25 percent on thinned plots. Maximum bitterbrush cover on thinned plots reached 50 percent. Where thinning was followed with fire, bitterbrush cover was severely reduced. Post-fire seed germination led to partial recovery of the bitterbrush. By 10 years following the burn, bitterbrush cover on burned plots averaged 13 percent compared to 25 percent on the unburned plots.

Recruitment of ponderosa seedlings could occur more slowly than that of the shrubs. Keyes and Maguire (2005) describe some of the factors capable of limiting seedling recruitment in ponderosa pine forests. Of the factors described, Keyes and Maguire indicate moisture stress represents the most significant of practicably controllable factors. Citing Heidman (1992), Keyes and Maguire (2005) state "the primary obstacle to regeneration of this species throughout its natural range is drought... Annual precipitation in the western and southwestern United States is generally adequate for tree growth but erratic distribution during the year makes seedling establishment difficult." As shrubs redevelop in the understory, recruitment of ponderosa pine regeneration may increase (Keyes and Maguire 2005).

Cumulative Effects: None of the actions that could contribute to cumulative effects (EA Appendix A) overlap areas proposed for treatment. There would be no cumulative effects.

FOREST VEGETATION MEASURE #4 – STAND STRUCTURE

Scope and Scale of Analysis

The Eastside Screens interim ecosystem standard indicates patterns of stand structure are to be characterized by biophysical environment for "the proposed timber sale and its associated watershed" and compared to the Historic Range of Variability (HRV). According this standard, HRV should be developed for "large landscapes across which forest types, environmental settings, and disturbance regimes (fire and insects/disease) are relatively uniform".

The South Bend HFRA is located within the Pilot Butte watershed (5th Field). The Pilot Butte watershed includes a diversity plant association groups (PAGs), including ponderosa pine wet and dry, mixed conifer wet and dry, and lodgepole pine wet and dry (Table 36). The South Bend HFRA is within the ponderosa pine dry PAG (Table 36).

Table 36: Plant Association Groups (PAGs) At Three Landscape Scales

Plant Association Group (PAG)	Pilot Butte Watershed		HRV Analysis Area			South Bend HFRA		
	Acres	% of Watershed	Acres	% of HRV Analysis Area	% of Watershed PAG	Acres	% of South Bend HFRA	% of Watershed PAG
Forest PAGs								
Ponderosa pine Dry	57,589	49.3%	30,325	68.8%	52.6%	8,751	99.3%	15.2%
Ponderosa pine Wet	9,052	7.7%	1,352	3.1%	14.9%	62	0.7%	0.7%
Lodgepole pine Dry	13,869	11.9%	1,350	3.1%	9.7%			
Lodgepole pine Wet	4,219	3.6%						
Mixed Conifer Dry	5,311	4.5%	750	1.7%	14.1%			
Mixed Conifer Wet	13,810	11.8%						
Mtn Hemlock Dry	17	<0.1%						
Subtotal	103,867	88.8%	33,777	76.6%	---	8,813	100%	---
Non Forest PAGs								
Hardwood	68	<0.1%						
Riparian	319	0.3%	296	0.6%	92.8%			
Meadow	756	0.6%						
Mesic Shrub	355	0.3%						
Xeric Shrub	499	0.4%						
Subtotal	1,997	1.7%	296	0.7%	---	---	----	---
Non-vegetated PAGs								
Cinder	201	0.2%	88	0.2%	43.8%			
Lava	10,183	8.7%	9,903	22.5%	97.2%			
Rock	199	0.2%	14	<0.1%	7.0%			
Quarry	45	<0.1%						
Water	422	0.4%	29	<0.1%	6.9%			
Subtotal	11,050	9.5%	10,034	22.7%	---	---	---	---
Total	116,914	99.9%	44,107	100%	---	8,813	100%	---

Due to the diverse conditions within the watershed, a subset of the watershed will be used for the HRV analysis. For an analysis area with relatively uniform environmental settings, a subset of the watershed has been identified that:

- Includes lands within the Forest boundary.
- Includes a representation of plant association groups in which the South Bend HFRA treatments would occur.

- Includes areas with similar annual amounts of precipitation. Precipitation increases in the western portion of the watershed and decreases in the eastern portion.
- Includes areas with similar aspects. West of the Deschutes River, aspects become more easterly. East of the Deschutes, aspects are generally level to rolling.

At approximately 44,000 acres, the analysis area is considered large enough and uniform enough to meet the interim standard for developing HRV. Similar to the Pilot Watershed and the South Bend HFRA project, the dominant PAG in the analysis area is the ponderosa pine dry PAG (Table 36). This analysis area includes much of the 18 Fire, allowing for comparing how proposed treatments, in combination with recent fires, affect patterns of stand structure relative to HRV. Historic range of conditions developed for this area should adequately reflect the range of conditions historically present in the ponderosa pine dry PAG in the Pilot Butte watershed. Historical patterns of structural conditions are characterized only for the ponderosa pine biophysical environment.

Methods

Forest vegetation was classified using structural stages described in Appendix B of the Eastside Screens. The proportion of these structural stages historically present (HRV) was estimated for the time period between 1850 and 1910 (Table 37). HRV is a reference for understanding forest succession and disturbance regimes. For a detailed description of classification methods, historic disturbance regimes, and determination of HRV, refer to Appendix G.

Existing Condition

The majority (55 percent) of the forested portion of the analysis area is within the understory reinitiation structural stage (Table 37). This is a higher proportion than what was present historically. Stands in this structural stage have a young cohort of trees establishing under an older cohort of trees (a cohort is a class of trees arising after a common natural or artificial disturbance). In these stands, the older cohort is ponderosa pine which established primarily following historic logging in the early 1920s and 1930s. Trees average 80 years in total age. They have an average diameter of 12 inches (4.5 feet above ground) and an average height of 60 feet. Some remnant older ponderosa pine trees which established prior to historic logging can be present and average 165 years in total age, 24 inches dbh, and 85 feet tall. The younger cohort of trees consists primarily of scattered ponderosa pine seedlings and saplings. While two cohorts are present, stands appear primarily single story due to the dominance of the older cohort. Tree density is low enough to also allow for the establishment and growth of forbs, grasses, and shrubs.

Single- and multi-story late and old structures (LOS) are currently below HRV (Table 37). Within the analysis area, ponderosa pine stands are classified as LOS if they have greater than or equal to 13 trees per acre greater than or equal to 21 inches in diameter (Hopkins et al. 1993).

Table 37: Structural Stage by Alternative Compared To Historic Range Of Variability

Structural Stage[1]	Historic Range of Variability	No Action		Proposed Action		Proposed Action Cumulative Effects	
		Percent Forested Area	Relation to HRV	Percent Forested Area	Relation to HRV	Percent Forested Area	Relation to HRV
Stand Initiation	0 – 15%	16%	Within	16%	Above (+1%)	16%	Above (+1%)
Stem Exclusion, Closed Canopy	0 – 20%	16%	Within	15%	Within	14%	Within
Understory	10 – 30%	55%	Above	56%	Above	57%	Above

Structural Stage[1]	Historic Range of Variability	No Action		Proposed Action		Proposed Action Cumulative Effects	
		Percent Forested Area	Relation to HRV	Percent Forested Area	Relation to HRV	Percent Forested Area	Relation to HRV
Reinitiation			(+25%)		(+26%)		(+27%)
Multi-story without Large Trees	0 – 30%	12%	Within	12%	Within	11%	Within
Multi-story with Large Trees	10 – 35%	1%	Below (-9%)	1%	Below (-9%)	1%	Below (-9%)
Single-story with Large Trees	20 – 55%	<1%	Below (-20%)	<1%	Below (-20%)	<1%	Below (-20%)

[1]Stand Initiation: Growing space reoccupied following a stand replacing disturbance. One cohort of seedlings or saplings. Stem exclusion, closed canopy: Occurrence of new tree stems is excluded. Closed canopy (crown closure ≥35%). One cohort. Pole, small, or medium diameter trees (<21" dbh). Understory re-initiation: A second cohort of trees is established under an older overstory. Overstory of pole, small, medium diameter trees. Large trees (≥21" dbh) are uncommon. Understory of seedlings, saplings, or poles. Multi-story without Large Trees: Several cohorts of trees are established. Diverse distribution of tree sizes. Large trees (≥21" dbh) are uncommon. Multi-story with Large Trees (LOS): Several to many cohorts of trees. Large trees (≥21" dbh) are common. Multi-story without Large Trees (LOS): One or more cohorts of trees. One dominant canopy stratum. Large trees (≥21" dbh) are common.

Environmental Consequences – Measure #4

Alternative 1 (No Action)

Direct and Indirect Effects: No treatments to change existing vegetation conditions or trends would occur. Given no actions would occur with this alternative, there would be no cumulative effects.

Alternative (Proposed Action)

Direct and Indirect Effects: Thinning would decrease the number of acres of stem-exclusion closed canopy and multi-story without large trees. The proportion of stem-exclusion closed canopy would decrease (Table 37). Reductions in the multi-story without large trees would not be great enough to change the proportion of this structural stage on the landscape (Table 37). The proportion of both structural stages would remain within the Historic Range of Variability (Table 37). There would be a corresponding increase in the amount of understory reinitiation (Table 37), increasing by one percent the extent to which this structural stage is above the historic range of variability.

Thinning, mowing, and burning treatments would increase the likelihood that treated stands would move towards LOS conditions. Treatments would maintain or accelerate tree diameter growth and reduce the hazard of crown fires and bark beetle outbreaks. The proportion of the landscape affected by these treatments would, however, be relatively small. Gross treatment acres (3,021 acres) are approximately 7 percent of the HRV analysis area (Table 36).

Cumulative Effects: There would be additional changes in stand structure associated with the proposed action in combination with reasonably foreseeable thinning treatments within the analysis area (Table 5, page 40). Combined thinning treatments would reduce the proportion of the analysis area in the stem exclusion, closed canopy and multi-story without large tree structural stages (Table 37). The resulting proportion of the analysis area in these structural stages would remain within the historic range of variability. There would be an associated 2 percent increase in the amount of understory reinitiation structural stage (Table 37), which is currently 25 percent above the historic range of variability. Tree removal associated with future road access projects (Appendix E) would affect less than one percent of the forested portion of the analysis area (Table 36).

Thinning, mowing, and burning associated with foreseeable future actions (Appendix E) would further increase the likelihood that treated stands would move towards LOS conditions. These acres together with those proposed for treatment with the proposed action alternative would total approximately 5,120 acres, or approximately 15 percent of the forested portion of the HRV analysis area.

EFFECTS ANALYSIS – FOREST HEALTH

FOREST HEALTH MEASURE #1 – STAND SUSCEPTIBILITY TO BARK BEETLES

Introduction

Bark beetles can act as agents of change, affecting ecosystems directly and indirectly. These changes as they relate to stand hazard or potential for tree mortality (Fettig et al. 2007) are summarized by Samman and Logan (2000).

> Direct effects include individual tree death, changes in forest stand densities, changes in coarse woody debris, changes in forest floor litter, and changes in the amount of light reaching the forest floor. Indirect effects include timing, scale, and intensity of fire, changes in water quality and quantity, changes in wildlife use of the forest, changes in species composition, age, and size of remaining trees, and changes in commodity and/or amenity values.

Effects of bark beetles within the South Bend Project would be similar to those described by Sammon and Logan (2000) for ponderosa pine forest ecosystems in the Rocky Mountain area.

> Endemic beetle populations have minimal effects on ponderosa pine stands, killing individual and occasionally small groups of trees. If populations build to outbreak levels, 40 to 60 percent of the stand can be killed, depending on the age and size classes within the stand. Historically, endemic populations of low-level outbreaks have provided the fuel necessary for the periodic low-intensity fires that help perpetuate uneven-aged ponderosa pine stands. However with the exclusion of fire, stand densities increase and age-class diversity decreases, making these stands more susceptible to beetle population outbreaks. When a large-scale outbreak does occur, fuel loads will increase, leading to large-scale crown fires and replacement of tree cover with grasses and shrubs.

Sammon and Logan (2000) state "although bark beetle outbreaks are important in the ecological development of a forest landscape, resulting levels of tree mortality may exceed desirable levels, affecting multiple resource objectives including timber, wildlife, and recreation."

Rating systems for bark beetles are intended to serve as general guides that aid in the identification of susceptible stands (Fettig et al. 2007). For forest stands, hazard relates to factors which affect the likelihood of bark beetle occurrence such as tree species composition, age-size structure, stand density and precipitation (Fettig et al. 2007). Risk is a function of insect presence, abundance and distribution.

Measures, Scope and Scale of Analysis

The scale of analysis is the gross area being analyzed for treatment (Appendix A, 3,021 acres). Beyond treatment area boundaries, the effects of the treatments on beetle susceptibility are not considered to be quantitatively or qualitatively meaningful. Beetle susceptibility is measured in terms of the number of acres being considered for treatment that would exceed the upper management zone in the short term (within 10 years) and long term (within 30 years).

Methods

To rate stand susceptibility to bark beetles, this analysis compares the stand density index (SDI) projected by FVS to the calculated upper management zones. This follows a rating system described

for use on the Deschutes National Forest (USDA Forest Service 1996). The system uses the procedures described by Cochran et al. (1994) to identify stand densities above which mortality from bark beetle could be expected. This rating system was described by the Deschutes Science Team (USDA Forest Service 1996) as being "based on the published risk and hazard rating systems which are most applicable to eastern Oregon". The Science Team stated "it is important to understand that risk/hazard models are not intended to precisely reproduce the complexity of nature, but rather to identify and relate key biological features which may have predictive value" (USDA Forest Service 1996).

Where stand exam information was not available for stands being considered for treatment, stand susceptibility was rated by comparing the size/structure and canopy cover classified from remotely sensed satellite imagery data (2004) to that of stands rated using stand exam information (SDI).

Existing Condition

Mountain pine beetle (*Dendroctonus ponderosae* Hopkins) is currently causing tree mortality within the South Bend HFRA project area. The 2007 Aerial Survey (USDA Forest Service 2007b) mapped a few, scattered patches of beetle induced mortality within and immediately adjacent to the South Bend HFRA project area. Mapped patches of mortality are concentrated in the western portion of the project. Mortality levels average approximately 1 tree per acre. Mapped patch size range from approximately 2 acres to 90 acres in size. The majority of forest dominated stands being analyzed for treatment, (Groups 1 and 2) have relatively continuous canopy cover with stand densities above the upper management zone, making many of them susceptible to bark beetle attack. Stands that are a mosaic of shrubs and forested aggregations (Group 3) have patches of dense ponderosa pine susceptible to beetle attack dispersed throughout the stand. In these stands, the discontinuous and variable canopy cover lessens the risk of widespread mortality due to mountain pine beetle.

Alternative 1 (No Action)

Direct and Indirect Effects: Relative stand density would continue to increase as tree diameters increase. By 2018, approximately 54 percent of the area being analyzed for treatment would be susceptible to bark beetle attack (Table 38). By the year 2038, this amount would increase to approximately 56 percent (Table 38).

Table 38: Short and Long Term Beetle Hazard within Treatment Areas (3,021 Acres).

Time Scale	No Action		Proposed Action		
	Acres of Hazard	Percent of Analysis Area	Acres of Hazard	Percent of Analysis Area	Change in acres relative to Alternative 1
Short Term (2018)	1,665	54%	781	25%	-54%
Long Term (2038)	1,746	56%	1,630	53%	-4%

Mountain pine beetle would continue to attack and kill larger diameter trees (greater than 8 inches dbh). Western pine beetle (*Dendroctunus brevicomis* LeConte) and red turpentine beetle (*Dendroctunus valens* LeConte) could also kill large diameter pines that are slow growing, lightning struck, or heavily infected with mistletoe. Potential for beetle activity would be highest in those stands, or portions of stands, where densities are above the upper management zone. Scattered, incidental mortality from beetles would also occur in stands that are below the UMZ, primarily due to stress induced by lightning strikes or high levels of mistletoe infection. Mortality from beetles would most likely occur in periods of both normal and below normal precipitation, with accelerated tree mortality rates possible during periods of low precipitation.

In describing bark beetle-tree interactions and forest health, Fettig et al. (2007) indicate as growing space diminishes, a tree's photosynthates are allocated to different uses in an order of priorities. They indicate that while the hierarchy is not absolute, photosynthates are allocated lastly to insect and disease resistance mechanisms. They summarize that production of insect resistance mechanisms may be compromised when growing space becomes limited by one or more factors.

Potential for epidemic levels of mountain pine beetles to become established would be highest in those stands above the upper management zone. If epidemic levels of mountain pine beetles become established in these stands, up to 67 percent of the current basal area, mostly in the largest trees, could have expected mortality (Barrett 1979).

Alternative 1 (Proposed Action)

Direct and Indirect Effects: Reductions in stand densities associated with thinning treatments would change one of the factors that contribute to the likelihood of bark beetle occurrence. Vigor of trees would be maintained or improved, increasing the ability of trees to survive beetle attack. Burning could increase beetle attacks, but if scorch is maintained below 50 percent of the live crown (Veg-1 Mitigation), mortality as a result of the attacks would be expected to be low.

Thinning Treatment

Thinning would reduce the number of acres susceptible to bark beetles in the short term (Table 38). In the short term, acres susceptible to bark beetle attack would be decreased by approximately 54 percent. Within 20 years, many of the thinned stands are projected to grow to densities in excess of the upper management zone. Acres of hazard in the long term, would only be slightly less (4 percent) than the no action alternative. While thinning would reduce acres of hazard in the short term, potential for beetle-caused mortality would remain. With 10 to 20 percent retention of wildlife clumps within the treatment units, conditions favorable to beetles would remain both within and outside of thinning areas. Areas proposed for thinning range from approximately 10 to 120 acres in size. Mortality from bark beetles could be expected within thinned areas adjacent to wildlife clumps and adjacent densely stocked stands. Smaller thinned stands could be overwhelmed by mountain pine beetle activity within adjacent stands.

Thinning would maintain or improve the vigor of residual trees, making more of a tree's photosynthates available for production of insect resistance mechanisms (Fettig et al. 2007). Thinning would also change the physical environment within the stands, potentially resulting in increased temperatures and windspeeds. Increased temperatures and windspeeds may accelerate the development of certain bark beetle species and force them to overwinter in stages that are more susceptible to freezing (Fettig et al. 2007). Lower stand densities could result in unstable layers of air and multi-directional movement of air. As described by Fettig et al. (2007), this type of air movement dilutes pheromone concentrations and could result in reductions in beetle aggregation. Fettig et al. (2007) indicate a significant number of pioneer beetles are required to overcome host defenses and a lack of beetle recruitment often results in unsuccessful attacks.

Reduced insect activity in thinned stands has been observed in a long-term study evaluating the effects of prescribed fire and thinning in central Oregon ponderosa pine forests. This study includes plots in site and stand conditions similar to those found in the South Bend HFRA project. In reporting fifteen year results from the study, Busse et al. (2006) indicate tree mortality was absent in thinned plots, while insect-caused mortality was noted during the second-half of the study in unthinned stands (4 percent of unthinned trees).

Fettig et al. (2007) reviewed tree and stand factors associated with bark beetle infestations and analyzed the effectiveness of vegetation management practices for mitigating the negative impacts of bark beetles on forest ecosystems. Their review drew from 498 scientific publications. Among the conclusions reported by Fettig et al. (2007) was the following regarding the effect of thinning on bark beetle susceptibility:

> "Factors involving tree density are consistently associated with the occurrence and severity of bark beetle infestations. …thinning has long been advocated as a preventative measure to reduce the amount of bark beetle-caused tree mortality and its effectiveness for this purpose is supported by the scientific literature. Some studies of the efficacy of thinning have failed to detect significant differences among treatments, and others are limited to anecdotal evidence. However, to date there are no reports of significant increases in the amount of Dendroctonus spp. – caused tree mortality in response to thinning treatments. …"

Black (2005) reports findings seemingly contrary to Fettig et al. (2007) in a synthesis of reviewed research (sometimes referred to as the Xerces Report). For a discussion of the Black report and the rational for excluding the associated information, refer to Chapter 1, Opposing Views of this report.

Schmid and Mata (2005) studied mountain pine beetle-caused tree mortality in partially cut [thinned] stands surrounded by unmanaged stands. The study took place in ponderosa pine stands in the Black Hills National Forest in South Dakota. Schmid and Mata (2005) drew the following management implications from their research:

> While partial cutting [thinning] can eliminate substantial mountain pine beetle caused mortality, some mortality could be expected in partially cut stands adjacent to unmanaged stands, especially in the vicinity of their common boundaries. Mountain pine beetle populations in the control and the unmanaged adjacent stands increased to the point where their numbers began to overwhelm the partially cut [thinned] stands.

Underburn Treatment

Use of prescribed fire has the potential to increase beetle attacks within the burn area. Fire can kill foliage and buds in the crown, heat the trunk to such an extent to where part or all of the cambium is killed, and heat and kill the roots (Agee 1993). Trees damaged by fire, would be most susceptible to insect attack. As a general rule, if ponderosa pine trees retain at least 50 percent of the live crown that was present prior to the burn, mortality resulting from beetle attacks should be minimal (A. Eglitis, Zone Entomologist, 1999, personal communication). If less than this live crown is retained, particularly if less than 30 percent is retained, the survival of the tree is dependent on a number of factors, one of which is climatic conditions. (A. Eglitis, Zone Entomologist, 1999, personal communication)

The majority of trees within burn units would incur some level of crown and bole scorch. Following the burns, attacks by a variety of bark beetles could increase. Turpentine beetle attacks would not be expected to kill the trees but would make trees more susceptible to other insects. Increase in attacks by the pine engraver beetle (*Ips pini*), the western pine beetle, and the mountain pine beetle could occur. The pine engraver beetle can be the most significant mortality agent following an underburn. Beetle damage could continue up to 1 to 2 years. Increase in beetle activity would not be expected to expand into unburned stands. Within the burns, undamaged trees would generally not be susceptible to insect damage (A. Eglitis, Zone Entomologist, 1999, personal communication). If crown scorch on dominant and co-dominant trees is generally be less than 50 percent (VEG-1 Mitigation), increased beetle activity would be expected to cause minimal mortality.

VEG-1 Mitigation is considered moderately effective in minimizing fire damage to dominant and codominant trees. Even with this mitigation, variable fuels and changing weather conditions, can result in high intensity burning occurring within portions of a stand. This can result in crown scorch in excess of 50 percent and in some cases complete killing of foliage. Areas where scorch exceeds stated limits (Veg-1 Mitigation) would be monitored (Underburn Monitoring Item) for mortality resulting directly from the fire or indirectly from bark beetle attack.

Cumulative Effects: None of the actions that could contribute to cumulative effects overlap areas proposed for treatment. There would be no cumulative effects.

FOREST HEALTH MEASURE #2 – LEVEL OF DWARF MISTLETOE INFECTION

Introduction

Effects dwarf mistletoes have on their hosts include: 1) reduced height and diameter growth, 2) increased mortality, 3) reduced seed production and reduced seed viability, 4) reduced wood strength and increased knot size, 5) increased susceptibility to attack be insects, particularly bark beetles, and 6) increased flammability (Hawksworth 1978). Koonce and Roth (1980) describe the following effects mistletoe has on the flammability of ponderosa pine stands:

> Mistletoe may influence the frequency of fire by making stands more flammable. Mistletoe infected branches are often laden with resinous spindles and brooms which form fuel ladders leading to crowning fires. Fallen brooms persist in slash, increasing the amount of large, resinous, partially rotten, highly flammable material. In decadent stands, dwarf mistletoe increases the amount of dry, dead aerial fuel.

Hawksworth and Wiens (1996) state the following:

> By inducing formation of witches' brooms and causing topkill and mortality of host trees, dwarf mistletoes affect the species composition, vertical crown structure, and spacing of trees within infected stands. These direct effects, in turn, have numerous consequences on the physical structure and functioning of the ecosystem. For example, the brooms provide forage, nesting, and cover for birds and mammals, but also increase the likelihood of ground fires becoming crown fires. Canopy gaps caused by mistletoe–induced mortality increase within-stand diversity but also reduce the interior-forest area.

Depending on management objectives and priorities, the effects of dwarf mistletoe are interpreted as positive, negative, or usually of mixed consequence (Geils et al. 2002).

Measure

Level of dwarf mistletoe infection is expressed qualitatively in terms of the average dwarf mistletoe rating of infected trees.

Existing Condition

Ponderosa pine dwarf mistletoe (*Arceuthobium campylopodum*) is present within some of the areas proposed for thinning. Where mistletoe is present, stand dwarf mistletoe ratings (DMR) are generally less than 2. As a reference, thinning to eliminate dwarf mistletoe is recommended only where stand DMR is 3 or less (Hawksworth and Wiens 1996).

Alternative 1 (No Action)

Direct and Indirect Effects: Within single-story stands with mistletoe infection, dwarf mistletoe would continue to spread vertically in the crown of the tree. Severity of dwarf mistletoe infection would increase over time. Lateral spread of trees would occur in denser stands.

Within multi-story stands with mistletoe infection, the crowns of shorter trees would continually be exposed to mistletoe seeds from taller trees. The upper crowns of understory trees would rarely remain free of increasing mistletoe populations, and reduction in tree growth with further increase in mistletoe infection would almost be certain (Parmeter 1978). Without treatment or a high intensity wildfire, this cycle of infection would continue indefinitely, causing increased reductions in stand growth and increased mortality rates. Mortality patterns would vary from isolated trees to clumps of trees.

Alternative 2 (Proposed Action)

Direct and Indirect Effects: Thinning would remove trees with heavier dwarf mistletoe ratings (Appendix A, Thinning Prescription), but overall stand dwarf mistletoe rating would remain relatively unchanged. Simplified canopy structure and reduced stand density associated with thinning would reduce the probability of mistletoe seed dispersal to susceptible understory hosts and lateral spread among host trees (Hessburg et al. 1994).

Mowing and burning treatments would have little effect on stand dwarf mistletoe rating. According to Koonce and Roth (1980), scorch heights of 30 to 60 percent of the crown length are required to significantly reduce dwarf mistletoe infestations. They also state low intensity fires, appropriate for prescribed understory burning, are generally insufficient to sanitize the dominant trees, including old-growth, whose crowns are above the mean scorch height.

Cumulative Effects: None of the actions that could contribute to cumulative effects overlap areas proposed for treatment. There would be no cumulative effects.

Consistency

Healthy Forests Restoration Act (HFRA)

Consistent with the large tree provision of the act, thinning (Appendix A, Thinning Prescription) would focus largely on removing smaller diameter trees while retaining larger diameter trees (Forest Vegetation Measure # 2). No treatments are proposed within old growth stands (Forest Vegetation Measure # 5).

National Forest Management Act (NFMA)

Table 39 summarizes the volume that could be harvested with the proposed action as modeled using FVS. The proposed action could harvest approximately 3.1 MMBF from approximately 1,109 acres (gross). Trees to be cut and potentially removed would average 8 inches dbh.

Table 39: Proposed Action – Projected Volume Harvest

Structural Condition	Net Acres of Thinning [1]	Average Merchantable [2] Volume per Acre		Total Merchantable Volume from Project		Cut DBH[2] (Average)
		Cubic Foot (CCF)	Board Foot (MBF	Cubic Foot (CCF)	Board Foot (MBF)	
Single-story (Group 1)	467	590	2,600	2,750	1,200	10
Single and multi-story (Group 2)	389	780	3,800	3,000	1,500	8
Mosaic of shrubs and single/multi-story. (Group 3)	123	630	3,200	775	400	6
Total	979	---	---	6,525 CCF	3,100 MBF	---
Average	---	---	---	7 CCF/Acre	3 MBF/Acre	8

[1] Subtracts 10 to 20% from gross acres for clump retention and in some cases in Group 3, shrub dominated areas.
[2] Minimum merchantable diameter = 4 inches dbh
[3] Cut DBH reported in 2-inch diameter classes (i.e. 7.0 to 8.9 inches dbh = 8 inch diameter class).

…insure that timber will be harvested from National Forest System lands only where there is assurance that such lands can be adequately restocked within five years after harvest (16 USC 1604(g)(3)(E)(ii)).

Timber harvest associated with the proposed action would not reduce stocking below minimum levels (Forest Vegetation Measure #1). Adequate stocking levels would remain following harvest. While harvest would not create a reforestation need, district experience has demonstrated there is assurance that harvested lands could be adequately restocked within five years after harvest if a need was created.

… insure that timber will be harvested from National Forest System lands only where the harvesting system to be used is not selected primarily because it will give the greatest dollar return or the greatest unit output of timber(16 USC 1604(g)(3)(E)(iv)).

The increase in the average quadratic mean diameter and the retention of many of the larger diameter trees reflects the use of a harvesting system that primarily thins from below (Forest Vegetation Measure #2). This harvesting system focuses on removing the smaller diameter trees, which have a lower value than the larger diameter trees. This harvesting system was selected because of its effectiveness in positively changing key components of canopy structure related to crown-fire hazard (Forest Vegetation Measure #4). The harvesting system was not proposed because it will give the greatest dollar return or the greatest output of timber.

Reforestation Policy

Mitigation measure Veg-1 would minimize the potential for underburn treatments to create reforestation needs (Forest Vegetation Measure # 1 and 3 and Forest Health Measure #1). Identification of reforestation needs that may be created directly or indirectly by underburn treatments (Forest Underburn Monitoring Item) would be consistent with Forest Service policy to identify and report all reforestation needs resulting from forest fires.

Management Plans

Deschutes LRMP - Eastside Screens

Consistent with the Interim Ecosystem Standard, patterns of stand structure have been characterized by biophysical environment and compared to the Historic Range of Variability (Forest Vegetation Measure #5 and Appendix G of this report).

Consistent with the Interim Wildlife Standard, no timber sale harvest activities would occur within late or old structure stages that are below HRV. There would be no net loss of late or old structure. Harvest in the proposed action would:

1. Maintain components of LOS by maintaining all live trees $\geq$21 inches dbh that currently exist within stands proposed for harvest activities (Forest Vegetation Measure #2),
2. Generally manipulate vegetative structure in a manner that moves it toward LOS (Forest Vegetation Measure #2),
3. Generally manipulate vegetation to encourage development of large diameter, open canopy structure (Forest Vegetation Measures #2 and #4).

Deschutes LRMP – Deer Habitat Allocation

Thinning proposed in deer habitat, including areas where timber would be harvested, is needed to maintain tree vigor for resistance to bark beetle attack (Forest Health Measure #1). Stand density would be managed at the highest level that would maintain healthy stand conditions with a low risk of catastrophic damage due to bark beetles (Forest Vegetation Measure #1 and Forest Health Measure #1).

Deschutes LRMP – Scenic Views Management Allocation

Thinning would be limited to trees less than 21 inches dbh. This would be consistent with Standard and Guidelines M9-11 which directs trees greater than or equal to 24 inches dbh are to be retained within ponderosa pine retention foregrounds.

Consistent with Standard and Guideline M9-14, thinning would meet the objective of eventually producing trees of 24 inches in diameter and larger in the retention foreground (Forest Vegetation Measure #2).

WILDLIFE

SUMMARY OF EFFECTS INCLUDING THE BIOLOGICAL EVALUATION (BE)

The Wildlife biological evaluation (BE) summarized the determinations for each alternative in Table 40. It was determined that implementation of all of the proposed activities would have no effect to threatened, endangered, proposed, or candidate species; and would either have no impact or would impact individuals but would not likely cause a trend towards federal listing of any sensitive wildlife species or associated habitat.

Table 40: Summary of Conclusions for Species Considered Under the Biological Evaluation for the South Bend Project

Species	Alternative 1 (No Action)	Alternative 2 (Proposed Action)
Northern Bald Eagle	No impact	No impact
Northern Spotted Owl	No effect	No effect
Oregon Spotted Frog	No effect	No effect
Crater Lake Tightcoil	No impact	No impact
Bufflehead	No impact	No impact
Horned grebe	No impact	No impact
Red-necked grebe	No impact	No impact
Yellow rail	No impact	No impact
Pacific fisher	No effect	No effect
California wolverine	No impact	No impact

INTRODUCTION

Guidance and Direction

The following report meets the direction provided by the (Forest Service Manual FSM 2600), the Deschutes National Forest Land and Resource Plan (LRMP)[1990] as amended by the Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl (Northwest Forest Plan) [1994]. It specifically addresses the project's effects upon federally proposed or listed candidate, threatened, or endangered species, and forest-wide sensitive species, and the components of these species' habitats.
Projects proposed in occupied or potential habitat of any federal candidate, threatened, or endangered species on the Forest must be consistent with the Project Design Criteria (PDC) for the Joint Aquatic and Terrestrial Programmatic Biological Assessment (BA) for Fiscal Years 2006-09 (USDA et al. 2006), hereafter referred to as the Programmatic BA, in order to require no further consultation. This project is designed to meet the Programmatic BA's PDCs.

This report considers and applies the best science available; including papers, reports, literature reviews, review citations, peer reviews, science consistency reviews, and results of ground-based observations or surveys. The best available science was used to determine species or habitat presence and effects. A complete list of the science used can be found within the species discussions in this

section and in the Literature Cited section in Chapter 4. The last section of this chapter provides a discussion regarding other scientific literature that was brought to attention during the public scoping process.

Generally three documents, in addition to the Endangered Species Act, provide guidance or species lists for consideration in the management of federal lands. Management actions should minimize negative impacts, promote habitat development or provide habitat protection to some degree for those species that occur within the habitats on federally managed land. The three documents and associated species lists include the Deschutes National Forest – Management Indicator Species, the US Fish and Wildlife Service Birds of Conservation Concern and 2004 High Priority Shorebirds, and a Conservation Strategy for Landbirds of the East-Slope of the Cascade Mountains in Oregon and Washington. Species listed in these documents overlap with each other, as well as the federal threatened, endangered and sensitive species lists.

On January 31, 2008 the Regional Forester released an updated version of the Sensitive Species List. The letter contains the following paragraph on the updated Sensitive Species list: "The updated RFSS list included in Enclosure 1 will apply to all projects initiated on or after the date of this letter. **Projects initiated prior to the date of this letter may use the updated RFSS list transmitted in this letter or the RFSS list that was in effect when the project was initiated** (emphasis added). For the purpose of this letter, "initiated" means that a signed, dated document such as a project initiation letter, scoping letter, or Federal Register Notice for the project exists." (USDA 2008). The public scoping letter for the South Bend Project was signed on April 27, 2007. The South Bend Project used the Regional Forester's Sensitive Species list that was in effect when the project was initiated. Given this new direction, the new Sensitive Species list does not apply to the Snow Project.

Neotropical migratory birds have become species of interest recently, due to the downward trend of landbirds in the western United States. The decline of these populations are a result of many complex issues, but factors believed to be responsible include; loss, fragmentation, and alteration of historic vegetation communities. Other probable causes to the decline include predation from feral species, nest parasitism, and use of pesticides associated with agriculture areas. There is currently an Executive Order (13186) that provides for enhanced cooperation between the Forest Service and USFWS in regards to addressing impacts to neotropical migratory birds in conjunction with the Migratory Bird Treaty Act. Specific activities are identified where cooperation between the parties will substantially contribute to conservation and management of migratory birds, their habitat, and associated values, and thereby advances many of the purposes of the Executive Order.

In response to this Executive Order and subsequent compliance with the Migratory Bird Treaty Act, the Deschutes National Forest is currently following guidelines from the "Conservation Strategy for Landbirds of the East-Slope of the Cascade Mountains in Oregon and Washington" (Altman 2000). This conservation strategy addresses key habitat types as well as biological objectives and conservation strategies for these habitat types found in the East Slope of the Cascades, and the focal species associated with these habitats. The conservation strategy lists priority habitats: 1) Ponderosa Pine 2) Mixed Conifer (Late Successional) 3) Oak-Pine Woodland 4) Unique Habitats (Lodgepole Pine, White Bark Pine, Meadows, Aspen, and Subalpine Fir). There is no Mixed conifer (Late-Successional), Oak-Pine Woodland, Lodgepole Pine, Aspen, Subalpine fir, White Bark Pine, or Meadow habitat within the proposed treatment areas.

Another publication became available in 2002 from the U.S. Fish and Wildlife Service entitled "Birds of Conservation Concern 2002" (BCC) which identifies species, subspecies, and populations of all migratory nongame birds that, without additional conservation actions, are likely to become candidates for listing under the Endangered Species Act (ESA) of 1973. Bird species considered for inclusion on

lists in this report include nongame birds, gamebirds without hunting seasons, subsistence-hunted nongame species in Alaska, and Endangered Species Act candidate, proposed endangered or threatened, and recently delisted species. While all of the bird species included in BCC 2002 are priorities for conservation action, the list makes no finding with regard to whether they warrant consideration for ESA listing. The goal is to prevent or remove the need for additional ESA bird listings by implementing proactive management and conservations actions (USFWS 2002). From this publication, Bird Conservation Regions (BCRs) were developed based on similar geographic parameters. One BCR encompasses the Bend/Ft. Rock Ranger District –BCR 9, Great Basin. See "Landbird" discussion for a list of the bird species of concern for each area, the preferred habitat for each species, and whether there is potential habitat for each species within the proposed treatment areas. Species on these lists are discussed within this document if they were known to or potentially could occur within the proposed treatment areas.

In 2004, a publication called "High Priority Shorebirds – 2004 became available, also by the U.S. Fish and Wildlife Service. This publication identifies U.S. and Canadian shorebird populations that are considered highly imperiled or of high conservation concern by the U.S. Shorebird Conservation Plan as of August 2004.

ENVIRONMENTAL CONSEQUENCES

Table 42 (page 113), Table 44 (page 116), Table 57 (page 150), Table 58 (page 151), and Table 59 (page 154) contain the name, status, a brief habitat description, and the presence of habitat relative to this project of each of the wildlife species considered in this document. Following these tables is a brief review of the rationale for the "No habitat within or adjacent to proposed treatment areas" conclusion for each of the species for which this was made, and no further analysis will be completed. Those species with any other conclusion are further analyzed in this document.

Habitat manipulation affects species differently. An action that may increase habitat for one species may decrease habitat for another species. This list also shows the connection between the species and its different habitat components analyzed, particularly those components seen as being limiting factors for the species.

Analysis Methodology for Species Receiving Further Consideration

Field reviews

Protocol surveys to determine presence and nesting status were conducted for the goshawk. Specific timing and methodology can be found under the species discussion. Field reconnaissance (a majority by wildlife biologists and biological technicians) was conducted at various times in the spring, summer, and fall of 2000-2008 for habitat suitability specific to elk, deer, and cavity-nesters, as well as field visits for general habitat classification and verification. This does not include historical and past information gathered for other projects in the vicinity, or the days spent recreating by different wildlife staff members in which noting wildlife species observed or habitat variables is habitual.

Often during the surveys for some species, other species of concern were observed. Other sources of a species' documented presence come from local knowledge (birdwatchers, Oregon Department of Fish and Wildlife records, past District records, and casual observations from other field-going District personnel). The species discussions notes if individuals have been observed recently, or if presence is determined by historic records.

Assumptions

In the absence of scientifically rigorous surveys for all species listed within the different tables, a species was presumed present unless proven absent. The assumption is if appropriate habitat components are available, then that species occupies or could occupy the habitat. Analysis focused on the habitat components. Examples of specific habitat components analyzed include: snag/coarse woody material (CWM), green tree replacements (GTRs), late/old structural habitat (LOS). Conclusions as to the whether the proposed action would or would not cause a trend towards federal listing were determined by assessing how the alternatives impact the structure and function of the vegetation (i.e. habitat components) relative to the current and historic habitat availability in conjunction with state conservation status information and ranking for the species in the Natureserve (2007) database (http://www.natureserve.org/explorer).

In addition to field reconnaissance information, current analysis tools, best available science, and Geographical Information System databases provided additional information.

Some wildlife habitats required a more detailed analysis and discussion. Level of analysis depended on the existing habitat conditions (i.e. limited habitat availability versus widespread habitat availability), the magnitude and intensity of the effects of the proposed actions (i.e. would the proposed actions cause a loss, no change, or increase in habitat), the risk to the resources (sustainability and availability of the habitat), and the issues identified. These factors were used to form conclusions as to how the information in regards to the effects would be useful and relevant in the process of making an informed decision.

Methodology for Cumulative Effects including Bounding

For a majority of species in this report, potential cumulative effects were bounded by the adjacent project areas (Sunriver HFRA, Fuzzy, OZ), and for deer and elk the combined Winter Range Analysis Unit (WRHU): Green Mountain. The proposed activities would occur on 3,021 acres. This cumulative effects scale was chosen as the initial bound because it sets a common management boundary (the area encompasses some of the biological winter range for deer and elk). This boundary also takes in multiple territories of a majority of wildlife species and gives a landscape perspective in regards to management and human uses. Treatment areas were selected on the basis of their strategic location in preventing a forest wildfire from spreading onto adjacent private land. The proposed actions are conducive to the strategies detailed in the Greater Bend Community Wildfire Protection Plan.

For bounding in time, generally 20 years is considered because it not only can represent multiple generations of a species, but also tree growth can alter the classification of habitat structure in this timeframe, and often new management policies are in place.

For analysis of cumulative effects and other actions, the present and reasonably foreseeable actions that have been considered are listed in Table 5, page 40 at the beginning of Chapter 3. Any effects of past actions are indistinguishable from each other and combined have been considered as part of the existing condition and the suitability or quality of the habitat.

Summary of Proposed Actions and Anticipated Effects

Table 41 summarizes the proposed action and the anticipated effect to forest structure. These anticipated effects were used to help analyze the amount of a species' habitat before and after the proposed action. Refer to the individual species analysis for details. All commercial harvest would use ground based logging methods. Refer to Table 4, page 14 of the Wildlife BE and BA in the project record for a complete summary with units and project description.

Table 41: Summary of Alternative 2 (Proposed Action)

Proposed Action	Anticipated Effects
1: Commercial thinning	Reduction of canopy closure; multi-layer stands to single layer; reduction of dead wood density
2: Precommercial thin	Reduction of multi-layers; reduction of hiding cover
3: Mowing and underburning	Reduction of shrub habitat and forage
4: Hand piling of slash	No adverse effects anticipated
5: Pruning	Incidental reduction of multi-layered canopy; reduction in hiding cover
6: Whole-tree yarding	No adverse effects anticipated

Threatened and Endangered Species Considered Under a Biological Evaluation (BE)

Table 42: Threatened and Endangered Wildlife Species Considered

Species	Status*	Habitat	Presence
Canada lynx	Federal Threatened	Subalpine fir with lodgepole pine	No Habitat within or adjacent to proposed treatment areas
Northern Spotted Owl	Federal Threatened, MIS	Old growth mixed conifer forests	No Habitat within or adjacent to proposed treatment areas
Oregon Spotted Frog	Federal Candidate, Regional Forester Sensitive	Stream, marsh	No Habitat within or adjacent to proposed treatment areas

***Federally listed and Regional Forester Sensitive** species come from the Region 6 Threatened, Endangered, and Sensitive species list for the Deschutes National Forest. These species were considered but not further considered in detail.

Rationale for Species not Considered in Detail

Lynx: In a letter to all District Wildlife Biologists on the Deschutes an Ochoco National Forest[s] and the Crooked River National Grassland (File code 2670; June 18, 2003) from Shane Jeffries and Dave Zalunardo, Forest Wildlife Biologists for the Deschutes and Ochoco National Forest (respectively), a determination was made that no lynx habitat or self-maintaining populations are present on these three administrative units. The rationale included using the best available science and guidance, and field surveys conducted on these units in 1999, 2000, and 2001. The authors of the letter relied upon the Lynx Biology Team's definitions of habitat and definitions that are part of the Lynx Conservation Assessment and Strategy. The US Fish and Wildlife Service was an integral part of both the Biology Team and the Conservation Assessment and Strategy. Due to lack of habitat, any actions or no action within the proposed treatment areas would have no effect to this species. The full letter documenting the rationale can be found in Appendix A of the Wildlife BE/BA in the Project Record located at the Bend-Ft. Rock Ranger District.

Suitable **northern spotted owl** nesting habitat on the Deschutes National Forest includes stands of mixed conifer, ponderosa pine with white fir understories, and mountain hemlock with subalpine fir; exclusive of high-elevation subalpine forests and low-elevation lodgepole pine/ponderosa pine forests. Suitable habitat is naturally fragmented by intrusions of lava and other forest types. It is not found in large patches but as inclusions of other stands (2006-2009 Programmatic BA). The proposed action areas are outside the range of the northern spotted owl. Due to lack of habitat, any actions or no action within the proposed treatment areas would have no effect to this species.

The **Oregon spotted frog** inhabits the margins of lakes, marshes, and pools in streams where there is an abundant growth of vegetation (Csuti et al. 2001). Literature cited in the Conservation Assessment (Cushman and Pearl, 2007) describes spotted frog breeding habitat as moderate to large wetlands with extensive emergent marsh coverage that warms substantially during seasons when Oregon spotted frogs are active on the surface (February to May). Sites always include some permanent water juxtaposed to seasonally inundated habitat. In literature cited within USFWS Species Assessment and Listing Priority Assignment Form (October, 2005), the Oregon spotted frog is inhabits emergent wetland habitats in forested landscapes, although it is not typically found under the forest canopy. There are no bodies of water or riparian habitat within or near the proposed action areas. Due to lack of habitat, any actions or no action within the proposed treatment areas would have no effect to this species.

Regional Forester's Sensitive Species Considered Under a Biological Evaluation (BE)

Table 43: Regional Forester's Sensitive Species Considered (Bold Receives Further Consideration)

Species	Status*	Habitat	Presence
Harlequin Duck	Regional Forester Sensitive, MIS	Rapid streams, large trees	No Habitat within or adjacent to proposed treatment areas
Tricolored blackbird	Regional Forester Sensitive, BCC	Lakeside, bullrush	No Habitat within or adjacent to proposed treatment areas
Greater sage grouse	Regional Forester Sensitive, BCC	Sagebrush flats	No Habitat within or adjacent to proposed treatment areas
American peregrine falcon	Regional Forester Sensitive, BCC	Riparian, cliffs	No nesting habitat within or adjacent to proposed treatment areas.
Pygmy rabbit	Regional Forester Sensitive	Sagebrush flats	No Habitat within or adjacent to proposed treatment areas
Crater Lake Tightcoil	Regional Forester Sensitive	Wet vegetation zone	Documented within general project area.
Northern Bald Eagle	Regional Forester Sensitive, MIS	Lakeside or riverside with large trees	Documented within general project area; no nesting within proposed units
Pacific fisher	Regional Forester Sensitive	Mixed conifer forest, complex forest structure	Historical documentation and unconfirmed reporting near the general project area. Potential habitat within some of the proposed units.
Bufflehead	Regional Forester Sensitive, MIS	Lakes, snags	Documented within the general project area.
Horned grebe	Regional Forester Sensitive, MIS	Lakes	Documented on Wickiup Reservoir. Potential habitat on lakes within the general project area
Red-necked grebe	Regional Forester Sensitive, MIS	Lakes	Potential habitat on lakes within the general project area. No Habitat within or adjacent to proposed treatment areas
Yellow rail	Regional Forester Sensitive, BCC	Marsh	Potential habitat on lakes within the general project area. No Habitat within or adjacent to

Species	Status*	Habitat	Presence
			proposed treatment areas
California wolverine	Regional Forester Sensitive	Mixed conifer habitat, high elevation	Historical documentation near the general project area. Potential habitat within some of the proposed units

***Federally listed and Regional Forester Sensitive** species come from the Region 6 Threatened, Endangered, and Sensitive species list for the Deschutes National Forest; **MIS = Management Indicator Species** come from the Deschutes National Forest Land and Resource Plan (LRMP)[1990]; **BCC = Birds of Conservation Concern** come from the US Fish and Wildlife Service Birds of Conservation Concern – BCR 9 (Great Basin) [2002];

For the rationale for the species not considered in detail, refer to the Project Record, Wildlife Report, beginning on page 7. These species are Harlequin Duck, Tri-colored Blackbird, Greater sage grouse, American Peregrine Falcon, Pygmy Rabbit, Crater Lake Tightcoil, Pacific Fisher, Bufflehead, Horned Grebe, Red-necked Grebe, Yellow Rail, and Wolverine. Rationale is also briefly provided in Table 43.

Species Receiving Further Consideration

Bald Eagle *(Haliaeetus leucocephalus) S4 Apparently Secure*

Summary

Alternative 2 would have no impact to bald eagles. Use of the proposed units is incidental, and the most likely foraging areas are either along Highway 97 for road kill or the Deschutes River which is over 1.5 miles from the closest proposed unit. The trees within the units are too small to support a bald eagle nest.

The recommendations for timber and forestry practices detailed in the U.S Fish and Wildlife Service National Bald Eagle Guidelines (USDI 2007) have been met. These recommendations focus on limiting disturbance to active nests through seasonal restrictions and maintenance of buffers or screening of nests.

Existing Condition

According to literature cited within the 2006-2009 Programmatic BA, bald eagle nesting territories are normally associated with lakes, reservoirs, or rivers. Nests are usually located in large conifers in uneven-aged, multi-storied stands with old-growth components. Factors such as tree height, diameter, tree species, position on landscape, distance from water, and distance from disturbance also appear to influence nest selection. Bald eagles often construct several nests within a territory and alternate between them year to year. Snags, trees with exposed lateral branches, or trees with dead tops are often present in nesting territories and are used for perching. This type of habitat is not available inside of or within 0.25 miles of any of the proposed units.

Bald eagle nests have been observed on the Fort Rock portion of the district many, many miles from any water source. However, these nests are within large diameter (greater than 30") ponderosa pines. With large diameter ponderosa pines seemingly being the common denominator for eagle use on the Fort Rock portion and the lack of such large diameter trees in the project area, there is no nesting habitat within a 0.25 mile radius of any proposed unit.

Alternative 1 (No Action)

Direct and Indirect Effects: No effects to bald eagles would occur. Use of the area by bald eagles is incidental and focused on road kill deer along 97 or slower parts of the Deschutes River.

Alternative 2 (Proposed Action)

Direct and Indirect Effects: Alternative 2 proposes actions on 2,268 acres (this accounts for untreated areas within units that are retained as mitigation measures). Because of the limited use of the area by bald eagles, the proposed actions would not impact this species. Any impact would have to be a chance event of an eagle either flying over the project area or feeding on a carcass during project implementation. Bald eagles are ordinarily on their nesting territories by early spring, and the chance of this kind of event happening is extremely small.

Cumulative Effects: Many of the projects listed in Table 5 (page 40) focus on reduction of fuels through thinning, prescribed fire, and mowing. Other projects focus on grazing, hazard tree removal and motor vehicle management. None of these projects would have additive or synergistic effects with the proposed actions to the incidental bald eagle use of the area because of the limited scope of eagle use and lack of direct and indirect effects to bald eagles from the proposed actions.

Management Indicator Species

Table 44: Management Indicator Species (MIS) Considered (Bolded Receive More Detailed Analysis)

Species	Status*	Habitat	Presence
Golden eagle	MIS, BCC	Large open areas with cliffs and rock outcrops	No Habitat within proposed treatment areas; potential habitat adjacent to proposed treatment areas
Great gray owl	MIS	Mature and old growth forests associated with openings and meadows	No Habitat within or adjacent to proposed treatment areas
Northern goshawk	MIS	Mature and old-growth forests; especially high canopy closure and large trees	Documentation in the general project area. Potential habitat in proposed units
Cooper's hawk	MIS	Similar to goshawk, can also use mature forests with high canopy closure/tree density	Potential habitat in proposed units.
Sharp-shinned hawk	MIS	Similar to goshawk in addition to young, dense, even-aged stands	Potential habitat in proposed units.
Great blue heron	MIS	Riparian edge habitats including lakes, streams, marshes and estuaries	No Habitat within or adjacent to proposed treatment areas
Red-tailed hawk	MIS	Large snags, open country interspersed with forests	Documented in the general project area. Potential habitat in proposed units.
Osprey	MIS	Large snags associated with fish bearing water bodies	No Habitat within or adjacent to proposed treatment areas
Townsend's big-eared bat	MIS	Caves and old dwellings	No Habitat within proposed treatment areas; potential habitat adjacent to proposed treatment areas

Species	Status*	Habitat	Presence
Elk	MIS	Mixed habitats	Documented in general project area. Potential habitat within proposed units
American marten	MIS	Mixed conifer or high elevation late-successional forests with abundant down woody material	No Habitat within or adjacent to proposed treatment areas
Mule deer	MIS	Mixed habitats	Habitat in proposed treatment areas
Snags and Downed Wood associated species and habitat	MIS	Snags and down woody material	Habitat in proposed treatment areas
Waterfowl Species:			
Common loon	MIS	Edges of remote freshwater ponds and lakes	No Habitat within or adjacent to proposed treatment areas
Pied-billed grebe	MIS	Edge of open water in freshwater lakes, ponds, sluggish rivers and marshes	No Habitat within or adjacent to proposed treatment areas
Eared grebe	MIS	Open water with emergent vegetation	No Habitat within or adjacent to proposed treatment areas
Western grebe	MIS	Marshes with open water and lakes and reservoirs with emergent vegetation	No Habitat within or adjacent to proposed treatment areas
Canada goose	MIS	Variety of habitat: shores of lakes, rivers, and reservoirs especially with cattails and bulrushes	No Habitat within or adjacent to proposed treatment areas
Wood duck	MIS	Cavity nester	No Habitat within or adjacent to proposed treatment areas
Gadwall	MIS	Concealed clumps of grasses in meadows and tall grasslands	No Habitat within or adjacent to proposed treatment areas
American widgeon	MIS	Clumps of grasses in meadows or tall grasslands	No Habitat within or adjacent to proposed treatment areas
Mallard	MIS	Open water with emergent vegetation	No Habitat within or adjacent to proposed treatment areas
Blue-winged teal	MIS	Marshes, lakes, ponds, slow-moving streams	No Habitat within or adjacent to proposed treatment areas
Cinnamon teal	MIS	Cover of vegetation near shoreline	No Habitat within or adjacent to proposed treatment areas
Northern shoveler	MIS	Grassy areas near water	No Habitat within or adjacent to proposed treatment areas
Northern pintail	MIS	Open areas near water	No Habitat within or adjacent to proposed treatment areas
Green-winged teal	MIS	Freshwater marshes with emergent vegetation	No Habitat within or adjacent to proposed treatment areas
Canvasback	MIS	Emergent vegetation	No Habitat within or adjacent to proposed treatment areas
Redhead	MIS	Freshwater marshes and lakes concealed in vegetation	No Habitat within or adjacent to proposed treatment areas
Ring-necked duck	MIS	Thick emergent vegetation on shorelines	No Habitat within or adjacent to proposed treatment areas

Species	Status*	Habitat	Presence
Lesser scaup	MIS	Dry grassy areas near lakes at least 10 ft. deep	No Habitat within or adjacent to proposed treatment areas
Common goldeneye	MIS	Cavity nester	No Habitat within or adjacent to proposed treatment areas
Barrow's goldeneye	MIS	Cavity nester	No Habitat within or adjacent to proposed treatment areas
Hooded merganser	MIS	Cavity nester	No Habitat within or adjacent to proposed treatment areas
Common merganser	MIS	Cavity nester	No Habitat within or adjacent to proposed treatment areas
Ruddy duck	MIS	Freshwater marshes, lakes, ponds in dense vegetation	No Habitat within or adjacent to proposed treatment areas
Woodpecker Species			
Red-naped sapsucker	MIS	Riparian hardwood forests	No Habitat within or adjacent to proposed treatment areas
Downy woodpecker	MIS	Riparian hardwood forest	No Habitat within or adjacent to proposed treatment areas
Lewis' woodpecker	MIS, Landbird focal species, BCC	Ponderosa pine forests, burned forests	Documented in general project area. Potential habitat in some of the proposed units.
Williamson's sapsucker	MIS, Landbird Focal species, BCC	Mature or old growth conifer forests with open canopy cover; weak excavator	No Habitat within or adjacent to proposed treatment areas
Hairy woodpecker	MIS	Mixed conifer and ponderosa pine forests	Documented in general project area. Potential habitat in some of the proposed units.
White-headed woodpecker	MIS, Landbird focal species, BCC	Mature ponderosa pine forests; weak excavator	Potential habitat in proposed treatment areas
Three-toed woodpecker	MIS	High elevation and lodgepole pine forests	No Habitat within or adjacent to proposed treatment areas
Black-backed woodpecker	MIS, Landbird focal species	Lodgepole pine forests, burned forests	Documented in general project area. Potential habitat in some of the proposed units.
Northern flicker	MIS	Variety of forest types but more associated with forest edges	Documented in general project area. Potential habitat in some of the proposed units.
Pileated woodpecker	MIS	Mature to old-growth mixed conifer forests	No Habitat within or adjacent to proposed treatment areas

***Federally listed and Regional Forester Sensitive** species come from the Region 6 Threatened, Endangered, and Sensitive species list for the Deschutes National Forest; **Landbird focal** species come from the Conservation Strategy for Landbirds of the East-Slope of the Cascade Mountains in Oregon and Washington (Altman 2000); **MIS = Management Indicator Species** come from the Deschutes National Forest Land and Resource Plan (LRMP)[1990]; **BCC = Birds of Conservation Concern** come from the US Fish and Wildlife Service Birds of Conservation Concern – BCR 9 (Great Basin) [2002]; and **Shorebirds** come from the 2004 US Fish and Wildlife Service U. S. Shorebird Conservation Plan.

Rationale for Species not Considered in Detail

The **Northern Bald eagle** was discussed under the Region Forester's Sensitive Species List.

For the rationale for the species not considered in detail, refer to the Project Record, Wildlife Report, beginning on page 14. Rationale is also briefly provided in Table 44. These species include Harlequin Duck, Tri-colored Blackbird, Greater sage grouse, American Peregrine Falcon, Pygmy Rabbit, Crater Lake Tightcoil, Pacific Fisher, Bufflehead, Horned Grebe, Red-necked Grebe, Yellow Rail, and Wolverine.

For the following species, there is no habitat within or adjacent to proposed treatment areas: **Golden Eagle, Great Gray Owl, Marten, Williamson's Sapsucker, Red-naped Sapsucker, Downy Woodpeckers, Three-toed Woodpecker, and Pileated Woodpecker.** For more detailed discussion refer to the Project Record, Wildlife Report, beginning on page 14.

The following species are dependent on riparian or water habitat: **Great Blue Heron, Osprey, Pied-billed Grebe, Eared Grebe, Canada Goose, Gadwall, American Widgeon, Mallard, Blue-Winged Teal, Cinnamon Teal, Northern Shoveler, Northern Pintail, Green-winged Teal, Canvasback, Redhead, Ruddy Duck**, **Common Loon**, **Western Grebe**, **Ring-necked Duck**, **Lesser Scaup**, **Wood Duck**, **Common Goldeneye** , **Barrow's Goldeneye**, **Hooded Merganser**, and **Common Merganser**. Because there is no riparian or water habitat within, adjacent, or near the proposed units and because a lack of habitat assumes a lack of presence of these species, any actions or no action within the proposed treatment areas would have no impact and would not contribute to a trend towards federal listing of these species.

Species Receiving Further Consideration

Northern Goshawk *S3 Vulnerable*

Summary and Plan Consistency

There would be minimal adverse effects to goshawks. If a nest is found during implementation then a seasonal restriction on all activities would be in effect around the new nest (mitigation). As a Management Indicator Species under the LRMP, the standards and guidelines are met through the analysis of available habitat and the provision for seasonal restrictions.

District records and survey efforts have not discovered any goshawk nests within or near the proposed treatment units. No new "Post Fledging Area" (PFAs) or 30 acre nest cores need to be established, and all proposed actions take place well away from any designated ones.

The Screens, however, do include under Scenario A (5) a) that all active and historically used goshawk nest site be protected from disturbance. The LRMP judges a disturbance distance of ¼ mile for non-blasting activities. Although there are no known or historic goshawk nests in the proposed treatment units, it is possible, due to the fact that goshawks are living beings and can move, and that a nest may be discovered in the interim between project implementation and completion. Mitigation measures address this circumstance.

- WL-6: "nesting habitat for at least 40 goshawk pairs will be provided in mixed conifer, mountain hemlock, and ponderosa pine forests…Habitat for an additional 30 pairs in lodgepole pine forest…" According the Screens, a nest core should be 30 acres in size; in the LRMP, nesting stands should be at least 25 acres in size. Of the potential habitat within treatment units, there are only two portions that are part of potential habitat clumps meeting at least these size definitions. Most of the other habitat is in smaller parcels of <10 acres. Nesting habitat will develop, in the long-term, within the

proposed units, and the largest potential nesting habitat clumps are outside of the treatment areas. Mitigation measures will ensure that any nests discovered receive protection.

- WL-7: "Nesting habitat is available in …old growth (MA15)…" there are no MA15 areas within or adjacent to the treatment units.
- WL-9: "Nest sites will be selected on the basis of present or past use whenever possible…" The proposed treatment areas and an adjacent larger area have been surveyed. No nesting goshawks were found.

Existing Condition

In Oregon, goshawks tend to select mature or old-growth stands of conifers for nesting, typically those having a multi-layered canopy with vegetation extending from a few meters above ground to more than 40 meters high. Generally nesting sites are chosen near a source of water and are on moderate slope, usually having northerly aspects. This habitat type is quite similar to that used by the Cooper's hawk, but the trees tend to be older and taller and have a better-developed understory of coniferous vegetation (Reynolds, Meslow, and Wight, 1982 *in* Marshall et al., 2003). Foraging generally occurs within these mature stands where small openings occur. These birds forage on passerines (e.g. songbirds), but often utilize small mammals such as rodents as well as the occasional snowshoe hare. Some gallinaceous bird species are also preyed upon such as blue and ruffed grouse. Species and abundance of gallinaceous prey varies in the range of the goshawk depending on elevation and latitude.

Within "Scenario A of the Eastside Screens Standard and Guides" as it amends the Deschutes LRMP, the direction for management is as follows:

- Protect every known active and historically used goshawk nest-site from disturbance. "Historically" refers to known nesting activity occurring at the site in the last 5 years. Seasonal disturbance restrictions may be implemented at sites.
- 30 acres of the most suitable nesting habitat surrounding all active and historical nest tree(s) will be deferred from harvest.
- A 400 acres PFA will be established around every known active nest site. While harvest activities can occur within this area, retain the LOS stands and enhance younger stands toward LOS condition, as possible.

Surveys have been conducted within the proposed treatment areas over the course of several years to determine species presence and locate nest sites. Surveys of potential northern goshawk habitat in the proposed treatment areas were conducted in 1998, 2000, 2001, using the method outlined by B. Woodbridge (1993), and in May, 2005 using the method outlined in Woodbridge and Hargis (2005). Goshawk responses in 1998, 2000, and 2001 were within known territories but nesting was not always confirmed (Table 45). In 2005, a survey was conducted in areas partially surveyed in previous years. There were no goshawk responses.

Table 45: Closest Recorded Goshawk Nest Sites, Post Fledging Areas, and Activity Status in Relation to the Proposed Units

Species	Nest #	Last known activity	Distance to Units
Northern Goshawk	3030	1988. Nest has not been located since '88 but vocal response and visual in proximity in 2000 and 2001. Nest core and post-fledging area designated	3.0 miles
Northern Goshawk	3031	1998 Nest core and post-fledging area designated	2.5 miles

Although there were no nesting goshawks were found within the proposed treatment areas, the areas do overlap approximately 213 acres of potential habitat, defined as stands with a mean canopy cover of 60% or greater, tree density of at least 195 trees per acre, stand age of 100 years or more (LRMP WL-9). This amounts to approximately 14% of potential habitat (a total of 1,531 acres meeting this definition within a 46,000 ac cumulative effects area).

Alternative 1 (No Action)

Direct, Indirect, and Cumulative Effects: Although there would be no effects to goshawks as a result of this alternative because there are no actions that would cause a change and effect from the existing condition, taking no action could have consequences to goshawk habitat.

In the short-term, there would be no effect to goshawk, potential habitat would remain, but a majority of the potential nesting habitat for this species is also at high risk to wildfire.

In the long-term, there would be increasing risk of the potential nesting habitat being lost to wildfire mortality. Loss of nesting habitat could effectively displace these species from the project area. It would take decades for nesting habitat to return.

Alternative 2 (Proposed Action)

Direct and Indirect Effects: Commercial and pre-commercial thinning would degrade goshawk habitat, in the short-term because it would reduce the multi-storied character and/or canopy closure. Where treatment units overlap potential goshawk habitat, 80 acres would be thinned/degraded (5% of the potential habitat in the larger area). Underburning or mowing, without associated commercial thinning, is not expected to have impacts to potential goshawk nesting habitat because they focus on the ground cover. As the remaining trees respond to thinning with diameter growth, more suitable nesting habitat than presently available is expected.

The proposed actions are not expected to impact the known territories (3030, 3031), and these territories are expected to remain as functioning nesting habitat. The proposed actions may impact dispersing goshawks as they move through the area. The habitat affected is of low quality because there are few trees of the size utilized for nesting (greater than 20" dbh), the acres lie within 1 mile of a subdivision, and an active railroad track is within 0.5 miles.

Cumulative Effects: An additional 80 acres of potential goshawk habitat would be degraded. The Sunriver HFRA project degraded 79 acres of habitat. Combined, there would be an additional 159 acres (10%) degradation of goshawk habitat over a 46,000 acre area. All activities involve thinning within low quality habitat and because the degradation would be short-term within habitat with low potential, the additive effects should be minimal.

There would be an additional 18 acres of forest eliminated due to Hwy 97 widening and interchange development and rerouting access. Although this is presently not goshawk habitat, it represents a long-term removal of forest that may have developed into habitat.

Cooper's Hawk *S4 Apparently Secure*

Summary and Plan Consistency

There would be minimal negative effects to Cooper's hawks. If a nest is found during implementation then a seasonal restriction on all activities would be in effect around the new nest. As a Management Indicator Species under the LRMP, the standards and guidelines are met through the analysis of available habitat and the provision for seasonal restrictions.

- WL-13: "Nesting habitat for at least 60 pairs of Cooper's hawk will be provided in mixed conifer and ponderosa pine forests outside of wilderness and the Oregon Cascades Recreation Area." The proposed treatment areas will degrade 86 acres of potential Cooper's hawk nesting habitat. This acreage is scattered into various sized parcels from 5-34 acres. Because these affected acres are scattered, and not concentrated on one territory. Overall nesting habitat is still being provided.
- WL-16: "Prospective sites with appropriate vegetative structure…will be identified before they have been precommercially or commercially thinned…" Potential habitat was identified and it has been acknowledged that commercial thinning would affect habitat. Mitigation measures will ensure that any nests discovered receive protection.

Existing Condition

The Cooper's hawk prefers coniferous, mixed and deciduous forests, as well as riparian, juniper, and oak woodlands. Vegetative profiles around nests are trees 30 to 60 and 50 to 70 years old in northwest and eastern Oregon, respectively with tree densities of 265 per acre and 469 per acre. Cooper's hawks commonly nest in deformed trees infected with mistletoe (Henny, C. J. *in* Marshall et al. 2003). There are no known Cooper's hawks nests within or adjacent to the proposed treatment areas (Table 46). Surveys for goshawks, often can disclose Cooper's hawk territories, and any Cooper's hawk responses were noted during goshawk surveys. During the survey for goshawks, no Cooper's hawks were found. Immature Cooper's hawks have been observed in the watershed as recently as August 2007. The observations, however, were of fledged, immature Cooper's hawks and the location of the observation is not a reliable prediction of where they nested. The observations do illustrate that nesting does occur within the watershed.

Table 46: Closest Recorded Cooper's Hawk Nest Sites and Activity Status - Relation to Proposed Units

Species	Nest #	Last known activity	Distance to Units
Cooper's Hawk	3074	1995	2.5 miles
Cooper's Hawk	3082	1995	5 miles
Cooper's Hawk	3095	1996	2.5 miles
Cooper's Hawk	Nest found during a field check	2004	3 miles

Potential habitat for this species is similar as the goshawk. Within the larger 46,000 acre watershed area there is approximately 3,144 acres of potential Cooper's hawk habitat (86 acres of this within proposed units) when using the LRMP definition of a stand has a "mean canopy cover of 60% or greater, tree density of at least 365 trees per acre, stand age of 50-80 years (LRMP WL-17). A Cooper's hawk territory can be 200-1,700 acres in size; with ranking in Oregon being "apparently secure"(Natureserve, 2006). This information would suggest that the larger area may have up to 2 pairs of Cooper's hawks when using the larger territory size.

Alternative 1 (No Action)

Direct, Indirect, and Cumulative Effects: Although there would be no effects to Cooper's hawks as a result of this alternative because there are no actions that would cause a change and effect from the existing condition, taking no action could have consequences to Cooper's hawk habitat.

In the short-term, there would be no effect to Cooper's hawks, potential habitat would remain, but a majority of the potential nesting habitat for this species is also at high risk to wildfire.

In the long-term, there would be increasing risk of the potential nesting habitat being lost to wildfire mortality. Loss of nesting habitat could effectively displace these species from the project area. It would take decades for nesting habitat to return.

Alternative 2 (Proposed Action)

Direct and Indirect Effects: Similar to the effects to goshawks, pre-commercial and commercial thinning would degrade habitat, in the short-term. Where treatment units overlap potential Cooper's hawk habitat, 86 acres would be thinned/degraded (3% of the potential habitat in a larger area of 46,000 ac). Underburning or mowing, without associated thinning, is not expected to have impacts to potential habitat because it focuses on the shrub component which is not heavily utilized by this species. As the remaining trees respond to thinning with diameter growth, more suitable nesting habitat than presently available is expected.

The proposed actions are not expected to impact Cooper's hawk foraging. Juxtaposition of non-treatment areas both within the units and adjacent to the units would provide for a diversity of prey. This juxtaposition would also minimize any impacts to any fledged Cooper's hawks from the larger area.

The proposed actions are not expected to impact the known territories (Table 4), and these territories are expected to remain as functioning nesting habitat. The proposed actions may impact dispersing Cooper's hawks as they move through the area.

Cumulative Effects: This alternative degrades an additional 86 acres of potential goshawk habitat. The Sunriver HFRA project degraded 79 acres of habitat. Combined, there will have been an additional 165 acres (0.4%) degradation of Cooper's hawk habitat over a 46,000 ac area. All activities involve thinning and because the degradation would be short-term, the additive effects should be minimal.

There would be an additional 18 acres of forest eliminated due to Highway 97 widening and interchange development and rerouting access. Although this is not Cooper's hawk habitat presently, it represents a long-term removal of forest that may have developed into habitat.

Sharp-shinned Hawk *S4 Apparently Secure*

Summary and Plan Consistency

There would be minimal adverse effects to sharp-shinned hawks as a result of the alternatives. If a nest is found during implementation then a seasonal restriction on all activities would be in effect around a new nest. As a Management Indicator Species under the LRMP, the standards and guidelines are met through the analysis of available habitat and the provision for seasonal restrictions.

Existing Condition

Sharp-shinned hawks, in Oregon, breed in a variety of forest types that have a wide range of tree species, though most are dominated by conifers. Nests have been located at elevations that range from roughly 300 to 6000 feet. Vegetative characteristics found at nest sites include high tree density and high canopy cover which produce cool, shady conditions. Nest stands preferred by sharp-shinned hawks are younger than those preferred by Cooper's and goshawks, usually 25-50 year old, even-aged stands. In eastern Oregon all nest sites found by Reynolds et al. (1982) were in even-aged stand of white fir, Douglas-fir, ponderosa pine, or aspen, with ground vegetation limited to grasses and creeping barberry (Marshall et al. 2003). Natureserve reports the sharp-shinned hawk has a ranking of "apparently secure" in Oregon. The Deschutes LRMP defines sharp-shinned hawk habitat as stands with a mean canopy cover of 65% or greater, tree density of at least 475 trees per acre, and a stand age of 40-60 years (LRMP WL-25). There are approximately 915 acres of habitat within the larger 46,000 ac area. This acreage best represents a nest core, rather than providing a full territory that includes foraging area, etc.

- WL-21 "Nesting habitat for at least 60 pairs of sharp-shinned hawk will be provided…"
- WL-28 "Active nest sites should be protected from disturbing activities within ¼ mile…by restricting operations…April 15-August 31.

Alternative 1 (No Action)

Direct, Indirect, and Cumulative Effects: Although there would be no effects to Sharp-shinned hawks as a result of this alternative because there are no actions that would cause a change and effect from the existing condition, taking no action could have consequences to sharp-shinned hawk habitat.

In the short-term, there would be no effect to Cooper's hawks, potential habitat would remain, but a majority of the potential nesting habitat for this species is also at high risk to wildfire.

In the long-term, there would be increasing risk of the potential nesting habitat being lost to wildfire mortality. Loss of nesting habitat could effectively displace these species from the project area. It would take decades for nesting habitat to return.

Alternative 2 (Proposed Action)

Direct and Indirect Effects: Similar to the effects to goshawks, pre-commercial and commercial thinning would degrade habitat, in the short-term. Where treatment units overlap potential sharp-shinned hawk habitat, 34 acres would be thinned/degraded (less than 0.1% of the potential habitat in a larger area of 46,000 acres). Underburning or mowing, without associated thinning, is not expected to have impacts to potential habitat because it focuses on the shrub component which is not heavily utilized by this species. As the remaining trees respond to thinning with diameter growth, more suitable nesting habitat than presently available is expected.

The proposed actions are not expected to impact sharp-shinned hawks foraging. The placement of non-treatment areas both within the units and adjacent to the units would provide for a diversity of prey. This juxtaposition would also minimize any impacts to any fledged sharp-shinned hawks from the larger area.

Cumulative Effects: The proposed actions would add an additional 34 acres of habitat degradation to the 4 acres degraded by the Sunriver HFRA project and 18 acres of forest eliminated in the area due to Highway 97 widening and interchange development and rerouting access.

Through time, nesting habitat would develop and be at lower risk to wildfire and of higher quality because of increased diameter growth due to thinning. In conjunction with current management objectives to develop more LOS habitat (often the best potential nesting habitat), this would help in creating more stable habitat amounts in the future. The result is more stable populations of this species throughout the landscape.

Red-tailed Hawk *S5 Secure*

Summary and Plan Consistency: Neither alternative is expected to contribute to a downward trend in red-tailed hawk populations. Standards and guidelines in the LRMP focus on limiting disturbance to known nests. These Standard and Guidelines are met, especially through the mitigation to protect any new nests found during implementation.

- WL-2 "Active nest sites will be protected by maintaining the forest character of an area at least 300 feet in radius around the nest…."
- WL-3 "Active nest sites should be protected from disturbing activities within ¼ mile …March 1 – August 31…"

Existing Condition

Red-tailed hawks have an extremely wide tolerance for habitat variation. Red-tails are largely perch hunters. Habitat types that provide suitable perches (trees, utility poles, outcrops, etc.) and are open enough to permit the detection of ground-dwelling prey would typically support red-tailed hawks. Red-tails frequent woodland, agricultural land, clearcuts, grasslands, sagebrush plains, alpine environments, and urban areas. They construct nests in a variety of situations including trees, utility poles, cliffs, and place there nests higher than other broad-winged hawks (Marshal et al. 2003).

Red-tailed hawk habitat is not considered limited in the area, because a majority of the area is forested, contains mature trees for perching, and openings that provide prey habitat.

Table 47: Closest Recorded Red-tailed Hawk Nest Sites and Activity Status in Relation to Proposed Units

Species	Nest #	Last known activity	Distance to Units
Red-tailed Hawk	3064	1997	4 miles
Red-tailed Hawk	New nest	June, '01	4 miles

Alternative 1 (No Action)

Direct and Indirect Effects: Because there are no actions associated with this alternative, there would be no changes from the existing conditions and therefore no effects to red-tailed hawks.

Alternative 2 (Proposed Action)

Direct and Indirect Effects: Removal of commercial sized trees (those trees that contribute to the upper canopy) removes potential nest habitat for red-tailed hawks; however, no trees over 21" would be removed. Red-tailed hawks, however, can use a variety of habitats and often hunt over more open

areas. This habitat would still be available. It is unlikely that the proposed actions under either alternative would have effects to red-tail hawk populations within the area.

Cumulative Effects: It is unlikely the proposed actions would have additive effects to the ongoing and reasonably foreseeable actions because of limited direct and indirect effects to red-tailed hawks.

This species of raptor is relatively common in the project area and adjacent areas, being found on the forest and within the city of Bend. No cumulative effects to this species are anticipated.

Prey habitat would improve under the action alternative. The commercial and precommercial thinning treatments would create more open stand conditions, allowing greater maneuverability and greater visibility and access to prey, while mechanical shrub treatment and prescribed underburning would promote greater plant diversity, providing habitat for a wide variety of small mammals, the primary prey of the red-tailed hawk (see Shrub Habitat discussion, page 133).

Townsend Big-eared Bat *S2 Imperiled*

Summary and Plan Consistency

The alternatives are consistent with LRMP standards and guidelines for Townsend's big-eared bats:

- WL-64 "[Big-eared bats] will be protected by:…3) maintaining the character of forest vegetation at the entrance of important caves; and 4) enhancement of habitat conditions."
- WL-65 "At caves already known to be important to [big-eared bats], monitoring will occur…"
- WL-70 "Because most lava tube caves have air movement that could be significantly influenced…existing forest vegetation will be maintained at these openings."

Compliance with bat habitat direction has been met. There are no known important caves adjacent to proposed units, and there is mitigation to maintain shrub diversity within proposed units as well as minimize smoke from prescribed burning. Known important caves on the district are monitored.

Existing Condition

Occurrence of Townsend's big-eared bats is documented on the Deschutes NF. This species of bat depends on caves for hibernation, for raising their young, and for day and night roosting. They forage in a broad range of forested conditions, from open savanna to fully stocked conifer stands. Prey species are strongly associated with bitterbrush, ceanothus, and other shrub species. Most foraging is suspected to occur within five miles of their day roosts. Past studies have shown that foraging along forest edges occurred most often, apparently related to availability of prey species (moths) and protective habitat for predation. They utilize open water to meet moisture requirements.

Large winter hibernating populations of these bats occur in a few caves on the Bend-Ft. Rock Ranger District. The population is estimated to be 600 individuals in central Oregon (including the Deschutes National Forest and immediately adjacent areas). There are about 2,500 in Oregon. As of 2003, population trends for central Oregon, based on winter counts in hibernacula, have indicated a decline of about 25% since 1986. The decline is probably related to disturbance of hibernating bats, disturbance to the maternity roosts, and effects of wildfires.

There are no known hibernaculums within 4 miles of any proposed unit.

Alternative 1 (No Action)

Direct and Indirect Effects: Because there are no proposed actions with this alternative, there would no change from the existing condition and therefore no effects resulting from this alternative. Stand-replacing wildfire has been implicated as one factor that can reduce bat populations. A wildfire through this area would have the potential to have serious effects to bat populations within a larger area.

Alternative 2 (Proposed Action)

Direct and Indirect Effects: There would be no direct effects to Townsend's big-eared bats.

Foraging habitat could be impacted by the prescriptions for fuels treatments in shrub habitat, page 133. Alteration of shrub habitat could influence prey availability within the project area. A variety of shrub structure is desirable in order to attract a variety of insect prey species. The proposed actions maintain a large amount of early shrub structure through fuels treatments (mowing and underburning). Early seral shrubs may not produce as many flowers or leaves that prey species such as moths and other insects would feed on as mid to late seral shrubs. The overall diversity of shrub structure is reduced by the proposed actions. The effect on bat species may be a reduction in available prey or foraging opportunities near roost habitat. Although retention patches within proposed units would help off-set this effect, there would be a dominance of early shrub structure because it is the objective within the CWPP boundary that fuels such as shrubs be kept in early structure.

Cumulative Effects: There would be cumulative effects to foraging habitat, page 133. Similar to the direct and indirect effects, cumulatively the maintenance of early shrub habitat may decrease the diversity of prey species for bats. Over the larger area, the areas with the best foraging opportunities for bats would be away from the urban-interface, where larger areas of more mature shrubs would be found. A lack of shrub habitat diversity (i.e. shrub seral /structural stages) may alter foraging patterns by western big-eared bats, or reduce bat prey species diversity which then can reduce bat populations or bat species diversity.

Elk *S5 Secure*
Mule Deer *S5 Secure*

Mule deer and elk are known to use the proposed treatment areas for hiding and thermal cover, and foraging. Approximately 2,060 acres of designated winter range (MA-7) are within proposed units.

For the purposes of this analysis, effects to these species will be addressed concurrently and focused on habitat uses (i.e. thermal and hiding cover, foraging habitat) since many similarities in habitat requirements exist. Because the LRMP more directly addresses elk and deer habitat under a variety of topics, the format for addressing effects is different than that used for other species.

Hiding and Thermal Cover

Hiding cover is defined as vegetation capable of hiding 90 percent of a standing adult deer or elk from view of a human at a distance equal to or less than 200 feet (Thomas, 1979, LRMP WL-54). Hiding cover provides security to big game and protection from predators. Hiding cover is especially important for reducing vulnerability to hunting and poaching pressure by providing concealment in areas that have high open road densities and easy access by hunters (e.g., the proposed treatment areas). Hiding cover is evaluated in deer summer range (the entire Forest outside the Deer Habitat

management allocation), key elk areas, and winter range, per LRMP direction. Hiding cover is not limited in the area (Table 48).

Cover used by big game to moderate cold weather conditions and to assist in maintaining a constant body temperature is referred to as thermal cover (Thomas, 1979). Tree canopy cover conditions that provide optimal thermal cover are considered to be greater than 75% canopy cover in seedling and sapling stands that are greater than 5 feet in height or canopy cover greater than 60% in pole sized (5-9 inches DBH) trees and larger (Thomas, 1979). Tree canopy cover conditions for optimal thermal cover on the Deschutes National Forest have been compromised somewhat due to low site productivity for tree growth and the risk of insect-pest epidemics killing or severely damaging tree stands (LRMP M7-5). Crown cover greater than 40 percent with trees 30 feet tall is recommended for thermal cover on the Deschutes National Forest (LRMP M7-13).

Ideally, hiding and thermal cover stands would be in close proximity to foraging areas and would make up approximately 40 percent of the land area (LRMP, Thomas 1979). The optimum distance between cover stands for maximum use by big game is thought to be approximately 1,200 feet with stand sizes ranging from 6 to 26 acres (Thomas, 1979).

Estimates of the amount of hiding cover within the proposed action areas were derived from field inventory and satellite imagery (ISAT). Estimates of the amount of thermal cover were derived from field inventory, satellite imagery (ISAT), and stands considered as high stocking/density (based on stand density indices and number of trees per acre).

Winter range habitat units (WRHUs) are areas in the biological winter range of mule deer (area utilized by deer during the winter regardless of LRMP management allocation) ranging from 15,000 to 20,000 acres where habitat conditions and the potential effects of management activities are evaluated (the proposed action areas are within the Green Mountain Winter Range Habitat Unit - WRHU). The hiding and thermal cover desired condition is based on a recommendation contained in the Devil's Garden - Winter Range Habitat Unit Analysis Paper (USDA, 2002).

Table 48 displays the existing amount (acres) of cover in each of the LRMP management allocations and deer winter range habitat unit. The applicable LRMP standards and guideline (S&G) or Goals and Objectives are displayed as the management objective. The management objectives are minimums and not necessarily the preferred or conditions for wildlife. Figure 13, page 129, displays hiding cover. All of the proposed action areas are within the Green Mountain Winter Range Habitat Unit. Hiding cover levels currently exceed LRMP levels; whereas thermal cover levels are currently below LRMP levels.

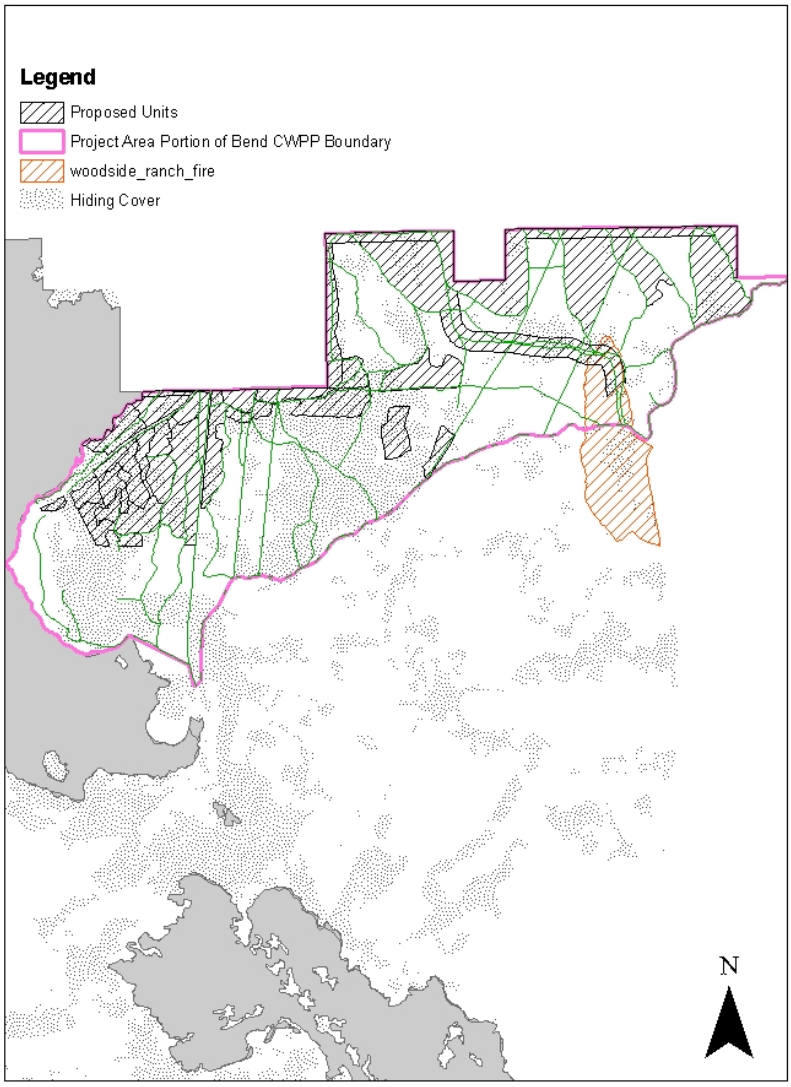
Table 48: Existing Condition of Hiding and Thermal Cover by LRMP Management Allocation and Winter Range Habitat Unit

	Hiding Cover – Acres (percent)	Management Objective for hiding cover	Thermal Cover – Acres (percent)	Management Objective for thermal cover
Proposed Units [1] (2,060 acres in MA-7; 1,008 acres in Summer Range)	1,150 (37%)	NA	0 (0%)	NA
Implementation Unit (42,063 acres outside of MA-7)	13,881 (33%)	30%	NA	NA
Summer Range in South Bend Project Area (2,566 acres)	1270 (49%)	30%	NA	NA

	Hiding Cover – Acres (percent)	Management Objective for hiding cover	Thermal Cover – Acres (percent)	Management Objective for thermal cover
Deer Habitat in South Bend Project Area (6,245 acres)	2,430 (39%)	10%	886 (14%)	30%
Green Mountain Winter Range Habitat Unit (19,982 acres)	5,158 (26%)	10%	4,795 (24%)	30%

[1] Displayed as an overview only. Not the geographic or management area in which the LRMP standards and guidelines are measured.

Figure 13: Hiding Cover within South Bend HFRA Project Area



Existing hiding cover levels are, for the most part, above the management objective levels. Hiding cover is generally well distributed throughout the summer and winter ranges but there are areas where cover stands are either larger or smaller than what is considered to receive maximum use by big game.

The existing amount of thermal cover is also largely below the objectives within the MA-7 and Green Mountain WRHU. Cook et al (2004) acknowledge that thermal cover may not be as crucial a component of winter habitat, animal health and survival as the components of quality forage and hiding cover. Thus, if thermal cover levels alone are not meeting LRMP goals and objectives it may not necessarily result in negative effects to wintering big game (deer and elk). The combination of effects to each component of winter habitat (thermal, hiding cover, and forage) determines the quality of the habitat and subsequently the magnitude of the effects.

Alternative 1 (No Action)

Direct and Indirect Effects: Big game hiding and thermal cover would be maintained in the existing quantities, qualities and distribution in the short-term. There would be a range of low to high quality cover, and there would be areas where the effectiveness of the cover is low because it is part of a large patch; or conversely large areas where there is little quality cover. Over the long-term (i.e., greater than 20 years), hiding cover quality in some of the ponderosa pine stands would diminish as crowns lift and self prune, increasing site distances. Reductions of hiding cover may be offset, however, by shrub growth and tree mortality caused by competition and bark beetles or other pathogens. Dead and fallen trees would provide visual screening, maintaining or improving hiding cover. Shrubs in many of the stands that do not currently provide hiding cover are relatively young in age. Growth of green leaf manzanita (Arctostaphylos patula) and snowbrush (Ceanothus velutinus) could provide hiding cover in some areas. Thermal cover quality and quantity is expected to remain about the same over the long-term, provided there are not more natural events such as the 18 Fire and Woodside Ranch Fire that occurred in 2003 and 2007 respectively. Similar habitat conditions, as present within the proposed action area, existed within the fire perimeters. As a result of the fires, it is now an area with large patches of little to no cover (hiding or thermal).

Indirect effects to big game cover entail the maintenance of a tenuous balance between sustainable habitat and no habitat. No action would maintain the remaining cover for the short-term. It also maintains the level of risk to high severity wildfire. No action also forgoes the opportunity to close and decommission some roads. Maintaining fire-susceptible and high beetle-risk stands for cover while still allowing for the road density to remain high does not promote quality habitat. Should another fire occur, not only would cover and forage be lost, but the high disturbance from motorized vehicles and other associated human uses would render the area poor habitat, especially in the winter.

Within the last 20 years, the area has experienced increased societal pressures. The human population of Central Oregon continues to grow. Many of the residences that border the project area are less than 20 years old. It is an advertised selling point for real estate to be adjacent to federal lands, and this project area is no different. These residences are often high value properties. The effect on the proposed action areas is that as wildfire continues to be a risk in these plant communities so is the risk to these high value homes. Social expectations along this urban interface have changed such that the wildfire risk should be minimized. This shift in expectations then has effects on the management of wildlife habitat (e.g., deer cover and forage). That is to say, maintaining the elements of good habitat (tall shrub forage, and higher canopy closure) can conflict with measures to reduce wildfire risk (maintain low shrub cover and a discontinuous canopy).

Another result of increasing human populations is the increased recreational pressure on the area because of its proximity to Bend and Sunriver, and the area tends to experience an early snowmelt. The types of recreational use run the full spectrum of low-impact to wildlife (e.g. hiking and bird watching) to high-impact (off-road vehicle use, target shooting, and hunting). As use increases, deer and other wildlife may seek "refuge" from these disturbances on private lands where access is considerably more restricted. This also leads to more wildlife/human conflict within the urban interface. Also, improvements to existing tourist attractions and recreational opportunities adjacent to the area (e.g. widening of Hwy 97 and providing better access to lava Lands Visitor Center and Lava River Cave) contribute to increases in recreational pressure, disturbance to wildlife, and the need to minimize wildfire risk.

Other Federal vegetation management actions have also contributed to effects to habitat (Sunriver HFRA, OZ EA, Lava Cast, Fuzzy). The Lava Cast and Sunriver HFRA project areas are within transitional and summer range for deer. Each of these efforts contain actions that would benefit deer populations and habitat (e.g. road closures, vegetation treatments to increase shrub growth and vigor), but the benefits may not be realized for many years after the activities are completed, with potential short-term negative impacts of reduced cover.

Table 49: Existing Proportions of Cover Habitat in the Northern Portion of the North Paulina Deer Herd Unit

Cover Type	LRMP Target	Overall Average	South Bend HFRA	Sunriver HFRA	OZ	Lava Cast	Fuzzy
Hiding Cover	30%	38-39%	42%	35%	22%	54%	39-44%
Thermal Cover	30%	11-13%	14%	27%	0%	NA	4-10%

Because there are no management actions proposed under the no action alternative, there are no cumulative effects to elk and deer cover. However, this alternative also forgoes the opportunities to improve habitat through road closures.

Alternative 2 Proposed Action

The following assumptions were made in regards to the effects of the proposed actions on cover:

- Assumption #1: Commercial thinning, pruning, underburning, and mowing can remove/degrade hiding cover. However, mowing, as the sole treatment would not remove hiding cover.
- Assumption #2: Commercial thinning would degrade/remove thermal cover. Fuels treatments, by themselves, would not remove thermal cover.
- Assumption #3: There are no cumulative effects to deer or elk habitat from the OSU study units (OZ) because they were not classified as cover.

Direct and Indirect Effects: Commercial harvest treatments, post sale thinning of smaller diameter trees (<7 inches DBH), and prescribed underburning would reduce stand densities including seedling and sapling sized trees, and shrubs and down logs that provide visual screening and hiding cover. This would simplify stand structure, and increase sight distances. The proposed actions would have the directly remove 999 acres of hiding cover (Table 50and Table 51). The proposed units do not overlap any stands classified as thermal cover; therefore the proposed action would have no effects to existing thermal cover levels.

The short-term, indirect effects of reduced amounts of hiding cover are increased vulnerability of big game to hunting and poaching. Areas of the greatest hunting pressure occur in deer summer range.

Despite this reduction of cover, the distribution of cover and forage would improve. Thinning treatments are generally proposed in large blocks of hiding cover that are larger than what is necessary to receive maximum use by deer and elk. The proposed actions would result in a better distribution and arrangement of cover and foraging areas, and utilization by deer and elk, than the current condition. Existing thermal cover stands are maintained.

Other positive indirect effects of the proposed actions are to improve the distribution of cover and foraging areas in the short-term (less than 20 years) and the amount of cover over the long-term (greater than 20 years). In the long-term, the area would be habitat with more diverse forest structure that provides more effective forage and cover distribution.

Table 50: Immediate Post Treatment Acres of Hiding and Thermal Cover

Indicator Acres	Hiding Cover - Acres		Thermal Cover - Acres	
Alternative	Alternative Acres - Percent (Management Objective)		Alternative Acres - Percent (Management Objective)	
	1 No Action	2	1 No Action	2
Proposed Units [1] (3,068 acres)	1,150 - 37%	151 - 5% (NA) [2]	0 - 0%	0 - 0% (NA)
Deer Summer Range (2,566 acres)[1]	1,270 - 49%	818 - 32% (30%)	NA	NA
Deer Habitat (MA-7: Winter Range in Project Area) 6,245 acres	2,430 - 39%	1,883 - 30% (10%)	886 - 14%	886 - 14% (30%)
Implementation Unit (42,063 acres outside of MA-7)	13,881 - 33%	13,429 - 32% (30%)	NA	NA
Green Mt. WRHU (19,982 acres)	5,158 - 26%	4,159 - 21% (10%)	4,795 - 24%	4,795 - 24% (30%)

[1] Displayed as an overview only. Not the geographic or management area in which the LRMP standards and guidelines are measured.
[2] NA - Does not apply

Direct and Indirect Effects: A trend towards a lower proportion of hiding cover over the entire area (Table 51) because of the objectives to maintain lower fuel levels in the proposed units. Add to this other proposed or ongoing fuels reduction projects (e.g. Sunriver HFRA, Fuzzy), high road density, and the proximity to human population centers and the proposed action areas becomes less effective and lower quality. This would be true for the short term (next 20 years). Closing and decommissioning roads would help off-set the negative effects of reduced cover.

Table 51: Proportions of Cover Habitat in the Northern Portion of the North Paulina Herd Unit Resulting from Proposed Actions

Cover Type	LRMP Target	Overall Average	South Bend HFRA	Sunriver HFRA	OZ	Lava Cast	Fuzzy
Hiding Cover	30%	36-37%	31%	35%	22%	54%	39-44%
Thermal Cover	Not affected – Refer to Table 49						

Over the entire biological winter range there would be a trend of decreasing quality for approximately the next 20 years. Wildfires and management actions have reduced cover and forage and/or would reduce it. Recreational pressures will increase, which thus increases the amount of disturbance to

wildlife in the area. As a result, it is likely that big game would either move to areas with better forage, cover, or less disturbance (e.g., private land) possibly increasing human/wildlife conflicts or the big game population would decrease. In the long-term, as the trees within the stands respond to management and crown begin close, thermal cover would be restored. An increase in the structural diversity within the forest would provide hiding and thermal cover.

Cumulative Effects: As a result of actions within the area, foreseeable federal actions, increased human disturbance, and shifting social pressures on federal lands adjacent to urban/suburban areas, there would continue to be a decline in the North Paulina deer herd. The North Paulina deer herd has not met the target size (as determined by ODFW in the Mule Deer Plan, Dec. 1990) for years (ODFW personal communication, February 2004, April 2005).

Although it is not likely that this is solely the result of current conditions, the winter range habitat may no longer be able to sustain the population objectives. There is a synergistic relationship of reduced cover, increased human disturbance, and reduced forage (refer to shrub discussion). The effect is that individuals in the populations would have to expend more energy in either fleeing disturbance or seeking quality food. If the animal is expending energy to deal with each of these pressures together, then the result is reduced health of the animal and smaller populations. Subsequent effects of this may be reduced hunting opportunities within the area (over $1 million of state revenue generated in 2001 from hunting fees in this unit; with approximately half of the applicants receiving tags) and increased wildlife/residential conflicts within the urban interface.

Within the herd unit area, however, the proposed action area only represents 2% of the total herd range area, and together with past, ongoing, and foreseeable projects would result in a 1% reduction in hiding cover and a 1% reduction in thermal cover. This assumes that all of the actions (Proposed, past, ongoing, foreseeable) would retain some habitat and that the treated stands would respond to treatment and some degree of cover would return. The proposed actions contribute a less than 1% decline, of the 1-3%, in cover over the herd range.

FORAGING – SHRUB HABITATS

Shrubs, primarily bitterbrush, provide critical mule deer winter forage. They also provide nesting and foraging habitat for shrub-associated species, such as the yellow pine chipmunk and golden mantle ground squirrel, and neotropical migrant birds, such as Brewer's sparrow and green-tailed towhee (Csuti et al, 2001). Many of these species, particularly the seed- caching rodents, i.e. the yellow pine chipmunk, serve an important ecological role in the regeneration of shrub species (Vander Wall, 1994). Shrubs need to generally be taller than the average snow depth and be in good condition with new growth to be considered high quality winter forage. Late seral/structure shrub habitat provides forage for wintering big game as well as habitat for other wildlife (e.g. nesting substrate, roosting, hiding cover, and perches. Mid-seral shrub habitat is able to provide some hiding, some forage, and some nesting. The early seral shrub habitat often provides the best forage if above snowfall (i.e. either early or late winter or years of low snow pack). Native shrublands also provide foraging habitat for bats (e.g. Townsend's big-eared bat). Bats prey upon the insects that feed on the flowers and other parts of the shrubs.

Shrub habitats were evaluated on a winter range habitat unit (WRHU) and ecological type (eco-type) basis, per recommendations from the Deschutes National Forest Integrated Natural Fuels Management Strategy (INFMS, 1998), and the Devil's Garden – Hole-in-the-Ground Winter Range Habitat Unit Analysis Process paper (USDA, 2002). Eco-types represent groupings of soil and potential vegetation. They represent areas that have similar site potentials and are expected to have similar responses to treatments. Eco-types reflect similarities in: 1) site carrying capacity, 2) shrub recovery period, 3)

expected successional pathways following various disturbances, and 4) potential for increases of undesirable plant species such as cheatgrass and rabbitbrush. The desired condition is a ratio of 1/3 early seral, 1/3 mid seral, and 1/3 late seral shrub habitat in each of the major eco-types within each WRHU.

The Green Mountain WRHU contains two major eco-types. Figure 14 displays the WRHUs and major eco-types and Table 52 describes the characteristics and management considerations of each of the major eco-types in the fuels reduction project area. Figure 15 displays the shrub seral stages in the WRHU while Table 53 displays the acres of early, mid and late seral shrub by eco-type. In this analysis seral stage does not necessarily reflect the age of the plant, but more to its structure and height. For winter forage, the plant should be above snow level for optimum foraging, and generally the mid-late seral stages have this height. Patches of early shrubs are assumed to not provide adequate winter forage, and would not have the structure or flowering densities to provide nesting habitat for neotropical birds or food sources for bat prey species.

Table 52: Characteristics and Management Considerations of the Two Major Eco-types Within the Project Area

Eco-type	Plant Association(s)	Shrub and Grass Potential Productivity (% cover)	Tree Species Potential Productivity (% cover)	Management Considerations
3	Ponderosa pine/bitterbrush/fescue (CPS2-11)* Ponderosa pine/bitterbrush/needlegrass (CPS2-12)*	Bitterbrush: trace-50% Idaho Fescue: 1-40% Squirreltail: 0-5% Western Needlegrass: trace-6%	Ponderosa Pine: 5-60% Western juniper: 0-10% Mtn. Mahogany: 0-10%	Underburning reduces shrub component considerably, increases herbaceous production 3-8 times. Disturbance increases grasses.
4	Ponderosa pine/bitterbrush-manzanita/needlegrass (CPS2-13) Ponderosa pine/bitterbrush-manzanita/fescue (CPS2-17) Ponderosa pine/bitterbrush-snowbrush/needlegrass (CPS3-11)	Greenleaf Manzanita: 0-40% Bitterbrush: 2-43% Snowbrush: 3-50% Idaho Fescue: 1-23% Western Needlegrass: trace-5% Squirreltail: 1-10% Ross Sedge: 0-5%	Ponderosa Pine: 5-50% Western Juniper: 0-5% Mtn. Mahogany: 0-20%	Bitterbrush remains codominant or strong subordinate after disturbance; manzanita and snowbrush increase. Bitterbrush decreases with grazing and canopy closure. Periodic burning stimulates manzanita and snowbrush. Goldenweed and gray rabbitbrush increase with site disturbance. Distribution of bitterbrush and manzanita strongly regulated by Idaho fescue. Highly disturbed sites may appear as brush fields of manzanita and snowbrush.

*Plant associations are defined by Volland, 1988, Plant Associations of the Central Oregon Pumice Zone.

Table 53: Existing Condition - Shrub seral Stage by Major Ecological Type (eco-type)

	Green Mountain WRHU – 19,982 total acres		
Seral Stage	Ecotype 3	Ecotype 4	Total by Seral Stage
Early	3,166 (44%)	4,831 **(37%)**	**7,997 (40%)**
Mid	979 (14%)	3,965 **(31%)**	**11,985 (60%)**
Late	2,979 (42%)	4,062 **(32%)**	
Total	**7,124 acres**	**12,858 acres**	**19,982 acres**

To quantify shrub seral stage within the WRHU recent events (i.e., wildfire) and past management activities were queried from the geographical information system (GIS) database. Assumptions were made on the effects of various management activities and the length of time since completion on shrub seral stage. Assumptions were as follows:

- Areas with the following list of management activities since 1990 were considered to have early seral shrub conditions: prescribed underburn, mechanical shrub treatment, seed tree harvest, clearcut harvest, final removal, overstory removal, partial removal, shelterwood harvest, commercial thinning, precommercial thinning, and wildfire. Areas of commercial thin and precommercial thin were considered to be densely stocked and limited shrub growth from competition. After thinning reduced competition would allow shrubs to increase in abundance.
- Areas of high tree stocking were considered to be early seral since tree canopy cover and competition for light, water, and nutrients would limit shrub growth.
- Areas with activities completed during the timeframe 1970-1989 were assumed to be mid seral.
- Areas with activities completed before 1970 were considered to be late seral.
- Areas that had no record of past management activity were considered to be late seral.

Existing conditions within shrub habitat vary widely between ecotypes (Table 53). Ecotype 4 approximates the desired level within each seral stage.

In a 35 year overstory and understory biomass study conducted in south central Oregon in the central Oregon pumice zone, as defined by Volland (1985), Peek et al (2001) found that as overstory canopy closure has increased there was a decrease in the productivity of the understory, mainly shrubs. This influences mule deer forage quantity and quality. Salwasser (1979) as cited in Peek et al (2001) has reported that declines in mule deer populations were caused by low-quality diet during late-spring and fawning, that influenced fawn survival, implicating quantity and quality of spring to early summer forage conditions. This information reflects the current declines in mule deer populations within the North Paulina Herd unit, and the stand and forage conditions present within parts of the proposed action areas.

Figure 14: Shrub Ecotypes within the Proposed Action Areas

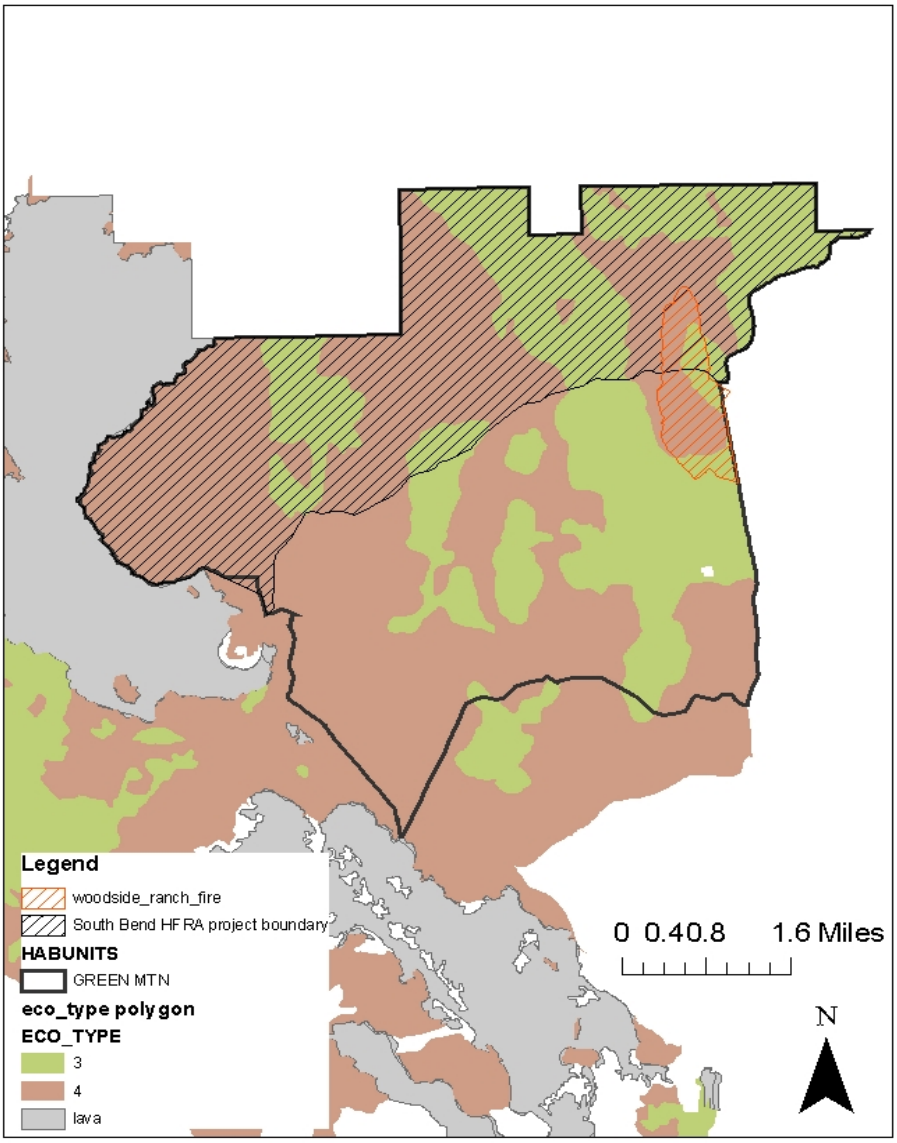
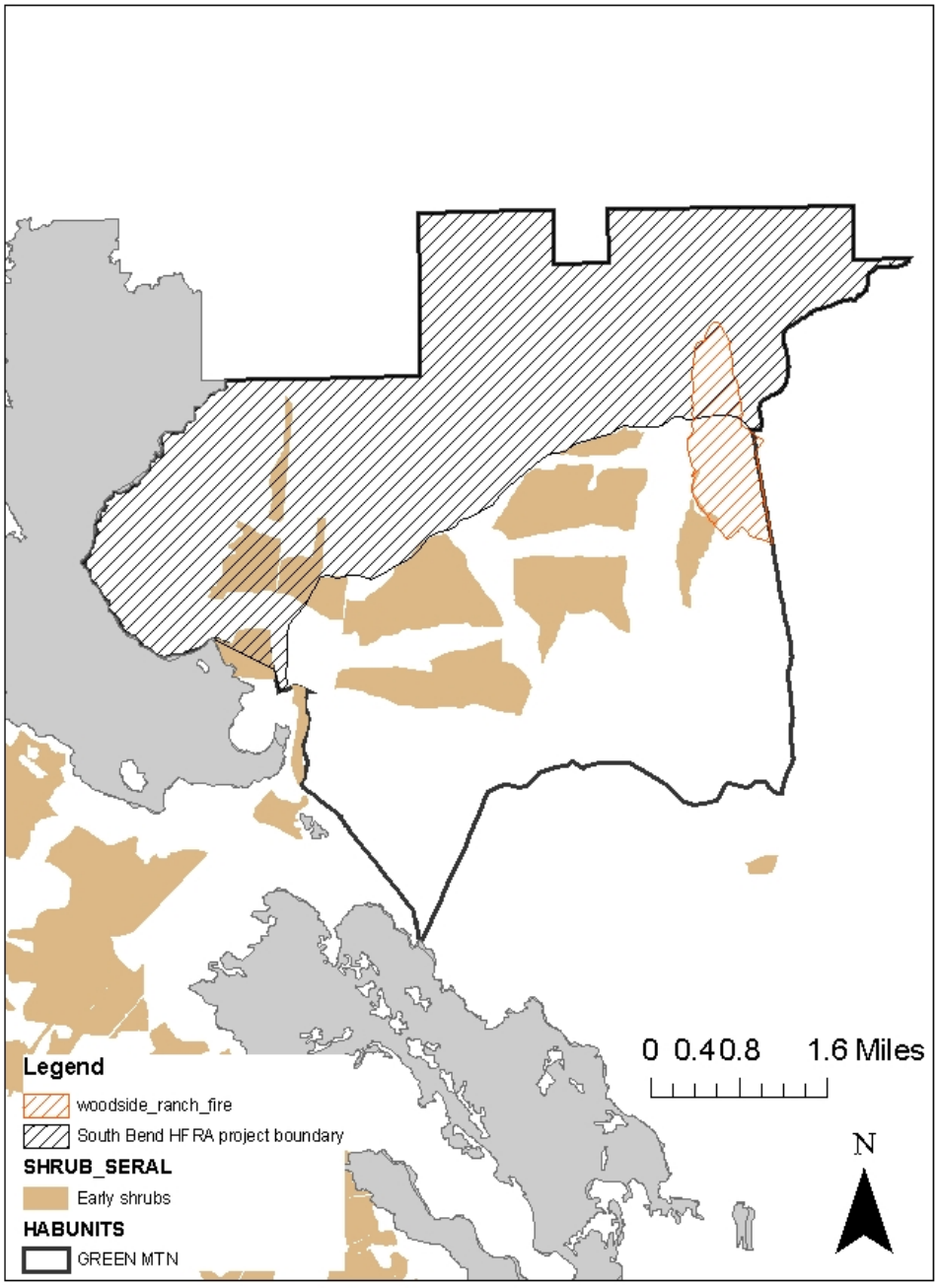


Figure 15: Shrub Seral Stages Within Proposed Action Areas [1]



[1] White areas within boundary are mid-late seral stages. This map reflects conditions prior to the 18 Fire and Woodside Ranch fires.

Alternative 1 (No Action)

Direct and Indirect Effects: Shrub habitats would continue to age. Mature shrubs that are above snow levels and accessible to deer (i.e., winter forage) would increase in abundance through time but as shrubs become decadent the nutritional quality would decline. Some natural regeneration of bitterbrush would occur, especially in the mid-seral shrub age classes, which would develop into winter forage. Herbaceous species, grasses and forbs, which are high in nutritional quality during spring and early summer periods would decrease in abundance and diversity with accumulation of needle litter, maturity of shrubs, increasing tree density, and lack of disturbance. The desired mix of seral stages would continue to be seen in Ecotype 4 for approximately 10-20 years until the shrubs age which would then skew the ratio to predominantly mid and late seral stages. In Ecotype 3, the shrubs would move towards mostly mid-seral stage. The risk of wildfire and potential for loss of critical mule deer winter forage in areas outside of the 18 Fire and Woodside Ranch Fire boundaries would remain high and may increase through time. It is noted that portions of the fires that burned with a high intensity were also areas that had late seral shrubs. The No Action alternative would forgo the opportunity to reduce the risk of wildfire occurring in mule deer winter forage and the opportunity to improve the abundance of herbaceous forage.

Shrub habitat for other species, especially those that depend upon late seral shrubs (e.g. nesting songbirds), would remain. There would still be the risk of wildfire events occurring. Another such event like the wildfires would further reduce this type of shrub habitat, but in the short-term this habitat would remain at the current levels and distribution. Reduction of shrub habitat may have negative effects to bat species that forage in this habitat type.

Although selection of this alternative would not have additive, cumulative effects to past, present, and foreseeable projects, as a result of no action in the area, the shrub habitat would remain at the existing levels. On a larger scale, the area would contribute to a large portion of late-seral shrub structure. Over the North Paulina herd unit, the diversity in shrub seral structure would be seen on a large-scale (hundreds of thousands of acres) versus the project level (thousands of acres).

An advantage to larger patches of shrub seral diversity would be more continuous habitat for the wildlife species that use shrubs for nesting, hiding cover, foraging, roosting, and perches (e.g., green-tailed towhee, Townsend's big-eared bat). An advantage of smaller patches of diversity would be a better distribution of foraging by big game and higher species diversity over a smaller area.

Alternative 2 (Proposed Action)

Direct and Indirect Effects: The direct effect of natural fuels treatments (mechanical shrub treatment and prescribed underburning), and to a lesser degree, ground-based timber harvest, is to convert treated areas to early seral conditions. Treatments would reduce the amount of mule deer winter forage provided by shrubs, primarily bitterbrush, and reduce the amount of cover or prey habitat for small mammals and birds (e.g. bats and bluebirds that prey upon insects that rely on shrub habitat). Mechanical shrub treatment and prescribed underburning conducted in the spring and early summer could also result in the direct mortality of small mammals and birds that nest in shrubs, small trees, or on the ground (e.g. chipping sparrow).

Table 54 displays the direct effects of the proposed action to shrub ratios in the WRHU. The desired condition is a ratio of 33.3% early seral, 66.6% mid to late seral shrub habitat The proposed actions would slightly move the shrub conditions away from what is desired and more towards an even amount of early and mid to late seral shrubs.

In the WRHU approximately half of the shrubs would be in the early seral stage post-treatment. This result moves the winter range forage condition away from the LRMP and INFMS guidelines and recommendations. Mitigation measure to retain some late and mid seral shrub structure within proposed units would help provide some late seral shrub habitat in patches throughout the units, but as shown in Table 54 this mitigation has been accounted for in the ratios.

Table 54: Post Treatment Shrub Condition - Shrub Seral Stage in the Green Mountain WHRU

Seral Stage	No Action	Proposed Actions [1]
Early	7,997 acres (40%)	10,015 acres (50%)
Mid-Late	11,985 (60%)	9,967 acres (50%)

[1] Includes 30% retention within treatment units (Mitigation BG-2)

Indirect effects of natural fuels treatments in Eco-type 3 would be to increase herbaceous species production (refer to Table 53). Post treatment, the units would be dominated by Idaho fescue. The length of time for shrubs to regenerate in this eco-type is unknown but is generally thought that it would take 5-10 years for shrubs to establish and approximately 30-40 years to attain late seral shrub conditions. While treated areas are in the early seral condition, they would provide poor winter forage (abundance, availability, and quality) for mule deer and are not expected to receive much deer use. During the winter months when there is snow on the ground there would be little forage available above the snow level in treated areas. Mule deer are expected to utilize mature shrubs in untreated areas between units. Although undesirable from a wintering mule deer perspective, treatments in Eco-type 3 in the Green Mountain WRHU are expected to be beneficial to elk by promoting preferred herbaceous forage species.

In Eco-type 4 in Green Mountain WRHU, proposed actions would result in approximately half of the eco-type being in early seral post-treatment (46% of the ecotype). Quantities of both mid and late seral shrub would be below the desired condition. Natural fuels treatments, particularly prescribed underburning, in Eco-type 4 are expected to stimulate the growth of green leaf manzanita, a non-palatable forage species. Bitterbrush, the preferred winter browse of mule deer, is expected to regenerate with time but be subordinate to manzanita. Treated areas would be poor wintering areas for mule deer until bitterbrush regenerates. This would take years (>10 years). Mule deer are expected to utilize other stands with mature bitterbrush until treated areas regenerate with bitterbrush tall enough to be available over snow. The length of time necessary for bitterbrush to regenerate in Eco-type 4 would be less than in Eco-type 3 due to better growing conditions in this Eco-type, including more productive soils and higher amounts of precipitation.

Other indirect effects of treatment include reducing the risk of wildfire. Wildfire fire areas are also prone to invasion of noxious or invasive weeds (e.g. cheatgrass and knapweed). Invasive or noxious weeds are unpalatable to big game, by reducing the risk of expanding the populations of these weeds, there could be a slight benefit to forage conditions.

Proposed treatments move the planning area away from what is desired and recommended in the Integrated Fire Management Strategy (INFMS, 1998). These efforts were conducted specifically in response to an aggressive fuel treatment program. The action alternative incorporates mitigation to retain as untreated 30% of a fuels treatment unit to continue to provide mature shrub habitat and forage. These patches would be well-distributed and help off-set some of the negative effects of having a dominance of early seral shrubs. This benefits other species that use shrubs as habitat as well as deer.

The dominance of early-seral shrubs would likely be a long-lasting effect. The proposal is driven by a need to reduce fuel loading and protect the urban interface. These treatments would likely maintain

the shrub habitat in an early seral condition. Habitat for species dependent on late-seral shrubs and winter forage would be reduced.

Commercial thinning and creation of small openings may aid in the development of higher quality foraging in winter and summer range as shrub growth responds to the decrease in canopy closure. However, aggressive fuels treatments in the wildland-urban interface may counter-act some of these benefits. Road closures would help reduce harassment of big game and contribute to a net benefit to big game.

Cumulative Effects: There would be a trend toward more early seral conditions (see discussion in No Action). This is particularly true in the lower elevation, most valuable mule deer wintering habitats along the forest boundary and adjacent to the urban interface. As fuel loading issues are addressed in the wildland-urban interface (and early seral habitats effectively maintained) and foreseeable projects are implemented, it would become difficult to achieve the desired winter forage age/structure ratios of 1/3:1/3:1/3 and other recommendations of the INFMS. Similar to the discussion for No Action, as a result of the action alternative, shrub seral stage diversity would likely become more simplified on a small scale (thousands of acres), with better distribution and diversity of seral stages on the landscape scale (hundreds of thousands of acres).

More than 20 years from now, the best quality habitat for late-seral shrub dependent species, would be found well away from the wildland-urban interface, in the areas where the shrubs have grown back and allowed to mature.

Winter forage is one component of quality big game winter range. As Cook et al (2004) summarized "among habitat attributes that can be managed, two remain fundamentally influential to energy balance: forage quality and quantity and their effect on energy intake and structural attributes of habitat that mediate energy expenditures associated with travel and harassment (e.g., snow intercept, security cover)." Studies cited in their document found that forage quality and quantity appeared to influence big game winter survival more than the amount of thermal cover. The proposed actions, in conjunction with past, present and foreseeable actions, would likely move forage ratios away from the desired levels; reduce road densities; and at first reduce cover, but in the long-term cover would increase. As a result of the proposed actions, forage quality and availability would be reduced for deer but may improve for elk. This would likely have greater impact on winter range where it has been determined that availability of quality forage is an important factor to big game health. Similarly, Peek et al (2001) have reported the relationship of forage quality and quantity to mule deer populations and discussed the effects as the individuals move from winter range to summer range (late-spring and fawning). The connected actions would reduce road densities which may off-set some of the negative impacts from the reduced forage.

In summary, there would likely be reduced herd numbers as a result of the proposed actions in conjunction with other past, present and foreseeable projects due to the reduced cover and forage availability on winter range and increased barriers to movement due to highway projects. Reducing human disturbance through road closures would help off-set some of the reduced herd numbers (specifically as a result of reduced cover) and help reduce wildlife/human conflicts within the urban interface.

Consistency with LRMP standards and guidelines:

As shown throughout the above analysis, the proposed actions would retain cover levels above the stated LRMP standard and guidelines.

OPEN ROAD DENSITY

Road analysis, as described in the Forest Service published Miscellaneous Report FS-643 "Roads Analysis: Informing Decisions about Managing the National Forest Transportation System" was completed for the earlier proposed Kelsey project area that overlaps this area. No actions were carried forward from this planning effort.

Table 55 displays the existing open road density and the target, based on LRMP standards and guidelines, open road density by management allocation. Note that open road densities are well above the LRMP standards and guidelines in all management allocations.

Table 55: Current Open Road Density by Management Allocation

Management Allocation	System Road Density (miles per square mile)	Target Open Road Density (miles per square mile)
Outside Deer Habitat (Summer Range)	3.4	2.5 (LRMP WL-53)
Deer Habitat (MA-7)	4.3	1.0-2.5 (LRMP M7-22)

Current LRMP standards and guidelines call for a further evaluation of road density/management in order to make a final judgment in compliance with the LRMP.

Alternative 1 (No Action)

Direct and Indirect Effects: Current open road density would be maintained in all of allocations, maintaining high levels of disturbance of wildlife, and increased vulnerability of big game to hunting and poaching. This alternative may preclude the option of closing system and non-system roads in the Deer Habitat (winter range) area.

In conjunction with the increase in human population and recreational pressure is the increase in use of the roads. Within this project area and adjacent project areas, road densities are high and it is difficult to enforce closures because of the flat terrain; people simply try to drive around the physical barrier. From a wildlife perspective, any reduction in road density would result in better habitat. The no action alternative would not close any roads and some foreseeable projects may add to the existing road density (e.g. widening of Hwy 97: 2.0 miles, new access to Lava Lands Visitor Center, Lava River Cave 2.5 miles added). As other planned projects are implemented within the MA-7 and Key Elk Area allocations, and the associated, planned road closures are implemented, overall road densities would go down (e.g. 18 Fire Salvage, Sunriver HFRA, and Fuzzy). With the foreseeable action of designating OHV routes (Access Management Planning) other sources of disturbance to wintering big game can be reduced.

For the entire winter range allocation, road densities, Table 56, will remain above the LRMP objective levels. Increased human disturbance, as a result of available road density and an increasing population, will continue. Although this alternative would have no additive effects to the existing conditions, cumulative effects would be similar to those discussed under cover and forage because the negative effects of a high open road density act synergistically with the negative effects of reduced cover and forage. A high open road density provides the medium for disturbance which would cause an animal to seek refuge on private/residential land (increasing those conflicts) or to flee. Thereby more energy is expended that can affect its health which then can result in death or no reproduction. Ultimately this can result in reduced herd numbers, reduced hunting opportunities, and reduced revenues.

Table 56: Project Road Densities in MA-7 and Areas Adjacent to South Bend

Project Name	Winter Range Road Density (miles per square mile)
South Bend	4.3
18 Fire Salvage	2.7
Ryan Ranch Key Elk Area	3.8
Fuzzy	1.5

Alternative 2 (Proposed Action)

Direct and Indirect Effects: No new roads will be permanently created, 1.6 miles of temporary road would be built and then removed following commercial sale activities, and some existing roads would be closed (5.9 miles of road closed and 3.4 miles of road decommissioned). Road closures would benefit wildlife species in the area.

The indirect effect of high road densities, is the increased disturbance to all wildlife species, not only big game, and reduced habitat quality (i.e., the higher the road density the poorer the quality of habitat). Some other wildlife species appear to tolerate more disturbance (e.g. red-tailed hawk) than others (e.g. northern goshawk). Projects adjacent to and within the planning area boundary that contribute to road density disturbance include the new access routes to Lava Lands Visitor Center and Lava River cave (2.5 miles), widening of Hwy 97 (2.0 miles), and the new Cottonwood and Sunriver interchanges (18 acres of habitat impacted).

Conversely some projects adjacent to the South Bend project area would help reduce disturbance from roads. A seasonal restriction on roads within the closest portion of the Ryan Ranch Key Elk area would be added to the existing Tumalo Cooperative Winter Closure Area that closes the roads seasonally from Dec. 1st to March 31st. Elk use the immediate/proximate key elk area primarily in the winter, the proposed addition to the seasonal closure would also help mitigate the reduction in cover levels and reduce disturbance.

Cumulative Effects: The action alternative cumulatively reduces the synergistic effect by limiting the amount of disturbance. Other wildlife species benefit from the reduced disturbance, by also reducing their energy expenditures and increasing the health of the individual.

Compliance with LRMP Direction

Road densities would be above the desired density as suggested within the LRMP (Table 55). The Deschutes LRMP contains direction that specifies when this situation occurs that the project biologist is to perform a further evaluation (standard and guidelines: TS-13 and 14, M7-22, WL-46). To summarize, seasonal and permanent road closures combine to help achieve the standard and guidelines and improve the existing condition over the wider area. However, disturbance and harassment to wildlife as a function of the open road densities throughout the project area continue to contribute to a cumulative negative effect to the North Paulina Deer Herd because the road densities remain at the higher end or exceed these thresholds. These road densities in conjunction with other effects contribute to declining habitat and a decline in deer numbers.

Lewis' Woodpecker *S2 Imperiled*

Summary and Plan consistency

Snag guidelines within the LRMP would be met within the proposed units. The proposed actions would help attain some of the conservation strategies (as stated in Altman, 2000) for this species. The proposed actions are not expected to contribute to a downward trend in populations of this species.

Existing Condition

This species utilizes dead wood (large snags) in open forests (ponderosa pine and in some cases riparian) that may have been logged or burned (Winkler, et al. 1995; Natureserve, 2006; Saab et al. 2002). Marshall, et al. (2003) reports this species is associated with open woodland habitat near water. It primarily breeds in Oregon white oak, ponderosa pine, and riparian cottonwood communities. Important components of breeding habitat include an open woodland canopy and large-diameter dead or dying trees. It is a unique woodpecker species because it feeds on flying insects and will often "hawk", or fly from a perch, to hunt. This species has been observed adjacent to the project area. Potential habitat, as described in the literature, is not found within the proposed units, but may be found within some of the recently burned areas of the Woodside Ranch fire.

According to Altman (2000), this species is a focal species for patches of burned old ponderosa pine forest and conservation issues for this species relevant to the proposed actions include: fire suppression; salvage logging of burned ponderosa pine trees; alteration of old ponderosa pine forest to young forest due to logging or fire suppression; increased competition with European starlings for nest sites; and lack of advanced decayed snags or ones with cavities already present.

Conservation strategies suggested in Altman (2000) and relevant to the proposed actions include: increase levels of acceptable opportunities to allow wildfires to burn; use prescribed burning and understory thinning to maintain existing old forest ponderosa pine stands and accelerate development of mid-successional stages to old forest; prohibit or limit salvage logging to retain both hard and soft snags in clumps; close roads where large ponderosa pine snags are present; retain standing dead or diseased trees where they occur; promote a shrubby understory; thin young pines in dense stands ; and retain large living and dead trees.

Alternative 1 (No Action)

Direct and Indirect Effects: Because there are no proposed actions with this alternative, there would be no change from the existing condition and therefore no effects resulting from this alternative.

Alternative 2 (Proposed Action)

Direct, Indirect, and Cumulative Effects: Thinning (commercial and precommercial), underburning, pruning, and mowing is not expected to impact potential Lewis' woodpecker habitat because this species can utilize open habitats, thinning would not target large (>20" dbh) trees (especially ponderosa pine – a favored tree species of this woodpecker). No snags would be removed by the proposed actions.

This alternative may negatively impact this species by helping to limit the extent and severity of a wildfire in the ponderosa pine habitat. The action alternatives do not address the conservation issues associated with this species, but they do address the conservation strategies. As described in the dead

wood analysis, the allocations in which the actions are proposed may not be the most appropriate for managing for Lewis woodpecker habitat at the 80% tolerance level (i.e. providing the conditions or snag densities where the research cited in the DecAID tool found 80% of the nests).

Because of the limited extent of any effects to Lewis' woodpecker (no snags removed, conservation strategies addressed, limited habitat within the proposed units), minimal cumulative effects are expected.

Hairy Woodpecker *S4 Apparently Secure*

Summary and Plan Consistency

This species is considered apparently secure over its range, and because of the limited effects, the proposed actions would not contribute towards a downward trend in hairy woodpecker populations. Forest Plan directed snag levels would be retained in the proposed units.

- WL-37 "…sufficient snags will be maintained to provide 40% of potential population levels of cavity-nesting species within eve-aged harvest units…groupings of green replacements will be preferred implementation technique. Compliance will be based on the harvest unit area…"
- The Eastside Screens revised this standard and guideline to reflect the 100% potential population level. This standard as been addressed under the Snag discussion.
- WL-38 "Specific guidance will be provided by the Deschutes National Forest Wildlife Tree Implementation Plan."

This document was used to determine green tree replacement habitat for future black-backed woodpecker habitat. See Green Tree Replacement discussion.

LRMP direction for this MIS species is met through the consideration and management of habitat currently and in the future. The dead wood analysis has shown that current estimates of snag densities generally meet the directed level except for large snags. The project alternatives would not directly affect current snag densities, and would likely improve habitat in the future.

Existing Condition

Bull et al. (1986) reported hairy woodpeckers using both lodgepole and ponderosa pine and mixed conifer habitats and a variety of snags sizes. This species is found in mature stands and utilizes (i.e. nest and forage) snags greater than 10" dbh. Hairy woodpeckers have been observed within the project area and in proximity to some of the proposed treatment areas. Because of its wide use of plant associations, and the recent wildfires, in general, habitat is not limited for this species. Although there are little to no snags within the proposed units, there are at least 8 to 10 snags per acre within the recently burned areas. This supports the assumption that hairy woodpecker habitat is not limiting in the watershed.

Alternative 1 (No Action)

Direct and Indirect Effects: Because there are no proposed actions with this alternative, there would be no change from the existing condition and therefore no effects resulting from this alternative.

Effects Common to Alternative 2 (Proposed Action) and Alternative 3

Direct, Indirect, and Cumulative Effects: The proposed actions would not remove any existing snags. Commercial thinning may improve the health of the stands making it unlikely that new, small diameter snags would develop in the short-term. This may reduce some foraging opportunities for this species, as the snags created in the fire areas fall to the ground.

Because of relatively small amount of hairy woodpecker habitat affected by the proposed actions (583 ac thinned), the action alternatives would have minimal cumulative effects to hairy woodpecker in consideration with the other ongoing and reasonably foreseeable projects within the watershed.

White-headed Woodpecker *S2 Imperiled*

Summary and Plan consistency

The action alternative would retain the Forest Plan-directed level of snags which would provide for habitat at the lower tolerance levels for this species (30 to 50%); Refer to snag discussion under Specific Habitat Features beginning on EA page 156. The proposed actions address the conservation issues and strategies for this species. Habitat would continue to be recruited within the area.

The proposed actions would not contribute towards a downward trend in white-headed woodpecker populations.

- WL-37 "…sufficient snags will be maintained to provide 40% of potential population levels of cavity-nesting species within eve-aged harvest units…groupings of green replacements will be preferred implementation technique. Compliance will be based on the harvest unit area…"

The Eastside Screens revised this standard and guideline to reflect the 100% potential population level. This standard as been addressed under the Snag discussion.

- WL-38 "Specific guidance will be provided by the Deschutes National Forest Wildlife Tree Implementation Plan."

This document was used to determine green tree replacement habitat for future white-headed woodpecker habitat. See Green Tree Replacement discussion.

LRMP direction for this MIS species is met through the consideration and management of habitat currently and in the future. The dead wood analysis has shown that current estimates of snag densities generally meet the directed level except for large snags. The project alternatives would not directly affect current snag densities, and would likely improve habitat in the future.

Existing Condition

White-headed woodpeckers utilize both live and dead ponderosa pines. They forage on both live and dead pines often selecting the large diameter pines because they have more seeds and make more suitable nesting habitat. Having large ponderosa pine does not assure this species' presence. Indications have been made that a well-developed understory of trees and shrubs may encourage mammalian predation on nests (Marshall, 1997). White-headed woodpeckers are absent from early seral ponderosa pine stands. These woodpeckers are poor excavators and generally select for a more moderately decayed or softer snag in which to nest (Dixon 1995).

Habitat for white-headed woodpeckers is limited within the area and more dramatically within the proposed treatment areas due to the lack of large ponderosa pines. There are large ponderosa pines (live and dead) adjacent to the areas so potential habitat is present. There have been no known observations of white-headed woodpeckers in or adjacent to the proposed units.

According to Altman (2000), this is a focal species of large patches of old ponderosa pine forest with large snags. Conservation issues for this species include: loss of large diameter ponderosa pine trees to logging; lack of recruitment of young ponderosa pine due to fire suppression that has allowed understory encroachment of firs; increased fuel loads that predisposes ponderosa pine stands to stand-replacement fires; loss of snags and downed wood; and fragmented habitat increases energy expenditure and risk of predation to individual woodpeckers.

Conservation strategies stated in Altman (2000) relevant to the proposed actions include: 1) inventory to identify stands meeting desired conditions (i.e. high quality white-headed woodpecker habitat) and stands that can be managed to meet desired conditions; 2) conduct thinning, partial cuts, group selection cuts, shelterwood, planting, snag creation, or prescribed burning as appropriate to meet desired conditions but not clear cuts or overstory removal; 3) manage for large diameter trees through wider tree spacing and longer rotation periods; and 4) retain all snags and high cut stumps greater than 10" dbh, soft snags, broken-topped snags, leaning logs, high stumps, downed logs, and all ponderosa pine trees greater than 17" dbh.

Alternative 1 (No Action)

Direct and Indirect Effects: Because there are no proposed actions with this alternative, there would be no change from the existing condition and therefore no effects resulting from this alternative.

Alternative 2 (Proposed Action)

Direct, Indirect, and Cumulative Effects: The actions proposed are mostly commercial and precommercial thinnings, ladder fuel reductions (pruning) to protect overstory ponderosa pine, and mowing and underburning of understory.

The proposed actions address the conservation issues and strategies associated with this species. Thinning and precommercial thinning within stands with ponderosa pine would favor the retention of large ponderosa pine. Current snag densities suggest habitat is being provided at the 0 to 30% tolerance level for this species within the South Bend Project Area (see Appendix B for snag densities and discussion of tolerance levels). This is unlikely to change much, and higher densities would be found outside of the units and in the wildfire areas to the east.

This species is expected to largely benefit from the proposed actions within potential habitat. The action alternatives would not have cumulative effects with other ongoing or reasonably foreseeable projects because of this management for habitat characteristics that favor this species. Other foreseeable projects include hazard tree removal and highway projects that may remove snags that could be used for nesting by this species. This proposal does not add to this effect because the large diameter ponderosa pine snags this species utilizes would not be removed.

Black-backed Woodpecker *S3 Vulnerable*

Summary and Plan Consistency: Forest Plan-directed levels for dead wood would be retained although these levels represent the lower tolerance level for this species (Refer to snag discussion under Specific Habitat Features beginning on EA page 156). Because of the relatively small amount of habitat affected, the proposed actions would not likely lead to a downward trend in populations.

Cumulative effects of this alternative would not contribute to a downward trend in black-backed woodpecker populations because of the small amount of habitat and possible territories affected the additive effects of this proposal are minimal with the other ongoing and reasonably foreseeable project, specifically hazard tree removal, in light of the above rationale.

- WL-37 "…sufficient snags will be maintained to provide 40% of potential population levels of cavity-nesting species within eve-aged harvest units…groupings of green replacements will be preferred implementation technique. Compliance will be based on the harvest unit area…"

The Eastside Screens revised this standard and guideline to reflect the 100% potential population level. This standard as been addressed under the Snag discussion.

- WL-38 "Specific guidance will be provided by the Deschutes National Forest Wildlife Tree Implementation Plan."

This document was used to determine green tree replacement habitat for future black-backed woodpecker habitat. See Green Tree Replacement discussion.

LRMP direction for this MIS species is met through the consideration and management of habitat currently and in the future. The DecAID analysis has shown that current estimates of snag densities generally meet the directed level except in the lodgepole pine habitats and for large snags. The project alternatives would not directly affect current snag densities.

Existing Condition

According to Goggans (1988) and Bull et al. (1986), the black-backed woodpecker uses mature ponderosa pine and lodgepole pine habitat types at relatively low elevations (less than 4,500 feet), but can be found at higher elevations. Altman (2000) designates black-backed woodpeckers as a focal species for old-growth lodgepole pine. The black-backed woodpecker will use smaller snags for nesting as well as foraging. Bull et al. (1986) suggested the use of smaller diameter snags for nesting is a way of competing with other woodpecker species in the same habitat (e.g. white-headed woodpecker, northern flickers, etc.). The wildfire areas have snags of this size class that can serve as potential habitat. Saab and Dudley (1998) found black-backed woodpeckers selecting for clumps of snags and unlogged control plots in their study on fire and salvage logging.

There is no lodgepole pine habitat within the proposed action areas, however black-backed woodpeckers have been seen foraging on the ponderosa pine snags in the burned areas adjacent to the project area.

According to Altman (2000), conservation issues for this species include: reduction in mature and old-growth lodgepole pine trees due to logging, insect outbreaks, fire suppression, overstocked stands; and salvage logging.

Conservation strategies detailed in Altman (2000) include: in burns and bug-killed forest, leave unsalvaged or if salvaging, maintain greater than 40% as unsalvaged; exempt areas from commercial or salvage timber management, and manage these areas to retain late-successional characteristics as long as possible. These conservation strategies mirror the recommendations set forth in Goggans et al. (1988) to exempt areas (956 acres in size) from salvage and commercial logging

Alternative 1 (No Action)

Direct and Indirect Effects: Because there are no proposed actions with this alternative, there would be no change from the existing condition and therefore no effects resulting from this alternative.

Alternative 2 (Proposed Action)

Direct and Indirect Effects: There would be no short-term, direct effects to populations of this species as a result of the proposed actions. This alternative may delay the development of larger patches of dead trees (i.e. habitat) by thinning or burning stands with a high risk of beetle mortality, thus making them more resilient to such events.

Generally, in the long-term (>20 years), by protecting the existing snags within units, and providing for some larger green trees, the treatment units in the ponderosa pine habitat types may achieve mature conditions more quickly than no action. These would become the mature tree and snag habitat in the future that is associated with black-backed woodpecker habitat. However, treatments that improve the growth and health of the forested stands would increase the resilience of these stands to disturbance such as beetle outbreaks and fires. Black-backed woodpeckers can take advantage of these outbreaks as foraging habitat. By increasing the resilience of the stands there is less likelihood that wide-scale outbreaks would occur. This type of foraging habitat may become limited in the future.

There would be no short-term, direct effects to populations of this species as a result of this alternative because of the general lack of habitat within the proposed units.

Cumulative Effects: Past, current, and foreseeable future actions often have the objective to reduce beetle and wildfire risk (e.g. Fuzzy and Sunriver HFRA EA), especially within the wildland-urban interface (WUI). Large, widespread outbreaks and wildfires are expected to become less common but still occur in patches away from the WUI. Foraging and nesting habitat in the future would likely be distributed in smaller densities across the landscape; and nesting and foraging habitat would become rarer in the WUI.

Cumulative effects to this species and its habitat as a result of the alternative would be negligible due the general lack of quality habitat and similarity of habitat quality throughout the landscape. The current wildfire areas that providing habitat would not be sustained in the long-term, and because the vegetation management objectives of other projects seek to reduce the risk of insect outbreaks and wildfire, habitat for this species outside of the lodgepole pine allocations may become more limited.

Northern Flicker *S5 Secure*

Summary and Plan Consistency: Effects to northern flickers are expected to be minimal. Areas of no treatment interspersed with proposed units, the fact that the snags and logs are not proposed for removal, this species is ranked “secure” and can utilize a myriad habitat types all support the conclusion that the proposed actions would not cause a downward trend in populations of this species.

- WL-37 "…sufficient snags will be maintained to provide 40% of potential population levels of cavity-nesting species within eve-aged harvest units…groupings of green replacements will be preferred implementation technique. Compliance will be based on the harvest unit area…"

The Eastside Screens revised this standard and guideline to reflect the 100% potential population level. This standard as been addressed under the Snag discussion.

- WL-38 "Specific guidance will be provided by the Deschutes National Forest Wildlife Tree Implementation Plan."

This document was used to determine green tree replacement habitat for future flicker habitat. See Green Tree Replacement discussion..

LRMP direction for this MIS species is met through the consideration and management of habitat currently and in the future. The dead wood analysis has shown that current estimates of snag densities generally meet the directed level except for large snags. The project alternatives would not directly affect current snag densities, and would likely improve habitat in the future.

Existing Condition

Northern flickers are perhaps the most common woodpecker resident in Oregon. They can be found in a range of terrestrial habitat but are generally abundant in open forests and forest edges adjacent to open country (Marshall et al. 2003). Being a large cavity nester (12.5" long according to Sibley, 2005); they require large snags or large trees with decay in order to build their nests.

Northern flickers have been observed within the area and within proximity to proposed treatment areas. Potential habitat for this species is considered any plant association with large trees. There is a general lack of large diameter snags within the proposed units and adjacent areas due to historical harvest of the area.

Alternative 1 (No Action)

Direct, Indirect, and Cumulative Effects: Because there are no proposed actions with this alternative, there would be no change from the existing condition and therefore no effects (direct, indirect or cumulative) resulting from this alternative.

Effects Alternative 2 (Proposed Action)

Direct, Indirect, and Cumulative Effects: The northern flicker is a relatively common species that can utilize a variety of habitat types from wilderness to back yards. Marshall et al. (2003) report that flickers require open space, therefore with habitat within the project area and the watershed in general, is not lacking. It is a relatively large bird, thereby requiring large snags in which to nest. The requirement of large snags may limit flicker populations. Mellen et al. (2006) recorded data for this species in the mixed conifer types utilizing snags from 17-29" dbh. Post wildfire data referenced in DecAID show the 30 to 80% tolerance levels for flickers being 27 to 84 snags greater than 10: dbh per acre and 2 to 40 snags greater than 20" dbh per acre.

The proposed actions would not have any direct effects to northern flicker habitat because no snags are proposed for harvest. Short-term indirect effects to flicker habitat would include removal of potential nest trees (i.e. trees greater than 16" dbh but less than 21" dbh). In the long-term, better habitat may

develop more quickly as retention trees respond to the thinning, individuals die, and more large snags are created.

Flicker habitat would remain on the landscape. Since neither the proposed action or no action alternative nor any ongoing or reasonably foreseeable project proposes to cut snags, cumulative effects would be negligible.

Landbird Focal Species

Table 57: Landbird Focal Species Considered - Those in Bold Receive Further Consideration

Species	Status*	Habitat	Presence
Lewis' woodpecker	Landbird focal species, MIS, BCC	Ponderosa pine forests, burned forests	Documented in general project area. Potential habitat in some of the proposed units.
Williamson's sapsucker	Landbird focal species, MIS, BCC	Mature or old growth conifer forests with open canopy cover; weak excavator	No Habitat within or adjacent to proposed treatment areas
White-headed woodpecker	Landbird focal species, MIS, BCC	Mature ponderosa pine forests; weak excavator	Potential habitat in proposed treatment areas
Black-backed woodpecker	Landbird focal species, MIS, BCC	Lodgepole pine forests, burned forests	Documented in general project area. Potential habitat in some of the proposed units.
Clark's nutcracker	Landbird focal species	Mature/old-growth Whitebark pine	No Habitat within or adjacent to proposed treatment areas
Sandhill Crane	Landbird focal species	Montane meadows	No Habitat within or adjacent to proposed treatment areas
Blue grouse	Landbird focal species	Subalpine fir	No Habitat within or adjacent to proposed treatment areas
Pygmy nuthatch	Landbird focal species,	Mature ponderosa pine forests and snags	Habitat in proposed treatment areas
Chipping sparrow	Landbird focal species	Open understory ponderosa pine forests with regeneration	Habitat in proposed treatment areas
Brown creeper	Landbird focal species	Large trees in mixed conifer forests	No Habitat within or adjacent to proposed treatment areas
Flammulated owl	Landbird focal species, BCC	Interspersed grassy openings and dense thickets in mixed conifer forests	No Habitat within or adjacent to proposed treatment areas
Hermit thrush	Landbird focal species	Multi-layered/dense canopy in mixed conifer forests	No Habitat within or adjacent to proposed treatment areas
Olive-sided flycatcher	Landbird focal species	Edges and openings created by wildfire in mixed conifer forests	Documented in general project area. Potential habitat in some of the proposed units.

Landbird focal species come from the Conservation Strategy for Landbirds of the East-Slope of the Cascade Mountains in Oregon and Washington (Altman 2000); **MIS = Management Indicator Species** come from the Deschutes National Forest Land and Resource Plan (LRMP)[1990]; **BCC = Birds of Conservation Concern** come from the US Fish and Wildlife Service Birds of Conservation Concern – BCR 9 (Great Basin) [2002];

Rationale for Species not Considered in Detail

The Williamson's sapsucker, and Lewis', white headed, and black backed woodpeckers are discussed under MIS.

As displayed in Table 57, the following species have no habitat within or adjacent to proposed treatment areas: Clark's Nutcracker, Sandhill Crane, Blue Grouse, Brown Creeper, Flammulated Owl, and Hermit Thrush. The full rationale for these species is discussed to a greater extent in the Wildlife report (Project Record, beginning on page 49).

Species Receiving Further Consideration

Pygmy Nuthatch: *Landbird Focal Species, S4 Apparently Secure*
Chipping Sparrow: *Landbird Focal Species, S4 Apparently Secure*

Summary and Plan Consistency

Although pygmy nuthatches and chipping sparrows are not Management Indicator Species under the LRMP, they are considered under the Conservation Strategy for Landbirds of the East-Slope of the Cascade Mts. in Oregon and Washington. This Conservation Strategy is used to address the requirements to assess the impacts to neotropical migratory birds under Executive Order 131186. The Conservation strategies have been addressed under the proposed actions. Habitat provisions for many of the MIS species also provides habitat for various landbirds and meets the intent of the Conservation Strategy.

Existing Condition

Pygmy nuthatches are a focal species for large trees, Table 58, in the ponderosa pine stand types. It is likely that they can be found in the proposed treatments. Although there may be a general lack of large trees in the proposed treatment areas, most of the units are of the ponderosa pine plant associations and pygmy nuthatches have been observed in similar habitats.

Chipping sparrows are a focal species of more open ponderosa pine stands with active regeneration, Table 58. They are a species that will nest relatively close to the ground in young pine trees (e.g. 4-8 ft. tall). This kind of habitat can be found in small pockets within some of the proposed treatment areas. Their habitat is limited by the more even-aged, tall, and high density of the proposed treatment units.

Table 58: Priority Habitat Features and Associated Focal Species for Conservation in Selected Habitats in the East Slope Cascades Landbird Conservation Planning Region and Found Within the Proposed Action Areas

Habitat	Habitat Feature/ Conservation Focus	Focal Species by Subprovince
		Central Oregon/Klamath Basin
Ponderosa Pine	large patches of old forest with large snags	white-headed woodpecker
	large trees	pygmy nuthatch
	open understory with regeneration pines	chipping sparrow

Effects to habitat for some of the focal species will be discussed under other headings: white-headed woodpecker (page 43)

According to the Conservation Strategy, the desired condition in ponderosa pine forest is a large tree, single layered canopy with an open, park-like understory dominated by herbaceous cover with scattered shrub cover and pine regeneration. Ponderosa pine forest within the East-Slope Cascades Landbird Conservation planning unit occurs extensively at low elevations in all the subprovinces except Columbia Foothills where it is a minor component. The proposed action areas fall into the range of this strategy.

Timber harvesting, particularly at lower elevations, has resulted in the loss of older forests and large diameter trees and snags. There is a high risk of loss of remaining overstory from stand-replacing fires due to high fuel loads in densely stocked understories (Altman, 2000). This is true for the proposed action areas, although it has been noted before there is a general lack of large diameter trees and snags.

Landbird conservation in ponderosa pine forest emphasizes maintaining healthy ecosystems through representative focal species for four habitat conditions. Within the proposed action areas, these include large patches of old forest with large snags and trees, and an open understory with regenerating pines.

Conservation strategies for management of this habitat include: use of prescribed burning and/or thinning when and where appropriate to reduce fuel loads and accelerate development of late-seral conditions; retain all large trees, especially ponderosa pine >20" dbh; initiate snag creation and recruitment where necessary; retain all existing snags and broken-topped trees in units; implement road closures (obliteration); and minimize invasion of exotic and noxious weeds and soil erosion.

Alternative 1 (No Action)

Direct, Indirect, and Cumulative Effects This alternative does not address the conservation strategies recommended by Altman, (2000). There is the potential effect of further loss of these habitats by retaining the existing condition. In the event of a wildfire, it would take decades for late seral habitat to develop.

The existing condition of ponderosa pine habitat in the proposed action areas is similar to the conditions of these habitats in the adjacent planning areas. Currently the existing condition provides little high quality habitat for the focal species (pygmy nuthatch and chipping sparrow) within this type. Maintaining the current level of risk to beetle-induced mortality and/or wildfire in these stands would contribute to an overall reduction of habitat for these focal species (pygmy nuthatch and chipping sparrow).

Alternative 2 (Proposed Action)

Direct, Indirect, and Cumulative Effects: This alternative addresses the management strategies for these habitat types (e.g. prescribed burning and thinning). No snags are proposed for harvest, and no trees over 21" dbh would be harvested. Proposed road closures would help prevent the spread of invasive weeds.

In the short-term there would be changes in habitat for the focal species. Habitat for chipping sparrows would increase due to the thinning of overstory trees that would open up areas to allow pockets of natural regeneration. In time, habitat for pygmy nuthatches and white-headed woodpeckers would increase as tree diameter growth increases as a response to the thinning and tree crowns close in, increasing the canopy closure.

As stands respond to treatment and risk is reduced, ponderosa pine habitat would become more stable. Fuels densities would become lower, possibly allowing for the historic fire regime to occur. Habitat for all of the focal species is expected to improve in quality.

Within the project area and the adjacent planning areas (Sunriver, OZ, and Fuzzy), improving the stability and quality of ponderosa pine habitat, and developing more late-seral ponderosa pine habitat would provide better distribution of the focal species. Increased amounts of quality habitat in the

project area would provide more resiliency of the focal species populations in the event of a large wildfire or insect outbreak.

Olive-sided Flycatcher *S3 Vulnerable*

Summary and Plan Consistency

Olive-sided flycatchers are a focal species of edges and openings created by wildfires (Altman, 2000). In Altman (2000), the list of conservation issues for the olive-sided flycatcher's habitat includes reduced amount of edge between early and late seral forest; and brush control that limits understory growth that provides insect productivity. The proposed activities are planned to reduce the size of a high severity and create smaller patches of openings; therefore the proposed actions would not contribute to the conservation issue. Mowing of 2,917 acres is proposed and this would contribute to the conservation issue of brush removal.

For conservation strategies stated in Altman (2000) to address the issues, this proposal meets: creating more edge habitat through patchiness; and using prescribed fire. Some of the other strategies did not apply (e.g. prohibit salvage logging in post-fire habitat; minimize pesticide spraying) or were not appropriate for the area (e.g. allowing fires to burn). The strategy to minimize brush cutting was not met by the proposed actions.

Existing Condition

This species will perch and hunt from dead trees within an open area and usually nest within the forest surrounding the opening (Natureserve, 2007). There are areas that have been burned recently (e.g. 18 Fire 2003 and Woodside Ranch Fire 2007). Olive-sided flycatchers have been observed adjacent to the area. Habitat is not seen as limited within the area due to the amount of recent wildfires.

Alternative 1 (No Action)

Direct, Indirect, and Cumulative Effects: Because there are no proposed actions with this alternative, there would be no change from the existing condition and therefore no effects resulting from this alternative.

Alternative 2 (Proposed Action)

Direct and Indirect Effects: Proposed actions under either alternative are expected to have minimal negative effects to olive-sided flycatchers. The proposed actions would not prevent fires or beetle kill from occurring within the watershed or the proposed units. Therefore, habitat for olive-sided flycatchers would continue to be recruited into the area.

Olive-sided flycatchers do use snags for perching while hunting/foraging. No snags are proposed to be removed.

Conservation issues associated with this species include: changes in fire regimes that have resulted in fewer but larger fires that reduce amount of edge between early and late seral forest; and brush control limits understory growth that provides insect productivity. Mowing and prescribed burning would reduce brush (see shrub discussion under Deer and Elk.).

Some of the Conservation Strategies in Altman (2000) for this focal species and relevant to the proposed actions include: 1) using prescribed fire with manual understory clearing where appropriate to create a patchy mosaic of burned forest; 2) increase the level of acceptable opportunities to allow wildfires to burn or ignite fires when conditions and opportunities exist; 3) where possible, prohibit salvage logging to occur in post-fire habitat; 4) for protection of snags, close roads or restrict fuelwood permits in areas where large snags are present; 5) retain standing dead or diseased trees where they occur; 6) If snags are limiting, create suitable snags through girdling, topping, etc., minimize brush control; 8) selective logging can be used to increase suitability of habitat as long as sufficient large living and dead trees are retained; and 9) eliminate or minimize pesticide spraying near nesting pairs which may reduce insect prey base. The proposed actions would contribute towards the strategies that encourage a patchy mosaic and retain large trees and snags through proposals to thin and pre-commercial thin. The proposed actions would not contribute towards the meeting of the strategy to minimize brush control because of the number of acres that mowing is proposed. The action alternative would contribute towards meeting the strategies for snag retention or prohibition of salvage logging, and snags would be retained on the landscape. The strategy to allow fires to burn is not appropriate for the proposed action areas because they are within the wildland-urban interface and human safety becomes an issue.

The mitigation to retain 30% of the mowing and burning units as untreated would help limit the disturbance to nesting olive-sided flycatchers.

Cumulative Effects: There would be additive effects to the ongoing and reasonably foreseeable actions that reduce shrub and brush cover (Sunriver HFRA, OZ, Fuzzy). For olive-sided flycatcher habitat these additive effects would be negligible because: 1) this species utilizes open habitat with snags; these would continue to be available within the proposed units as well as areas intermingled with proposed units that would continue to provide habitat for this species, and 2) within each project proposal, mitigation was added that retains part of the unit as not be treated.

Birds of Conservation Concern (BCC)

Table 59: Birds of Conservation Concern Considered - Those in Bold Receive Further Consideration

Species	Status*	Habitat	Presence
Tricolored blackbird	Regional Forester Sensitive, BCC	Lakeside, bullrush	No Habitat within or adjacent to proposed treatment areas
Yellow rail	Regional Forester Sensitive, BCC	Marsh	No Habitat within or adjacent to proposed treatment areas
American peregrine falcon	Regional Forester Sensitive, BCC	Riparian, cliffs	No nesting habitat within or adjacent to proposed treatment areas.
Golden eagle	MIS, BCC	Large open areas with cliffs and rock outcrops	No Habitat within proposed treatment areas; potential habitat adjacent to proposed treatment areas
Flammulated owl	Landbird focal species, BCC	Interspersed grassy openings and dense thickets in mixed conifer forests	No Habitat within or adjacent to proposed treatment areas
Lewis' woodpecker	MIS, Landbird focal species, BCC	Ponderosa pine forests, burned forests	Documented in general project area. Potential habitat in some of the proposed units.
Williamson's sapsucker	MIS, Landbird Focal species, BCC	Mature or old growth conifer forests with open canopy cover; weak excavator	No Habitat within or adjacent to proposed treatment areas
White-headed woodpecker	MIS, Landbird focal species, BCC	Mature ponderosa pine forests; weak excavator	Potential habitat in proposed treatment areas

Species	Status*	Habitat	Presence
Swainson's hawk	BCC	Open country	No Habitat within or adjacent to proposed treatment areas
Ferruginous hawk	BCC	Open sagebrush flats; open country	No Habitat within or adjacent to proposed treatment areas
Prairie falcon	BCC	Rimrock, cliffs in open country	No Habitat within or adjacent to proposed treatment areas
Greater sage grouse	BCC	Sagebrush flats	No Habitat within or adjacent to proposed treatment areas
American golden plover	BCC, Shorebird	Upland tundra, rare in OR in dry mudflats, fields and pastures	No Habitat within or adjacent to proposed treatment areas
Snowy plover	BCC, Shorebird	Sandy beaches	No Habitat within or adjacent to proposed treatment areas
American avocet	BCC	Shallow water	No Habitat within or adjacent to proposed treatment areas
Solitary sandpiper	BCC, Shorebird	Small, freshwater mudflats	No Habitat within or adjacent to proposed treatment areas
Whimbrel	BCC, Shorebirds	Grassy marshes and tidal flats	No Habitat within or adjacent to proposed treatment areas
Long-billed curlew	BCC, Shorebird	Dry grasslands	No Habitat within or adjacent to proposed treatment areas
Marbled godwit	BCC, Shorebird	Expansive mudflats and sandflats on beaches	No Habitat within or adjacent to proposed treatment areas
Sanderling	BCC, Shorebird	Sandy beaches with wave action	No Habitat within or adjacent to proposed treatment areas
Wilson's phalarope	BCC, Shorebird	Shallow ponds within grassy marshes	No Habitat within or adjacent to proposed treatment areas
Yellow-billed cuckoo	BCC	Riparian hardwoods	No Habitat within or adjacent to proposed treatment areas
Burrowing owl	BCC	Open grassland or agricultural land	No Habitat within or adjacent to proposed treatment areas
Black swift	BCC	Damp coastal cliffs	No Habitat within or adjacent to proposed treatment areas
Loggerhead shrike	BCC	Open habitat with scattered trees and shrubs	No Habitat within or adjacent to proposed treatment areas
Gray vireo	BCC	Rocky, dry hillsides with scattered trees	No Habitat within or adjacent to proposed treatment areas
Virginia's warbler	BCC	Mountain mahoghany	No Habitat within or adjacent to proposed treatment areas
Brewer's sparrow	BCC	Sagebrush habitats	No Habitat within or adjacent to proposed treatment areas
Sage sparrow	BCC	Sagebrush habitats	No Habitat within or adjacent to proposed treatment areas

***Federally listed and Regional Forester Sensitive** species come from the Region 6 Threatened, Endangered, and Sensitive species list for the Deschutes National Forest; **Landbird focal** species come from the Conservation Strategy for Landbirds of the East-Slope of the Cascade Mountains in Oregon and Washington (Altman 2000); **MIS = Management Indicator Species** come from the Deschutes National Forest Land and Resource Plan (LRMP)[1990]; **BCC = Birds of Conservation Concern** come from the US Fish and Wildlife Service Birds of Conservation Concern – BCR 9 (Great Basin) [2002]; and **Shorebirds** come from the 2004 US Fish and Wildlife Service U. S. Shorebird Conservation Plan.

Rationale for Species not Considered in Detail

The **Lewis' woodpecker** and **White-headed woodpecker** are discussed under MIS.

The following species have no habitat within or adjacent to proposed treatment areas: tricolored blackbird, yellow rail, American peregrine falcon, golden eagle, flammulated owl, Williamson's sapsucker, Swainson's hawk, ferruginous hawk prairie falcon, greater sage grouse, American golden plover, snowy plover, American avocet, solitary sandpiper, whimbrel, long-billed curlew, marbled

godwit, sanderling, Wilson's phalarope, yellow-billed cuckoo, burrowing owl, Black's swift, loggerhead shrike, gray vireo, Virginia's warbler, Brewer's sparrow, and sage sparrow. These species are discussed in further detail on pages 42 through 46 of the Wildlife report contained in the project record.

Specific Habitat Features

It was determined that certain wildlife habitat features would be more appropriately analyzed as a whole category since they tend to develop as an issue in and of themselves apart from the species that utilize them. To be sure, where there are species specific effects, these have been analyzed under the appropriate species. The analysis in this section is a more broad approach.

Dead Wood (Snags, Logs, and the Provision for Future Snags and Logs – Green Tree Replacements)

Snags

Summary and Consistency with Direction

The proposed actions are not expected to change the existing dead wood densities. Habitat for cavity nesters may be provided, generally, at the 30 to 50% tolerance levels over the larger area that would take in the more recent wildfire areas. Because the proposed actions take place within the wildland-urban interface with the community of Bend, suggests that the proposed units would not provide as high quality of habitat as other management allocations.

Eastside Screens, 6. Interim Wildlife Standard, d. Scenario A, 4) a) Snags, Green Tree Replacements and Downed Logs: (1) "All sale activities…will maintain snags and green tree replacement trees of greater than or equal to 21" dbh, (or whatever is the representative dbh of the overstory layer if it is less than 21 inches), at 100% potential population levels of primary cavity excavators. This should be determined using the best available science on species requirements as applied through current snag models or other documented procedures. NOTE: for Scenario A, the live remnant trees (greater than or equal to 21" dbh) left can be considered for part of the green replacement tree requirement."

No snags are planned to be removed under any alternative.

Existing Condition

Numerous species of animals use snags and coarse woody material (CWM) for foraging, nesting, denning, roosting and resting. A snag is defined as a dead tree that is over 10 inches dbh and taller than 10 feet. Coarse woody material is considered to be dead and down material that is greater than 5 inches in diameter (Ohmann and Waddell, 2002; Mellen et al. 2006). The most notable species using snags and CWM are the primary cavity nesters (e.g. woodpeckers and nuthatches) that excavate nest cavities in decayed wood in standing trees, marten and bats. Vacated cavities are subsequently used by many other birds and small mammals (i.e. secondary cavity users). Selected wildlife species known or suspected to occur in the proposed action areas that utilize these habitats are listed in the various Tables and can be found in the earlier discussions under each species (e.g. hairy woodpecker, white-headed woodpecker, Lewis' woodpecker).

Snag and CWM habitat conditions were analyzed and compared using current direction and newer research, including the DecAID Advisory tool. The DecAID Advisor is a planning tool intended to help specialists manage snag and log levels best suited for their management area's habitat types and associated wildlife species. This tool uses the best available science and most recent research for species dependent on snags and coarse woody material. Densities are given in the form of wildlife species tolerance levels at the 30%, 50%, and 80% levels. For example, assuming normally distributed data, if 20% of a species' nests were in areas with greater than 18 snags per acre, then 80% of the nests were found in areas with 0 to 18 snags per acre, and 18 snags per acre is the 80% tolerance level. Information in regards to existing snag and log densities and sizes were gathered through field sampling and aerial insect and disease maps.

The wildlife and inventory data within the specific habitat types displayed in DecAID were used to analyze the current condition within the planning area in its relation to providing habitat for the various species. In characterizing the landscape, several links within the DecAID advisor were used including "Relative potential for dead wood within wildlife habitat types as influenced by fire regime, sub-series, and topographic position" found in the DecAID Implementation Guide; and the Aerial Insect and Disease Survey maps.

The habitat types found within the proposed action areas and adjacent planning areas are within a high frequency fire regime. Topography is generally flat to moderate slopes. This suggests that the relative potential levels of dead wood would be low to moderate. It also suggests that the proposed action areas would tend to the lower wildlife tolerance levels (30%-50%).

The proposed action areas are within the WUI for the community of Bend. Recent legislation and focus has been to reduce the wildfire risk in these areas through actions such as those proposed. A ramification of this new focus and emphasis is that attaining these objectives are not conducive to retaining dead wood densities or the conditions that would most likely generate dead wood at the rate to achieve the 80% tolerance levels. In short, the WUI may not be the most suitable land allocation to manage for high levels of dead wood.

Table 60 is a summary of the current snag levels (determined from 1995 stand exam data) followed by a summary of the wildlife data. Selected species are MIS species that may be found in the planning area and displayed by habitat type, from the DecAID advisor (Table 61).

Table 60: Existing Snag Information

Plant Association Group/ Habitat Type	Average snags/acre 10-19.9" dbh	Average snags/acre ≥20" dbh
Ponderosa Pine Dry/ Ponderosa Pine Douglas-fir (PPDF)	1.4	0.09

Table 61: Snag densities for Wildlife Species at 30, 50, 80 Percent Tolerance Level for Snags Greater Than 10" DBH and Greater Than 20" DBH Based on Wildlife Data in DecAID

	30% Tolerance level (Number of snags/acre)		50% Tolerance level (Number of snags/acre)		80% Tolerance level (Number of snags/acre)	
	≥10"dbh	≥20"dbh	≥10"dbh	≥20"dbh	≥10"dbh	≥20"dbh
Ponderosa Pine/ Doug-fir						
Black-backed woodpecker (BBWO)	2.5	0	14	1.4	29	6
Cavity-Nesting Birds (CNB)	1	0	5	1	10	3
Long-legged Myotis (LLMY)	4		17	-	37	
Pygmy Nuthatch (PYNU)	1	0	6	2	12	4
White-headed woodpecker (WHWO)	0.3	0.5	2	2	4	4
Current Direction for Ponderosa Pine [1]	**3**	**1**				

1 Current Direction (Screens) is provided by habitat type and densities >10" and >20". It is not broken down into tolerance levels but rather represents a 100% biological potential which has been determined to be a flawed technique (Rose et al 2002)

Based upon the information in Table 60 and Table 61, there is a lack of >20" dbh snags, and current snags densities are roughly providing habitat at the 0-30 % tolerance level for most species (30-50% for the white-headed woodpecker). This would reflect the earlier discussion regarding relative potential of dead wood being low-moderate reflecting the lower tolerance levels.

Since most of the planning area falls within the small/medium tree types, the clumps of snags would be expected to be small (2 to 5 per acre) with the majority of these snags being less than 20" dbh. The 2006-2007 Insect and Disease maps show potential outbreaks of mountain pine beetle in ponderosa pines occurring within the proposed units to the west and southwest. These areas may provide the higher density clump of snags utilized by some species (e.g. BBWO)

In considering the distribution of snags for those habitat types within proposed treatment areas, the DecAID data show that for the PPDF small/medium habitat type 54% of the area had no snags. Over 80% of area had less than 4 snags/acre that are greater than 10" dbh and less than 2 snags per acre greater than 20" dbh; no areas had greater than 6 snags per acre that were greater than 20" dbh. This distribution information suggests that most of the habitat types in the proposed action areas would not have the densities within each unit to meet the 80% tolerance level for many of the MIS species, but may have more or less even distribution of smaller densities. These distributions would likely be most suitable for wildlife species that select for a more even distribution of snags (e.g. white-headed woodpecker) than those that capitalize on dense pockets of snags (e.g. black-backed woodpeckers).

In looking at the relation of snag dbh and tolerance level, according to the inventory tables within each of the habitat types these species tend to select for snags greater than 20" dbh for nesting and/or roosting/denning across all of the habitat types, with the smaller snag sizes being used at the lower tolerance levels. Smaller diameter snags were more often used for foraging as reflected in the 10-20" dbh range of snags being in the 80% tolerance level for foraging.

The existing low density of snags coupled with the importance of large diameter snags to many of the MIS species, emphasizes the need to retain all existing snags as possible in the planning area, as well as creating conditions that would favor the recruitment of large snags.

In summary, there is snag habitat being provided albeit at lower levels than may be optimal for many MIS species. The planning area may be capable of providing more habitat than is currently present but with current social expectations, is not likely to sustain habitat at more than the 50% tolerance level. Populations may remain limited due to the current availability of habitat. As management away

from the WUI trends towards the historic range of variability and an increase in large ponderosa pine habitat, large clumps of snags as a result of beetle-kill or stand-replacing fire may become a more uncommon feature but would still occur on the landscape.

Coarse Woody Materials (CWM)

Summary and Consistency with Direction

The proposed actions would generally not effect existing downed log levels except in the instance of loss during the prescribed burning. Mitigation measures CWM-1 and CWM-2 would help ensure that at least the directed levels of downed wood are retained. Similar to the discussion for snags, the wildland-urban interface may rarely achieve any higher densities of downed wood due to societal concerns for fuel loadings.

- WL-72 "…An average of at least 3 cull logs-per-acre, plus 3 additional logs-per-acre…will be retained after timber management activities. Minimum qualifying sizes are 10 inches in diameter at the small end and 15 feet long…"
- WL-73 "Where logs…are not available, and average of 1 slash pile…or concentration…per acre will be retained to supplement qualifying logs."

Eastside Screens, 6: Interim wildlife standard; d. Scenario A, 4) Snags, Green Tree Replacements and Down Logs; [2]) revised these standards to read: " Pre-activity (currently existing) downed logs may be removed only when they exceed the quantities listed below…It is not the intention of this direction to leave standing trees for future logs in addition to the required snag numbers…" Quantities of logs: 3-6 pieces greater than 6 ft long and 12" in diameter or greater be maintained in ponderosa pine types (15-20 in mixed conifer), and 15-20 pieces greater than 8 feet long and 8" in diameter be maintained in lodgepole pine types.

Existing Condition

In order to analyze downed log habitat (CWM), a variety of information sources were used. The DecAID tool was used to determine a normal distribution of downed log densities across different habitat types. Research by Brown et al. (2003) suggests that the optimum quantity of coarse woody debris for fuel loading and wildlife habitat needs is 5 to 10 tons per acre for warm, dry ponderosa pine and Douglas-fir types (PPDF). Screens direction specifies pieces per acre of certain sizes to be retained according to habitat type. Table 62 compares the existing levels with these two measurements; reconciling to a common unit of measure.

Table 62: Comparison of Existing CWM and Directed Levels [1]

Habitat Type	Existing Level (% Cover)	LRMP/Screens Direction (% cover)	DecAID Level (% cover)
Ponderosa Pine (PPDF)	1.4	0.3-0.9	0.9-8.5

[1] Estimates of percent cover are given in order to compare with information in DecAID Advisor. The information for % cover levels from DecAID was taken from the inventory data. The wildlife data source either had limited sources (PPDF – one species). The ranges given reflect the 30-80% tolerance levels for all the structural stages.

Based on the Screens direction, the proposed action area is currently meeting CWM guidelines in the Ponderosa Pine habitat type. There may be a discrepancy in the stand exam data and what is currently there. That is to say, in the last 10 years there has been more dead wood creation. Whether considering the stand exam data or field verification, the ponderosa pine habitats are currently within the 30-50% tolerance levels when compared to the inventory data in DecAID.

Green Tree Replacements (GTRs)

Summary and Consistency with Direction

Eastside Screens, 6: Interim Wildlife Standard, d. Scenario A, 4) a) Snags, Green Tree Replacements and Downed Logs: (1) "All sale activities…will maintain snags and green tree replacement trees of greater than or equal to 21" dbh, (or whatever is the representative dbh of the overstory layer if it is less than 21 inches), at 100% potential population levels of primary cavity excavators. This should be determined using the best available science on species requirements as applied through current snag models or other documented procedures. NOTE: for Scenario A, the live remnant trees (greater than or equal to 21" dbh) left can be considered for part of the green replacement tree requirement."

LRMP direction refers to Deschutes WLTL for GTR numbers. This document gives figures based on Thomas 1979. In Bull et al (1997) it is suggested that Thomas figures were not high enough to cover all habitat needs. Using Screens direction to use most recent research, the GTR figures given in the DWTL were recalculated to reflect the updated 100% potential population levels based on newer research. Rose et al (2002) and Mellen et al (2006) determined that the "potential population level" is a flawed technique. Mellen et al (2006) uses statistical "tolerance levels" in the DecAID tool. DecAID is not part of the Screens direction; therefore its use was for comparison purposes.

As illustrated in Table 24 GTR levels after project implementation are expected to be met. Proposed treatments are expected to retain 30-90 trees per acre, and would meet the directed levels for the ponderosa pine types. These levels exceed the baseline GTR levels given in the Screens direction and WLTL that were based on Thomas (1979).

Existing Condition

Green tree replacements are trees retained, or managed through time, to provide snag or CWM habitat at some point in the future. The treatment unit is the area of accountability for meeting GTR objectives (Deschutes National Forest Wildlife Tree and Log Implementation Strategy [WLTL], 1994). The objective for treatment units is to provide patches of habitat, or GTRs in a distribution pattern suitable for home range needs of primary cavity excavators (WLTL 1994). According to the WLTL, green tree replacements do not need to be provided on every acre in the forested ecosystem. A mosaic distribution across the landscape maintaining viable populations and ecological functions is the desired condition. The desired condition is based on the assumptions that: 1) deficits or surpluses, whether natural or related to past management activities, would continue to be part of the landscape; 2) treatment units would be designed to meet WLTL objectives each entry or treatment; and 3) that some treatment units would not provide WLTLs due to preference given to other resource issues. The Eastside Screens direction requires all sale activities (including intermediate in both even-age and uneven-age systems) to maintain GTRs of >21 inches dbh, or the representative dbh of the overstory layer if less than 21 inches, at 100 percent maximum potential population levels (MPP) of primary cavity excavators. As shown in Table 24, this 100% MPP is estimated to be 4 snags per acre for ponderosa pine habitat types and 6 snags/acre for lodgepole pine habitat types. Table 63 illustrates the number of GTRs per acre that would be needed to meet current direction and DecAID levels assuming the average diameter of the stands after is at least 9 inches.

Table 63: Estimated Green Tree Replacement Trees per Acre (tpa) Required to meet Current Direction

	Habitat Type	
	Ponderosa Pine	**Lodgepole Pine**
Current Direction (100% MPP based on most recent literature)	4 snags per acre	6 snags per acre
GTRs (9" residual stand)	20 tpa	19 tpa

Alternative 1 (No Action)

Direct, Indirect, and Cumulative Effects: Because there are no proposed actions associated with this alternative there would be no change from the existing conditions, and therefore no direct, indirect or cumulative effects.

This alternative would maintain snag, CWM and green tree replacement habitats in the current condition during the short-term (<20 years). However, natural disturbances such wildfire, wind events, insect and disease pathogens, and lightning would recruit snag and CWM habitat through time in the project area. High tree density in some of the ponderosa pine stands would not only retard the development of large diameter (>21") ponderosa pine trees and future snags but also may hasten the development of smaller diameter snags and CWM as a result of mortality from bark beetles or fire.

With a history of timber management, the proposed treatment areas and the federal lands adjacent to it, have limited large snag, and log habitat. The area is dominated by stands of even-aged, uniform forest canopy where the trees are 50-80 years old and average less than 21" in diameter. The lack of large snags and logs makes habitat conditions for some woodpeckers (white-headed, and black-backed) marginal (see discussions for MIS species). Under the No Action alternative, to retain the current forest habitat conditions also means maintaining an increasingly higher risk of losing the habitat due to bark beetles and/or wildfire mortality. Snags created through these means would be <21" because most of the existing trees are smaller, and subsequently the logs created by these snags falling over would be smaller. It would take many decades for large snag and log structure to develop within the planning area.

Past wildfires in this habitat type (18 Fire, Skeleton Fire, and Woodside Ranch) have demonstrated what can happen to the existing habitat. In areas that naturally have a frequent understory burning regime, such as the ponderosa pine associations within the proposed treatment areas, there would be changes in bird communities after a wildfire with normally a relatively quick recovery to the community seen before the fire (Smith, ed. 2000). In the proposed treatment areas, this type of regime of frequent understory burning has not occurred partly due to aggressive fire suppression efforts in the past. The result of a fire burning in the area now may be a slower recovery of bird communities.

The indirect effect of no action is the increased risk of a dramatic shift of habitat and the associated bird, and other animal communities; (i.e., forested community to a mosaic with grass or shrub openings).

Alternative 2 (Proposed Action)

Direct and Indirect Effects: The action alternative does not propose commercial harvest or salvage of any snags or coarse woody material (CWM). With the exception of the occasional felling of snags that pose a hazard to human safety during timber sale operations, commercial harvest treatments would have no direct effects to snags or CWM habitats. In the short-term, commercial harvest would directly affect green tree replacements (GTR) by reducing the number of trees in treatment units. However the units would retain enough GTRs to exceed currently directed levels (Table 61 and Table 63). It is estimated that in units receiving thinning, 30-90 green trees per acre would be retained with a minimum of 9" dbh. This would meet the current direction. Commercial thinning would, in the long-term, contribute towards the development of larger GTRs and ultimately dead wood.

Prescribed underburning in the ponderosa pine habitat type would have direct effects to snags and CWM. Direct effects include a reduction in the amount of CWM either by length and diameter reduction or overall abundance. Prescribed burning, depending on burn intensity, may result in a reduction in the number of existing snags. Mortality of larger diameter green trees (>15") may also occur as a result of prescribed fire, supplementing snag numbers in the short-term and CWM over the long-term. The exact number of snags and CWM lost to prescribed fire or recruited from prescribed fire is unknown but with mitigation measures (CWM-1 and CWM-2) would minimize this risk while also attaining fuels objectives. The overall amount of dead wood would likely remain at directed levels. Incidental mortality of GTRs may occur but is expected to be minimal. Post treatment, the numbers of GTRs would likely exceed minimum management levels. Mechanical shrub treatments would have no direct effects to snags or CWM.

Indirect effects of the proposed actions include decreasing the recruitment of snags and CWM by removing trees, thereby reducing the risk of wildfire. Although the recruitment of dead wood habitats would slow, silvicultural treatments (commercial thinning, pruning) would provide beneficial indirect effects by promoting faster growth of GTRs, ultimately providing larger diameter snags and CWM. There would still be some recruitment of snags as a result of beetle activity because there would be dense patches within and adjacent to the proposed units. Natural fuels treatments (prescribed underburning and mechanical shrub treatment) would provide the indirect benefit of reducing fire risk and maintaining these habitats over the long-term.

Cumulative Effects: The effects of the proposed, current, past, and foreseeable actions, would be a reduction in the amount and recruitment of smaller snags and CWM over the landscape due to harvest prescriptions that would improve the health of the stands and make them less susceptible to beetle-induced and/or wildfire mortality. This may affect the density of dead wood in the small/medium structure stages, in the short-term, but is not expected to substantially change the current ratios seen over the landscape. This may be a long term effect within the wildland-urban interface and high recreation areas (e.g. Lava Lands Visitor Center) where higher densities of dead wood are not encouraged.

One benefit of the proposed actions with other vegetation management projects is the long-term (>30 years) reduced tree competition, allowing for accelerated tree growth resulting in larger snags and CWM, as trees grow, die, and fall; thereby substantially improving the density of large snags and log available over the analysis area. It is this large size structure that is currently the most lacking.

LOS Habitat/Connectivity

Late and Old Structure Forest Habitat (LOS)

Summary and Consistency with Direction

Eastside Screens, 6. Interim wildlife standard, d. Scenario A "DO NOT allow timber sale harvest activities to occur within LOS stages that are BELOW HRV." 2) (a) "maintain all…live trees ≥21" dbh that currently exist. b) manipulate vegetative structure that does not meet late and old structural conditions…in a manner that moves it towards these conditions as appropriate to meet HRV."

There are no proposed commercial thinning actions within any classified LOS. Proposed treatments are expected to move the project area towards the historic range of variability (HRV) for LOS, as shown in Table 64.

Existing Condition

Late and old structure forest habitat is defined by the Eastside Screens as multi-strata stands with large trees (referred to as stage 6) and single strata stands with large trees (referred to as stage 7). A large tree is defined as being greater than or equal to 21 inches in DBH. Multi-stratum stands are comprised of two or more tree canopy layers and two or more size cohorts of trees. Medium and large sized trees dominate the overstory but trees of all size classes may be present. Stand structure and tree sizes are diverse. Single stratum LOS stands are comprised of a single dominant canopy stratum consisting of medium or large sized trees. Large trees are common. Young trees are absent or few in the understory. The stand may appear "park-like".

There are no Old-Growth Management Areas (OGMAs) within or proximate (within 1 mile) of the proposed action areas. There is a small patch of classified LOS overlapping with one proposed action areas. The amount of late and old structure forest habitat around the proposed action areas is extremely limited due to extensive timber harvest in the early to mid part of the 20th century. Both the stage 6 and stage 7 structural stages are below the Historical Range of Variability (HRV), defined as conditions in the pre-European settlement area. Low amounts of this habitat limit the abundance of LOS associated wildlife species in the area, such as the northern goshawk, white-headed woodpecker, and pygmy nuthatch. Table 64 displays the amount of LOS habitat around the proposed action areas (for an area of approximately 8811 acres) by structural stage, tree species, and selected LOS associated wildlife species. For further discussion of the HRV refer to the silviculture report, Project Record, Appendix C.

Table 64: Acres of LOS Habitat by Structural Stage, Plant Association Group, and LOS Associated Wildlife Species

Structural Stage (Eastside Screens)	Plant Association Group (PAG)	Acres	HRV	Selected LOS Associated Wildlife Species
6	Ponderosa Pine Dry	15-70 (1%)	10-35%	Cooper's Hawk, Northern Goshawk, Sharp-shinned Hawk, Pygmy Nuthatch,
7	Ponderosa Pine Dry	0	20-55%	Lewis's Woodpecker, White-headed Woodpecker, Pygmy Nuthatch
Total LOS within proximity to the proposed treatment areas (8,811 acre area)		15-70 (~1%)		

Alternative 1 (No Action)

Direct and Indirect Effects: Because there are no proposed actions associated with this alternative there would be no change from the existing conditions, and therefore no direct or indirect effects.

Late and old structure (LOS) forest habitats would continue to age and mature, developing LOS characteristics (large diameter trees, large lateral limbs, snags, CWM). Earlier structural stage stands (structural stages 1 through 5) would also mature, moving these stands towards LOS habitat. High tree densities in many of the ponderosa pine stands would retard tree growth, increasing the amount of time to attain large diameter trees, and also place these stands at risk to insects, disease, and wildfire and may result in loss of LOS habitats.

In the long-term (40 years for lodgepole and 70-90 years for ponderosa pine), assuming there are no large-scale disturbances (e.g. fires or beetle outbreaks), a growth rate of 1 inch dbh per decade and that there are a number of large trees existing within the stands, LOS may develop from existing Understory Reinitiation and Multi-story without Large Trees stands. Current LOS would likely remain LOS in the long-term.

With a long history of timber management, the proposed action areas have no LOS and the federal lands adjacent to it, have limited LOS habitat. According to the Historic Range of Variability (HRV) analysis (Silviculture Report, B. Schroeder , Silviculturist, July, 2007), 20-55% of the HRV Analysis area should be single-storied with large trees (SS 7) and 10-35% multi-storied with large trees (SS 6). The current ratios are 0-1% for both types. For the most part, there are areas of even-aged, uniform forest canopy where the trees are 50-80 years old and average less than 21" in diameter, with some of these areas containing some regeneration. This type of forest can provide some habitat for pygmy and flammulated owls (great grey owls with the meadows associated on private land and in the riparian corridor), Cooper's and sharp-shinned hawks, goshawks, some myotis species, chipping sparrows, pygmy nuthatches, and olive-sided flycatchers. With current conditions, to retain this forest habitat also means maintaining an increasingly higher risk of losing the habitat due to "natural" thinning via bark beetles and/or wildfire. It would take many years (>40 years) for LOS structure to develop within the proposed action areas.

In areas with a frequent understory burning regime (e.g. ponderosa pine associations), there would be changes in bird communities with a relatively quick recovery to the community seen before the fire (Smith, ed. 2000). The proposed project areas, historically, had this type of regime. In this type of regime where frequent understory burning has not occurred (as present now), the result of a fire eventually burning the area would be a slower response of the bird communities, and thus a slower recovery of bird communities. The indirect, cumulative effect of an increased risk to the existing condition is the increased risk of a dramatic shift of bird, and other animal communities.

The 18 Fire illustrated what could happen under the no action alternative. As a result of no action, this particular area would provide continuous forest habitat for wildlife but with a high risk of wildfire. Forest and LOS habitat, with a low risk to beetles and/or wildfire, would be provided in the long-term (>20 years) adjacent to the project area as a result of the current and foreseeable projects (e.g. East Tumbull: approx. 496 acre of LOS).

Alternative 2 (Proposed Action)

Direct and Indirect Effects: There is one unit that overlaps with an LOS patch. Unit 136 proposes to mow and underburn the stand. This is not expected to directly affect the LOS conditions, and may actually improve the resiliency of the stand.

In time, the effects of the proposed actions would be to increase tree growth within the proposed units, providing a dominance of large diameter trees and multiple canopy layered stands in the future; to reduce the risk of loss to wildfire by reducing ground and ladder fuels; and to reduce the risk of mortality from insects, primarily bark beetles, by reducing tree competition. Stands of structural stage 7 (single-story with large trees) may develop. This would benefit species associated with this habitat type, such as the white-headed woodpecker. A negative effect is to reduce the immediate recruitment of snags and coarse woody material (CWM) by increasing tree growth and vigor. This negative aspect is offset by the increased tree growth that would in time provide for larger diameter snags and CWM suitable for a greater variety of cavity and down wood associated wildlife. Over time, treated stands would become LOS, provide large diameter trees, and large diameter snags and CWM.

The long-term effects of the proposed actions would be to increase the amount of ponderosa pine LOS (open understory, frequent fire regime). In the short-term (e.g. next 20 years), much of the area would have little LOS habitat as a result of past management actions and natural events such as wildfire. Over the long-term (>20 years) the abundance of LOS habitat and the wildlife species associated with it are expected to increase within the units. Existing LOS habitat is also expected to be more resilient to major events (e.g. wildfire or insect outbreak) because of the managed stands around them and an overall decrease in fuel loading around them. Wildlife species that would benefit the most in the long-term would be those that are associated with old-growth ponderosa pine.

Cumulative Effects: Over a larger area of adjacent planning areas (15,000 acres), the current proportions and trends with LOS/old growth habitat are similar and effects within proposed action areas are additive to those in adjacent areas. Assuming that thinning would set the stage for an increase in LOS, the proposed actions would add 583 acres of ponderosa pine LOS over the area. In the long-term, as larger structure develops as a result of the other vegetation management objectives to increase health, vigor/growth, and resiliency of stands contributed by other vegetation management projects (Sunriver HFRA, OZ, Kapuka).

Connectivity

Summary and Consistency with Direction

There are no proposed actions within any LOS corridors. All alternatives meet LRMP and Screens direction by the designation of corridors connecting OGMAs and LOS habitat by at least two ways, and vegetation treatment proposed within any corridors would meet criteria.

Eastside Screens, #6 Interim wildlife standard, d. Scenario A, 3) "Maintain connectivity and reduce fragmentation of LOS stands by adhering to the following standards…(1) …a contiguous network pattern by at least 2 different directions…(2) canopy closures are within the top one-third of site potential. Stand widths should be at least 400 ft. wide…(4) Harvesting within connectivity corridors is permitted if all the criteria in (2) above can be met, and if some of understory…is left in patches or scattered to assist in supporting stand density and cover. Some understory removal, stocking control, or salvage may be possible activities, depending on the site."

Existing Condition

Maintaining connectivity between habitats, particularly late and old structured habitat, is believed to be important for numerous wildlife species. Connectivity of habitats is believed to allow free movement, interaction of adults, and dispersal of young. Although there current controversy regarding

the value of corridors (Nature.com/news/2007), management direction pertaining to maintaining connectivity between late and old structured stands, in addition to designated old growth management areas, is provided by the Eastside Screens.

Eastside Screen direction is to maintain or enhance the current level of connectivity between LOS stands and between all LRMP designated old growth (OGMA) habitats by maintaining stands between them. LOS stands and old growth (OGMA) habitats need to be connected to each other inside the project area, as well as, to adjacent project areas, by at least two directions. Connectivity corridor stands should be those in which medium diameter or larger trees are common, and canopy closures are within the top one-third of site potential. Stand widths should be at least 400 feet wide at their narrowest point. If stands meeting this description are not available then the next best stands should be used for connections. The length of corridors between LOS stands and old growth management areas should be as short as possible.

Connectivity corridors, meeting Eastside Screens direction, were identified within the overall project area (Figure 16). The corridors connect all Forest Plan Old Growth management areas to stands classified as LOS, and to old growth management areas and LOS stands in adjacent project areas.

Management direction related to maintaining travel corridors for big game (deer and elk) is provided by the LRMP. Travel corridors may be provided where needed by linking stands that meet hiding cover definitions for deer and elk (LRMP WL-48 & WL-56). For this project proposal, many of the big game travel/movement corridors are the same as the LOS connectivity corridors since many of the connectivity corridors were the densest available.

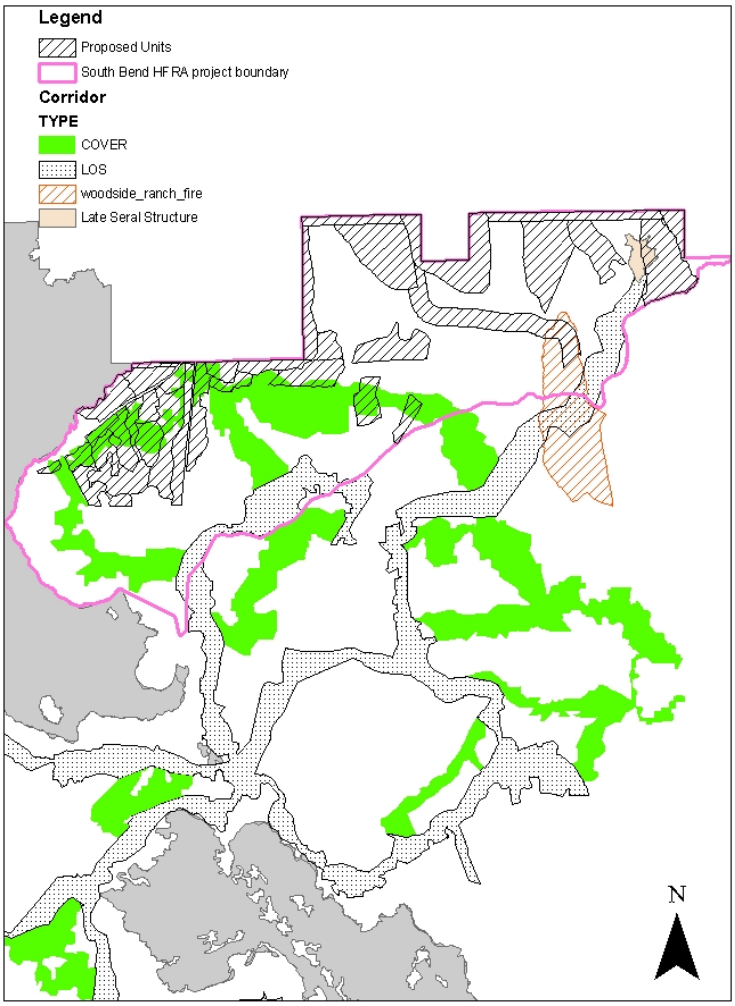
Alternative 1 (No Action)

Direct and Indirect Effects: Because there are no proposed actions associated with this alternative there would be no change from the existing conditions, and therefore no direct, indirect or cumulative effects.

Similar to the discussion for LOS and old growth habitat, connections to these stands would also be at risk to wildfires and beetle infestation. However, these linkages may provide for dispersal and movement until the surrounding treated areas develop LOS characteristics (taking over 40 years). The current levels of connectivity in the project area would be maintained given no major disturbance events occur. Some of the acres within LOS corridors are at high risk of beetle-caused mortality. These acres are dispersed over a number of linkages. If beetle-caused mortality were to occur, connectivity would be disrupted across the landscape.

Designation of connectivity corridors across the project area would provide linkages to old growth areas throughout this portion of the district. This helps assure opportunities for movement and dispersal for species that select for closed forest canopy. Similar to the discussion under LOS habitats, the corridors would remain intact so long as there is no beetle outbreak or wildfire. Loss of connectivity due to beetle or wildfire mortality not only disrupts movement within the project area but also across the landscape.

Figure 16: Connectivity Corridors Crossing the Proposed Action Areas



Effectiveness of the corridors is also influenced by roads. Major roadways can provide a barrier to movement. Highway 97 is an effective east/west barrier to land animal movement. Forest roads do not have the same effect as a paved highway, but disturbance and harassment as a result of a high road density can reduce the effectiveness of a corridor. Past, current and foreseeable actions that potentially disrupt connectivity and movement across the landscape include: Hwy 97 road barriers (past action: 3.0 miles), widening of Hwy 97 (future action: 2.0 miles), and the new access and interchanges around Cottonwood Road, Lava Lands Visitor Center, and Lava River Cave (future actions: 2.5 miles and 18 acres impacted).

Alternative 2 Proposed Action –

Direct and Indirect Effects: Similar to the No Action alternative, connections with other LOS and designated old growth areas (OGMAs or MA-15) are established. There are no proposed actions within any of the LOS corridors. As shown in Figure 5 some portions of big game cover corridors would be treated under the action alternatives. The treatment prescriptions would retain 30% of the unit from fuels prescriptions and 10% of commercial thinning units. These retention areas may overlap. Commercial thinning may have the most potential to reduce the effectiveness of the corridor. There are 190 acres of commercial thinning units overlapping the big game cover corridors. With retention patches, the corridors would still function for movement and dispersal of big game.

Roads do cut across the corridors. Ideally, a corridor would not have roads so as to eliminate any barrier to movement. Roads going through corridors, although narrow, may limit movement of small, ground-dwelling species. Forest roads that cross corridors are not expected to have measurable impacts to birds (e.g. forest hawks) or large mammals. Not all of the roads that cross corridors are proposed to be closed, but 1.7 miles of roads are proposed for closure that do (e.g. 1815-236 and 1815-640). This increases the quality of the corridor.

Cumulative Effects: The analysis for connectivity focuses on the project area but remains mindful that the corridors connect to others in adjacent project areas. If connectivity is disrupted at the project-level scale, then it is also disrupted in the adjacent areas. The proposed actions reduce the risk of connectivity being disrupted due to wildfire. They also reduce disturbance caused by forest roads by closing some roads that cross corridors.

Highway 97, residential areas, and large open stands significantly contribute to the loss of connectivity (e.g. Hwy 97 barriers and widening, new access routes and interchanges). Past residential subdivision expansion has removed some overstory vegetation and added fences that can have a negative effect on animal movement. Additive effects as a result of the proposed actions would be minimal because the amount to be treated will not prevent the corridors from functioning because the designated corridors would not receive any treatment.

SOILS

Proposed Actions

Commercial tree thinning vegetation treatments would likely be accomplished using modern, track-mounted machines equipped with a felling head to fell and accumulate trees on designated skid-trail networks. Trees would be whole tree yarded to landings using grapple skidders or processed and transported by machine forwarders. Mechanical harvesters would only be allowed to make a limited number of equipment passes on any site-specific area. Skidders would be restricted to designated skid trails at all times. Main skid trails would be spaced approximately 100 feet apart on average for feller buncher/ grapple skidder operations, and 60 feet on average for a harvester/forwarder operation.

Restoration subsoiling treatments would also be employed on some primary skid trails and log landings where detrimental soil conditions exceed 20 percent of the unit area prior to, or following treatment activities. Soil restoration activities would comply with Region 6 policy by reducing the cumulative levels of detrimental soil conditions anticipated from this project proposal (FSM 2520, R-6 Supplement No. 2500-98-1).

Soil Issues: Soil Productivity

The proposed use of ground-based mechanical equipment can cause detrimental soil disturbance and increase the amount and distribution of these conditions to levels affecting the soil productivity of a site. Planning documents for projects must include provisions for mitigation of ground disturbances and associated effects to soil productivity where activities are expected to cause resource damage in excess of LRMP standards and guidelines and Region 6 policy interpretations of Soil Quality (FSM 2520, R-6 Supplement No. 2500-98-1).

Issue Background:

The long term sustainability of forest ecosystems depends on the productivity and hydrologic function of soils. Ground disturbing management activities can directly affect these soil properties by compacting and displacing soil, changes which may adversely affect the natural capability of soils and their potential responses to use and management. The reduction of soil porosity as a result of compaction, and/or the displacement of organic or mineral surface layers, can reduce the soils ability to supply nutrients, moisture, and air necessary to support soil microorganisms and the growth of vegetation. The biological productivity of the soil resource can also be affected by the amount of surface organic matter and coarse woody debris retained or removed from a site.

Issue Measures:

- Changes to the existing levels of detrimental soil conditions within each individual activity area proposed for mechanical treatments following proposed harvest and mitigation treatments.
- Estimated amount of coarse woody debris (CWD) and surface organic matter that would likely be retained for microbial habitat, nutrient storage and surface cover.
- Probable success of implementing management requirements and mitigation measures through project design to minimize adverse impacts capable of altering the soils ability to function in a desirable manner.

Scope of the analysis

The discussion of soil quality standards and potential effects to the soil resource are focused on the analysis of the direct, indirect and cumulative effects of the proposed management practices within the bounds of each activity area. An activity area is defined as "the total area of ground impacted activity and its feasible unit for sampling and evaluating" (FSM 2520; DLRMP, p. 4-71). For this project, activity areas are considered to be the unit boundaries proposed for silvicultural and fuels reduction treatments in the South Bend HFRA.

Issue measures are evaluated using quantitative analysis and professional judgment to compare existing conditions within units prior to treatment to those anticipated following the implementation of the proposed actions. Direct, indirect and cumulative effects analyzed in this report consider the effectiveness and probable success of implementing the LRMP management requirements, mitigation measures, and Best Management Practices (BMPs) designed to avoid, minimize or reduce potentially adverse impacts to soil productivity. Changes to soil properties that would generally revert to pre-existing conditions within 5 years or less are considered to be within the temporal scope of this analysis.

AFFECTED ENVIRONMENT

Landscape Characteristics

The project area is located on the lower northwestern flanks of the Newberry volcano complex. Landforms, rocks, and soil materials in this area are essentially all derived from volcanism. Elevations range from about 3,980 feet at the northern end of the planning area to 4,687 feet at the top of Green Mountain in the southwest portion. Mean annual precipitation ranges from 12 to 14 inches, increasing slightly from northeast to southwest in direct proportion to elevation and winter snowfall amounts. Except for a few small cinder cones and minor areas of barren lava flows, soils in the project area have developed from a surface mantle of volcanic ash and pumice deposits ranging from 10 to 40 inches in depth.

The project area contains 12 landtype units delineated in the Deschutes National Forest Soil Resource Inventory (SRI). Landtype unit delineations are based on characteristics of landforms, geology, and climatic conditions that influence defined patterns of soil and vegetation on the landscape (Larsen, 1976). Approximately 90 percent of the planning area is comprised of gently sloping, uneven lava plains sourced by the Newberry shield volcano complex to the south and east. Approximately 10 percent of the planning area is comprised of a basaltic ridge escarpment along a fault line defined by the cindery buttes of the Green Mountain complex. Slopes throughout the lava plains generally range from 0 to 20 percent, with the exception of short steeper side slopes associated with the ridge escarpments and cinder buttes.

Landtypes in the project area are primarily defined by changes in the depth of the ash mantle and the varying rates of organic matter production and cycling provided by the associated vegetative community types. The productivity of these landtypes ranges from a low to moderate potential for the growth of vegetation. The majority of soil organic matter and plant available nutrients are concentrated in a thin mineral surface horizon.

The young ash soils have loamy sand and sandy loam textures and consist mainly of loose and fine sand sized ash and pumice particles with little or no structural development. These soil types have naturally low soil bulk densities with high infiltration and percolation rates that readily absorb and

drain moisture during rainstorms in their natural condition. No water is yielded from these lands to streams, although deep seepage is likely to become a part of documented subsurface flows to the north. The soils have a moderate capacity to store water and generally maintain available soil moisture from winter rains and snowmelt into the summer season.

Soil Characteristics (Hazards, Suitability, Productivity, and Sensitive Soils)

The physical and biological characteristics of the SRI landtype units can be interpreted during resource planning to identify the hazards, suitability, and productivity potentials of soils on which proposed management could occur. In general, primary hazards for soils in the project area include susceptibilities to compaction and displacement; suitability for timber production is not limited; and productivity potentials are low to moderate in their natural condition.

Hazards

Specific hazards include mechanical disturbances which can result in compaction and/or displacement of the soil resource. The ash soils in the project area are moderately susceptible to changes in soil bulk density, soil strength (increased resistance to penetration), and soil pore size distribution from mechanized compaction. These changes can reduce the productivity and hydrologic function of the soil when they exceed detrimental thresholds (Powers, et al. 1999; USDA FS 1998; LRMP). Conversely, soils within the project area are well suited for tillage restoration treatments (subsoiling) due to the absence of rock fragments within the soil profiles. Subsoiling treatments loosen compacted soil layers and improve the rate at which the soil can return to natural conditions that better supply habitat for biotic soil organisms and nutrients, moisture, and air for vegetative growth. Detrimentally compacted skid trails and landings can be rehabilitated to conditions closer to natural levels of soil strength and pore size distribution through this process.

The sandy textured surface layers are also easily displaced by equipment operations, especially during dry moisture conditions. Although careless operation of mechanized equipment can cause displacement on level ground, the soils are most susceptible to soil displacement damage on steeper landforms when slopes exceed 20%. Due to their lack of plasticity and cohesion, the dominant sandy textured soils within the project area are not susceptible to soil puddling damage.

Surface erosion by water is generally not a concern because dominant landtypes have gentle slopes and sufficient surface cover to reflect low to moderate erosion hazard ratings. Surface erosion occurs at naturally low rates due to high infiltration rates, gentle slopes and the cover provided by vegetation and organic litter layers. Accelerated surface erosion is can be associated with disturbances that reduce vegetative cover, displace organic surface layers, or reduce soil porosity through compaction. Soils derived form volcanic ash are easily eroded when water becomes channeled on disturbed sites such as road surfaces, recreation trails, and logging facilities.

Suitability

The suitable lands database for the Deschutes National Forest LRMP identifies areas of land which are considered to be suitable for timber production using criteria that affect reforestation potential and reflect productivity growth rates (FSH 2409.13). Lands that do not meet these criteria are considered unsuitable or partially suitable for timber harvest due to regeneration difficulties or the potential for irreversible damage to resource values from management activities. This data was originally developed during the development of the Forest Plan designate a broad scale timber base area for forest wide planning.

Inherent Soil Productivity

Dominant landtypes within the SBHFRA Project area have low to moderate inherent productivity ratings. Activity areas proposed for commercial and /or non commercial thinning treatments under this project meet the criteria for land suitability that would allow them to be regenerated or resist irreversible resource damage. The locations of the proposed activity areas do not include miscellaneous landtypes with site conditions and soil properties considered to be unsuitable for timber production.

Sensitive Soil Types

Criteria for identifying SRI soils that are sensitive to management are found in the Deschutes LRMP (Appendix 14, Objective 5). Management concerns for sensitive soils located within the project area include: cindery soils on slopes greater than 30 percent (landtype 81); depressions or flat areas prone to frost and cold air drainage (landtype 6G); rough, uneven lava flows with variable ash caps and steep slopes (landtypes 14 and LK); and barren lava flows (landtype 01). Table 65 summarizes the extent of sensitive soil landtypes within the project area.

Table 65: Landtype Acres of Sensitive Soils Within the Project Area

SRI Map Unit Symbol	Geomorphology (Representative landforms)	Type of Concern	Planning Area Landtype Acres
6G	Depressions or flats	Frost and cold air settling	98
01	Rough, uneven lava flows	Lack of soil	17
14, LK (68)	Uneven lava flows with ash cap and steep slopes	Variable soil depth and productivity	40, 190
81	Soils on slopes greater than 30 percent (cindery buttes)	Displacement of loose, cindery soils	282

Landtype 81 is primarily associated with the Green Mountain area located on the southwest portion of the planning area; Landtypes 14 and complex LK (map unit 68) are associated with older lava flows variably covered with ashfall located on the western and north central portions of the planning area; Landtype 6G is found in low lying terrain between higher ridges in areas of complex, uneven lava flows covered by moderate to deep layers of ashfall; and Landtype 01 comprises the barren lava flow emanating from Lava Butte that borders the western edge of the planning area. No proposed activity units contain these soils.

Management Direction

The Deschutes LRMP includes Forest-wide standards and guidelines designed to ensure that the soil resource is managed to provide sustained yields of vegetation without impairment of the productivity of the land (Deschutes LRMP, p. 4-70). The LRMP specifies that land management activities be prescribed to promote the maintenance or enhancement of soil productivity potential following the implementation of activities (SL-1 and SL-3; p. 4-70); direct the use of rehabilitation measures when the cumulative impacts of management activities are expected to cause damage exceeding soil quality standards and guidelines on more than 20 percent of an activity area (SL-4); and limit the use of mechanical equipment in sensitive soil areas (SL-5).

The Pacific Northwest Forest Service Region 6 has developed soil quality standards and guidelines that supplement LRMP standards and guidelines to further protect or maintain soil productivity. The

Regional supplement to the Forest Service Manual provides policy for planning and implementing management practices that maintain or improve soil quality in order to limit detrimental soil disturbances associated with management activities (FSM 2520, R-6 Supplement No. 2500-98-1). This Regional guidance is consistent with LRMP interpretations of standards and guidelines that limit the extent of detrimental soil conditions within activity areas (LRMP, SL-3 and SL-4). Detrimental soil disturbances are those that meet the criteria described in the Regional Soil Quality Standards listed below.

- Detrimental Soil Compaction in volcanic ash/pumice soils is an increase in soil bulk density of 20 percent, or more, over the undisturbed level.
- Detrimental Soil Puddling occurs when the depth of ruts or imprints is six inches or more.
- Detrimental Soil Displacement is the removal of more than 50 percent of the A horizon from an area greater than 100 square feet, which is at least 5 feet in width.
- Severely Burned Soils are considered to be detrimentally disturbed when the mineral soil surface has been significantly changed in color, oxidized to a reddish color, and the next one half inch blackened from organic matter charring by heat conducted through the top layer.

The Regional supplement also includes the following policy when initiating new activities**:**

- Design new activities that do not exceed detrimental soil conditions on more than 20 percent of an activity area, including the permanent transportation system.
- In activity areas where less than 20 percent detrimental soil impacts exist from prior activities, the cumulative amount of detrimentally disturbed soil must not exceed the 20 percent limit following project implementation and restoration.
- In activity areas where more than 20 percent detrimental soil conditions exist from prior activities, the cumulative detrimental effects from project implementation and restoration must, at a minimum, not exceed the conditions prior to the planned activity and should move conditions toward a new improvement in soil quality.

Desired Conditions

Management goals for the soil resource include the maintenance or enhancement of soil conditions at acceptable levels to allow the soil to function in a desirable manner. A functioning soil environment is ensured by the minimization of detrimental disturbances and the retention of adequate supplies of surface organic matter and coarse woody debris without compromising fuel management objectives. The extent of detrimental soil disturbances would be minimized through the application of management requirements and mitigation measures designed to minimize, avoid or eliminate potentially significant impacts, or by rectifying impacts in site specific areas by restoring the affected environment.

Ecological typing of tree/shrub communities

The South Bend Project Area includes Deer Habitat defined by Management Area 7 (MA-7) in the Deschutes LRMP, as well as biological winter range identified as a result of field review by biologists. Although LRMP direction for MA-7 does not contain specific standards and guidelines for the soil resource, it does provide direction regarding the management of bitterbrush and other shrubs to provide optimum habitat conditions. In order to assist in maintaining and managing this habitat, ecological types comprised of similar tree/shrub communities within MA-7 were delineated within the project area using soil type and plant association layers in GIS.

Further adjustment and verification of the ecological type boundaries in the field incorporates physical features that influence the type of vegetation that can occur on site, including landform, aspect and soil type. Once delineated, the ecological types help to show the potential distribution of plant communities across the landscape as they relate to habitat and fire condition class. Each ecotype developed for the deer winter range within the project shows differences in site productivity, fire risks, conversion potential to less desirable species and expected shrub recovery times and seral stages (Table 52, page 134).

Ecological Type 3: (pine-juniper/bitterbrush/fescue)
Comprised of: Soil resource inventory Units #6A
Soils: Soils occur on gently sloping lava plains, generally in lower lying areas defined by very broad drainage contours. Slope gradients are typically less than 15 percent, but range up to 30 percent. This landtype has excessively drained soils formed from a thick layer of pumiceous volcanic ash soils over residuum.
Annual Precipitation: estimated between 12 and 14 inches.
Tree Vegetation Type: This low precipitation type typically supports open tree canopies of ponderosa pine with occasional juniper.
Forage Potential: Without disturbances such as fire and mowing, understory vegetation consists of a mixture of bitterbrush. With repeated disturbance understory vegetation is typically converted to an Idaho fescue and forbs with little or no brush.
Cover Potential: Low potential for growing thermal and hiding cover.
Other: Where seed sources exist, these sites have a high potential for increases in undesirable plant species such as rabbit brush and cheat grass following disturbances.

Ecological Type 4: (pine/bitterbrush-manzanita and or snowbrush/fescue)
Comprised of: Soil resource inventory Units # 64,
Soils: Soils occur on gentle to uneven lava plains. Slopes are typically convex, complex, and range from 0 to 30 percent gradient with 8 to 15 percent being the most common. Rock outcrops are also common in this landtype. Soils are well to excessively drained and derived from a moderately thick layer of pumice and volcanic ash over an older soil on basaltic lavas. Surface soils are typically pumiceous loamy sands and sands, and buried soils are sandy loams. Permeability is very rapid and depth to bedrock is 24 to 60 inches.
Annual Precipitation: Annual precipitation in ecotype 4 is estimated between 16 and 20 inches.
Tree Vegetation Type: This ecotype supports tree densities of ponderosa pine that are higher than ecotype 3.
Forage Potential: Without disturbances such as fire and mowing understory vegetation shrubs include manzanita and bitterbrush. With repeated disturbance understory vegetation is typically converted to an Idaho fescue and forbs dominated understory with little or no brush. Disturbance followed by a recovery period on this ecotype appears to favor bitterbrush over manzanita.
Cover Potential: High potential for growing thermal and hiding cover.

Inventory of shrub seral stages

Recommendations for the management and analysis of shrubs are also included in the Deschutes Integrated Natural Fuels Management Strategy (IFMS, 1998). The IFMS recommends the assessment and analysis of shrub composition and seral conditions within designated Winter Range Habitat Units (WRHU's). An assessment of existing seral condition classes of shrub communities provides a snapshot of the existing condition and function of these communities in terms of wildlife habitat (bitterbrush forage) and fire condition class. Because the plant communities within the South Bend HFR project area provide an important food source for deer during the winter months, an assessment

of the current seral composition of these communities was completed within the Green Mountain WRHU.

The IFMS includes an interim management goal for managing shrubs in shrub dominated landscapes to provide an equivalent composition of early, mid and late seral conditions. The existing composition of seral stages provides a base condition from which changes as a result of management activities can be tracked. Existing composition of shrub seral stages varies in the Green Mountain WRHU between ecotypes (Table 53, page 135). Ecotype 3 has few mid-seral shrubs and Ecotype 4 approximates the desired composition of seral stages identified by the IFMS (See Wildlife specialist report for assumptions used to create this assessment in GIS).

The 2007 Woodside Ranch fire burned approximately 590 acres within the Green Mountain WRHU, of which 190 acres are within the South Bend project area. Approximately 401 of these acres lay within mapped areas of Ecotype 4, and 189 acres lay within Ecotype 3. Most of the acres burned had mid-seral shrub conditions converted to early seral.

Existing Condition

The existing condition of the soil resource within proposed activity units varies by the extent and type of past management activities. All unit areas were essentially clearcut prior to 1943 during a period of heavy railroad logging. Aerial photos from 1943 show distinct skid trail and road systems created and utilized during this period. Many of the existing forest roads were created by this time. Other maintenance level 2 roads were formalized from primary skid trails created by the railroad era logging activities and remain as ground dedicated to infrastructure. Although portions of secondary skid trails from this era are evident on the ground, most have recovered from initial compaction and currently have 'natural' levels of soil strength throughout the profile.

More recent management activities within the project area identified in the Forest Service Activity Tracking System (FACTS) database include commercial black bark thinning projects over the last 15 years and silvicultural prescriptions such as pre-commercial thins and commercial clearcuts. Recent activities are identified within proposed unit 447 (Bugout thin, 1990), which has evidence of skid trails and landings from this entry. None of the other 17 potential commercial thinning units proposed under this project has had recent silvicultural prescriptions utilizing ground based machinery within their boundaries, except for what appears to be machine planting in areas of slow regeneration.

ENVIRONMENTAL CONSEQUENCES

Analysis of the potential effects on the soil resource from the proposed actions utilizes the location and type of management activities included in the Alternative Descriptions of the EA. The soils effects analysis includes a discussion of the potential effects on the physical and biological components of the soil as a result of implementing the proposed vegetation and fuels management treatments. The environmental effects to the soil resource are presented and tracked by the issue measures used to evaluate the estimated impacts on soil productivity. Narrative summaries on the extent of effects to the soil resource consider the physical extent of existing and needed logging system infrastructure, as well as the effectiveness and probable success of implementing mitigation and resource protection measures designed to avoid, minimize or reduce potentially adverse impacts to soil productivity.

Effects of the following proposed actions on the soil resource will be analyzed in detail**:**

Harvest, Yarding and Haul activities: Mechanical harvest equipment used for commercial thinning typically consists of track mounted harvesters with boom shears; yarding typically utilizes rubber tired grapple skidders with travel limited to an identified transportation system; and haul activities may utilize a dozer or skidder to define temporary roads to reach log landings. Eighteen activity units totaling 1,102 acres are proposed and analyzed for commercial thinning.

Roads: There would be no construction of new roads for access and hauling that would remain as classified system roads. Approximately 1.6 miles of temporary road would be established or re-established to allow access to units 113 and 119. Temporary roads are often placed on skid trails created during commercial yarding, but portions are likely to consist of new segments or re-opened segments of old access roads from previous entries. Temporary roads would be closed and obliterated to an appropriate level upon completion of the vegetation management activities.

Fuel Reduction Activities: Mechanical treatments proposed include the mowing, mastication and/or thinning of brush and small trees to reduce shrub layer heights and continuity over approximately 2,665 acres. These activities are likely to utilize a low ground pressure, wheeled or tracked ASV tractor with a mower or cutter head mounted on it. Although mowing operations cover a large percentage of the activity area, this machinery operates under a one equipment pass limitation throughout the unit in order to reduce direct and cumulative impacts to the soil resource. This limitation also applies to this machinery if it is utilized for the pre-commercial thinning of smaller diameter trees. The mounting of the cutting head on the rear of the machine requires it to drive to every tree that it treats, which may increase the level of impact it incurs on the soil resource.

Pre-commercial thinning of trees in the smaller diameter classes would be accomplished manually using chainsaws. Hand piling of slash is designated to occur in all pre-commercially thinned only unit areas and prioritized for all units in which pre-commercial and/or commercial thinning would occur. All units in which pre-commercial and/or commercial thinning would occur may require grapple piling to meet fuels objectives and have been analyzed for this possibility. There is also the potential that the piled slash could be moved to the landings by grapple skidders or forwarders to become a source of biomass.

Prescribed burning is proposed in four activity area units without prior treatments where existing fuel loads and shrub heights currently allow safe implementation. Pre-burn mowing treatments are prescribed in 13 activity areas where existing fuel loads and shrub heights exceed criteria for safe implementation of a prescribed burn. In most cases, existing roads and other existing fuel breaks would be used as firelines, minimizing the extent of soil disturbance to the minimum necessary to achieve fuel management objectives.

Soil Restoration Treatments: Soil restoration treatments may be applied to reclaim and stabilize detrimentally compacted soil on temporary roads and some of the primary skid trails and log landings following post-harvest activities. Subsoiling treatments are recommended to occur with a self-drafting winged subsoiler. Additional treatment options for improving soil quality on disturbed sites include redistributing topsoil in areas of soil displacement damage, using small chisel points on the end of boom-mounted implements to break up surface compaction on skid trails, and pulling available logging slash and woody materials over impacted surfaces.

Alternative 1 (No Action)

Measure #1: Detrimental Soil Disturbance

Direct and Indirect Effects: No additional land would be temporarily removed from production for temporary roads or logging facilities utilized for harvest and yarding operations. There would be no cumulative increase in detrimental soil conditions above existing levels. Although disturbed soils would continue to recover naturally from the effects of past management, the current extent of detrimental soil conditions would likely remain unchanged for an extended period of time.

Alternative 1 would defer thinning, mowing and precsribed burning fuel reduction activities proposed at this time. Although hazardous fuel loads are not contiguous throughout the project area, fire exclusion has resulted in undesirable vegetation conditions and high fuel loadings in portions of the project area that could raise the risk of stand replacement wildfires (see Fire/Fuels Section). Areas that have not been thinned or mowed have an elevated risk of carrying fire into the crowns and producing uncontrollable fire fronts. Risks to the soil resource are relatively low, however, due to the relative lack of large coarse wood on the surface within the project area that would be susceptibile to harboring extended durations of elevated temperatures capable of altering soil properties.

Soil productivity is not likely to change appreciably under this alternative unless future stand-replacing wildfires in areas of high fuel loads cause intense ground-level heating capable of altering physical and chemical characteristics of the soils. Soils supporting community types that include manzanita or snowbrush may be susceptible to the formation of a water repellent layer where the consumption and deposition of chemicals in shrub leaf vegetation occured during intense fire fronts. This process could increase the short term risk of surface runoff and subsequent erosion in these areas. Potential wildfire would also incur the temporary loss of protective ground cover that would also increase the risk for acelerated wind erosion on the loose, sandy textured soils present throughout the project area.

Measure #2: Coarse Woody Debris (CWD) and Surface Organic Matter

Direct and Indirect Effects: The amount of coarse woody debris on the surface would gradually increase or remain the same in the short term. In forested areas, coarse woody materials would continue to increase through natural mortality, windfall, and recruitment of fallen snags over time. Existing levels of large CWD (>20" in diameter) are relatively low due to the intense harvest of the residual old growth from these stands during the railroad era logging period. Existing levels of small and medium CWD are variable throughout the project area, but are elevated where mistletoe and beetle mortality has produced higher levels of windthrow. Current levels are within acceptable estimates for dry ponderosa pine plant associations in many areas, and may exceed them in pocket areas of mortality.

In the long term, the accumulation of CWD on the surface would increase the potential of wildland fires to completely consume heavy concentrations of fuel and ground cover vegetation. High-to-extreme fire hazard and potential for excessive soil heating exists when downed woody debris exceeds 30 to 40 tons per acre (Brown et al., 2003). Although intense ground-level fire is capable of creating areas of severely burned soil underneath CWD, wildland fires in similar plant associations across the Forest have produced detrimental burn conditions on less than 5% of the soil resource within the burned areas. There would be an increase of CWD on site in the long term following a wildfire as fire killed trees were recruited to the forest floor.

Surface litter and cover would also increase in the short term under this alternative through the accumulation of small woody material from shrub and tree branches, annual leaf and needle fall, and the decomposition of vegetative components of grasses and forbs. Although short term nutrient sources would appear to increase as a result of this process, the actual cycing of this material would occur at relatively low rates until the event of a wildland fire.

Despite an immediate loss of organic matter providing ground cover and the consumption of nutrients stored in the vegetative and organic components of the soil, wildland fires also provide a flush of nutrients on site. Although there would be a short term increase in the potential for accelerated wind erosion due to the exposure of mineral soil, the return of shrubs, conifer seedlings and annual and perennial forbs and grasses has been readily observed in the first few years following wildfires across the Forest.

Measure #3: Project Design and Mitigation

Direct and Indirect Effects: Implementation of project design criteria and mitigation measures developed for Alternative 2 would not be necessary under Alternative 1.

Alternative 2 (Proposed Action)

Measure #1: Detrimental Soil Disturbance

Direct and Indirect Effects: **Harvest treatments (cutting and yarding) -** The effects of ground based logging disturbances on soil productivity vary, based on the types of silvicultural prescriptions and the extent of machine activity. Detrimental soil disturbance incurred by ground based machinery includes compaction and displacement of the soil from direct ground pressure and maneuvering to access and yard material. The extent of this disturbance is estimated as a change from the existing condition as a result of implementing the proposed actions.

Soil condition assessments utilize local monitoring reports, observations of similar types of harvest systems, research references, and field surveys to predict the potential extent of detrimental soil disturbance associated with this project proposal. Estimates are also based on the cruised volume removal, the type of logging equipment, the spacing of skid trails, and the number of log landings that would be needed to deck accumulated materials. The extent (surface area) of temporary roads, log landings, and designated skid-trail systems that would likely be used to facilitate yarding activities within each of the commercial thinning activity areas was also analyzed to predict changes in detrimental soil conditions. Refer to Table 66, page 183, for a summary of the existing and predicted levels of soil disturbance for each activity unit based on these criteria.

In summary, implementation of the proposed commercial thinning units would incur detrimental soil disturbance within each unit. The level of soil disturbance is predicted to be within LRMP standards for the soil resource in 14 of 18 units following harvest and yarding activities, and is likely to temporarily exceed LRMP standards in four units prior to mitigation subsoiling activities. These units and conditions are discussed in more detail under the cumulative effects and restoration subsoiling sections for this alternative.

Monitoring of soil conditions following the implementation of commercial harvest activities on the Forest has shown that detrimental soil conditions increase each time a stand is treated with mechanical equipment (Deschutes Soil Monitoring Reports 1996, 1997, and 1999). Even with careful planning and implementation of project activities, the extent of detrimental soil conditions can be expected to

increase by 5 to 10 percent with each successive entry into a stand (Craigg 2000). A newly implemented harvest system in a unit with 5% or less existing impact is expected to incur additional impacts on up to 15% of the activity area. Soil monitoring results on local landtypes and similar soils have shown that 15 to 30 percent of the unit area can de detrimentally disturbed by ground-based harvest systems depending on harvest prescriptions and soil conditions at the time of harvest (Deschutes Soil Monitoring Reports, 1995, 1996, 1997 and 1999).

Direct effects to the soil resource include the compaction of mineral soil by machine traffic used to harvest and accumulate commercial material. Areas with single, or out and back passes of harvest machinery imprint the soil visually but generally do not increase compaction levels to thresholds affecting productivity (Craigg, 2007). However, detrimental impacts can be incurred by harvest machinery off of designated trails where they pass over existing areas of disturbance that have slightly elevated levels of compaction. Harvest machinery traffic off trails can be expected to detrimentally impact less than 5% of an activity area in which commercial thinning occurs.

Accumulated harvest material would likely be whole tree yarded by grapple skidders. Whole tree yarding would limit the amount of slash generated throughout the unit and focus accumulation of this material at the landings. This has the potential to increase landing sizes and the extent of compaction by up to 5% within each unit area. Multiple passes of skidders on designated skid trails would compact the soil to detrimental levels across approximately 11% of the unit area if trails are maintained at 100 ft intervals. Areas with multiple machine passes incur elevated levels of compaction in which bulk density and soil strength are increased to levels capable of affecting root growth and moisture holding capacity. Research has shown that areas with 3 to 5 or more passes from ground-based machinery will incur detrimental compaction (McNabb, Froelich, 1983). This analysis assumes that skid trails and landings created and utilized during these activities would have detrimental soil conditions following their use by harvest and yarding machinery.

Ground-based machine traffic also has the potential to directly affect the soil resource by displacing surface mineral soil. The turning movement of track or wheeled machinery can gouge and displace the non-cohesive ash and pumice, especially when conditions are dry and slopes exceed 20%. Operator skill and awareness is imperative in reducing this impact. Field observations have shown that although displacement of soil does occur from machine traffic, it is rarely of the depth and extent to qualify as detrimental under Regional Soil Quality parameters. Detrimental soil displacement, as defined by FSM 2521.03, was rarely observed and equipment turns generally causes more mixing of soil and organic matter than actual removal from a site.

Direct and Indirect Effects: **Fuels treatments -** Fuels treatments proposed under this project include hand piling, machine piling, mowing, mastication, and prescribed burning. All commercial thin units have been prioritized for hand piling, although Unit 113 has been identified as having the highest potential for the need to machine pile and all other units may also have this operation if slash accumulations are determined to be too high to efficiently hand pile following harvest operations. Hand piling would incur no direct physical detrimental impacts on the soil resource. Hand piles would occur on and off of skid trails and average approximately 25 square feet in size.

Machines used to pile would be limited to skid trails, temporary roads and landings created and/or used during the harvest operations. Grapple machinery or other specialized equipment with low ground-pressures capable of accumulating woody materials without moving appreciable amounts of topsoil into slash piles would be utilized. Piles would occur on skid trails and landings and approximate 250 square feet in size. These operations would incur direct effects to the soil resource in the form of compaction and disturbance where machines traveled and maneuvered to complete operations. Machine piling would have a minimal effect on the overall extent of detrimentally

disturbed soil because equipment would operate on the same logging facilities used and impacted by the harvest and yarding operations. Machine piling may cause additional soil impacts where occasional maneuvering occurred off of previously impacted areas, which is conservatively estimated to be less than 2% of the unit area.

Hand piles would be burned during fall, winter or spring burn windows. Burning of these piles would incur direct and indirect effects to the soil resource in the form of consumption of localized amounts of minerals, nutrients, and flora. Although the burning of handpiles does consume the majority of biomass underneath them, the duration of elevated temperatures is relatively short since the piles are generally loosely packed and detrimental burn conditions generally do not occur. Recovery of these sites with funeria moss has been observed within the first year, followed by herbaceous plants in subsequent years.

Grapple and landings piles are likely to be burned, although there is the possibility that the material may be utilized as biomass and not burned, primarily depending on market prices and sources at the time. No direct burn effects to the soil resource would occur if this were the case. The burning of grapple piles can cause elevated levels of soil heating and detrimental impacts to the soil resource due to their larger size than handpiles. However, these conditions would not increase the extent of detrimental conditions within a unit since these areas would occur on trails or landings that already have detrimental conditions following harvest and yarding activities. Grapple piles are smaller in size and more loosely compacted than landing piles and generally have lower impacts due to shorter residence times and a smaller extent of influence. Areas under grapple piles may or may not be detrimentally burned as a result. The burn effects on these sites have been observed to be relatively short term, with recovery of bacterial, fungal and some floral species observed within the first few years.

Excess material on landings would be piled following commercial material processing, each estimated to cover approximately 2,500 square feet, totaling less than 1% of the unit area. If they are burned and not utilized, detrimental burn damage is likely to occur on these areas, although not additional to unit totals since these areas would be already detrimentally compacted. Temperatures exceeding 200 degrees C have been measured 2-5 cm below the soil surface for greater than 4 hours during active pile burns, while soil pH levels were shown to increase dramatically for the 0-2.5 cm and 2.5-10 cm soil horizons following these burns (Sheay 1993). Although few studies have monitored the long-term recovery of soil underneath pile burns, these operations likely inhibit the productivity of these areas for a number of years.

Mowing and mastication operations are likely to occur using an ASV tractor with mounted implements. Although indents from the ASV tracks are visible in the soil surface, displacement and changes to soil strength from single passes of this machinery have been observed to be within detrimental criteria. Monitoring of these activities show that increases in soil displacement and compaction do not meet the criteria for detrimental soil conditions within the activity area units (Deschutes Soil Monitoring Report, 1997). Relatively light machine ground pressures, limited repeated travel, and operator awareness are key elements that minimize impacts from these operations.

Prescribed burns in timbered stands are accomplished under carefully controlled conditions to minimize damage to standing trees and surface resources. Prescribed burn plans would comply with all applicable LRMP standards and guidelines and Best Management Practices (BMPs) prior to initiation of burn treatments. These elements dictate that prescribed burning activities are conducted at times and under conditions that maximize benefits while reducing the risk of resource damage. It is expected that detrimental changes to soil properties would be minimal as a result of prescribed burning activities in either timbered or non-timbered activity units.

Prescribed fire objectives include the reduction of natural and harvest activity fuel accumulations in the activity areas proposed for treatment. Direct effects to the soil resource include the consumption of a portion of surface organic cover on site, the conversion of nutrients to forms that are more readily available for plant uptake, and the heating of mineral soil during the activity. Since burn plans include fuel and visual management objectives to minimize the loss of the protective surface cover, it is expected that adequate retention of coarse woody debris and fine organic matter (duff layer) would occur for protecting mineral soil from erosion and supplying nutrients that support the growth of vegetation and soil organisms.

Soil heating is expected to be minimal from prescribed burns in this project. Soil moisture guidelines are included in burn plans to minimize the risk for intense ground-level heating and volcanic ash and pumice soils are poor conductors of heat. The degree of soil heating from prescribed burns also depends upon the fuel type (grass, brush, trees), fuel density, nature of the litter and duff layers (thickness, moisture content), and burn conditions at the time of ignition. Natural fuel accumulations within treatment areas proposed for prescribed burning consist mainly of fine fuels (i.e., decadent brush, tree branches, and needle cast litter) that typically do not burn for long durations and cause excessive soil heating. Some activity areas do have accumulations of small and medium CWD that may increase the duration of elevated heating. However, elevated heat penetration down into the soil profile is expected to be limited to the top few centimeters for a relatively short period of time and detrimental burn conditions are unlikely to occur or would be very isolated and limited in extent if the units are treated within burn plan prescription windows.

The successful implementation of prescribed burn activities would likely result in beneficial effects to the soil resource by reducing fuel loadings and wildfire potential, as well as increasing short term nutrient availability in burned areas. Fuel reductions achieved through planned ignitions usually burn with low-to-moderate intensities that do not result in severely burned soils. Low-intensity fires generally do not consume material larger than 3 inches in diameter, and charring does not substantially interfere with the decomposition or function of coarse woody debris (Graham et al., 1994). The conversion of organic nitrogen to mineralizable forms more readily available for plant uptake would also occur in the short term, giving these sites a flush of a normally limiting nutrient on site.

Direct and Indirect Effects: **Restoration and Mitigation Treatments (Subsoiling):** Subsoiling treatments may occur to rehabilitate skid trails and landings within activity units if proposed activities incurred detrimental impacts temporarily exceeding LRMP standards and guidelines. Subsoiling may also occur on all temporary roads where conditions allow. Soils within the project area are well suited for tillage treatments due to their naturally low bulk densities and the absence of rock fragments on the surface and within the soil profiles. Loamy sand and sandy loam-textured soils have little or no structural development within the principal root development zone (4 to 12 inches in depth) where changes in soil compaction (bulk density) are assessed according to Regional direction (FSM 2521.03).

Direct effects from subsoiling treatments include an immediate reduction of soil strength and bulk density within the soil profile to or below natural levels. The winged subsoiling equipment used on the Deschutes National Forest has been shown to lift and shatter compacted soil layers in greater than 90 percent of the compacted zone with one equipment pass (Craigg, 2000). Although multiple passes of equipment traffic during harvest operations can decrease soil porosity on local soils, compacted sites can be mitigated physically by tillage with a winged subsoiler (Powers, 1999). Since the winged subsoiler produces nearly complete loosening of compacted soil layers without causing substantial displacement, subsoiled areas on this forest are expected to reach full recovery within the short-term (less than 5 years) through natural recovery processes.

Subsoiling can mix and/or displace mineral soil and organic matter if woody debris accumulating in front of the shanks, or obstructions beneath the surface, impede the implement and cause it to pull the soil profile forward. The equipment is designed with adequate clearance between the tool bar and the surface of the ground to allow smaller logging slash to pass through and minimize the displacement of the surface organic matter. Since surface organic material or mineral soil is not removed off site, the mixing or displacement from this subsoiling generally does not meet detrimental soil displacement criteria. Operator awareness while pulling the subsoiler is essential to keeping mixing and displacement to a minimum.

Although the biological significance of subsoiling is less certain, these restoration treatments are likely to improve subsurface habitat by restoring pore size distribution and the soils ability to supply nutrients, moisture, and air to soil microorganisms. Research studies on the Deschutes National Forest have shown that the composition of soil biota populations and distributions rebound back toward pre-impact conditions following subsoiling treatments on compacted skid trails and log landings (Moldenke et al., 2000).

Measure #2: Coarse Woody Debris (CWD) and Surface Organic Matter

Direct and Indirect Effects: Professional judgment was used to evaluate changes in the amount and composition of coarse woody debris and surface organic matter on these sites. Under Alternative 2, the amount of coarse woody debris and surface organic matter would be reduced in the short-term and then would gradually increase over time. Although the supply of trees available to produce CWD on site would be reduced, all existing snags would remain on site to become future sources. CWD currently on the ground in unit 113 may be piled, but all other units would have existing CWD on the ground left in place. Prescribed fire would reduce the size of some CWD but would not reduce them enough to affect their presence as CWD.

Surface organic matter would be reduced in the short term on most treated sites, depending on how much consumption of woody material from mowed shrubs occurs in units prescribed for mowing and burning. Burn prescriptions seek to minimize complete consumption of surface litter and cover and would generally leave sufficient surface cover to minimize risks to wind and water erosion in the short term. Vegetative recovery in the form of annual and perennial forbs and grasses is not expected to be impeded from the proposed activities and would likely increase cover steadily over the first few years.

Measure #3: Project Design and Mitigation

Direct and Indirect Effects: Implementation of project design criteria and mitigation of project-related soil disturbances would substantially minimize potential detrimental disturbances to the soil resource. Harvest traffic restrictions, burn plan guidelines and subsoiling restoration treatments all combine to reduce impacts and help proposed activities meet LRMP standards and guidelines for the soil resource.

Cumulative Effects

The cumulative effects to the soil resource are analyzed as the sum total of detrimental impacts within each activity area. These impacts cumulatively include those existing from past activities and those expected to occur from the management activities proposed under this project. The predicted total of soil impacts within each activity unit depends on the existing conditions prior to entry, the ability to re-use previously established landings and skid trail systems, types of equipment, amount of material

removed from treatment areas, operator experience, and contract administration. Existing levels of detrimental impact

Proposed management activities under the South Bend HFR project are expected to meet LRMP standards and guidelines for the soil resource following implementation of all machine operations, including those used for harvest, fuels reduction and potential mitigation subsoiling. The proposed activities are likely to elevate disturbance levels within 14 of 18 commercial thinning units to or slightly below 20% without the need for mitigation subsoiling to meet LRMP standards. Units 113 and 447 are conservatively predicted to exceed 20% following harvest and fuels treatments and may require subsoiling mitigation treatments of primary skid trails and landings. Units 114 and 131 are likely to exceed 20% following treatments and would need mitigation subsoiling to meet LRMP standards.

Predicted levels of detrimental impact were estimated using past monitoring of similar machine thinning operations and professional judgment of local conditions and proposed operations. Local conditions assessed for these predictions include the level to which existing logging system infrastructure can be re-utilized for this entry; proposed volume removed per acre; and the additional temporary roads and log landings necessary to implement proposed operations. Predicted levels of impact assume operations under non-winter conditions and the implementation of project design criteria listed at the end of this report. Levels of predicted impact in commercially thinned units would be reduced if operations were to occur over snow and/or frozen ground conditions.

Table 66: Unit Summary of Existing and Predicted Detrimental Soil Impacts

Unit	Acres	Harvest Treatment	Natural Fuels	Detrimental Soil Existing Acres	Detrimental Soil Estimated (Follow Treatment)	Acres To Subsoil*
107	**10**	HTH	MST	1	20%	0
110	**66**	HTH	MST	10	20%	0
113	**61**	HTH	MST	2	25%	3.0
114	**47**	HTH	MST	11	25%	2.4
115	**65**	HTH	MST	2	20%	0
116	**28**		MST	0		0
119	**70**	HTH		0	20%	0
120	**36**	HTH		3	20%	0
131	**37**	HTH	MST	12	25%	1.8
132	**94**	HTH	MST/UBN	5	20%	0
133	**63**		MST/UBN	16		0
134	**231**		MST/UBN	7		0
135	**110**		MST/UBN	2		0
136	**213**		MST/UBN	0		0
137	**239**		MST/UBN	14		0
138	**113**		MST/UBN	29		0
139	**224**		MST/UBN	15		0
141	**262**		MST/UBN	11		0
153	**44**		UBN	4		0
221	**16**	HTH	MST	1	20%	0
222	**61**		MST	1		0
251	**38**		MST/UBN	4		0
252	**34**		UBN	2		0
254	**49**	HTH	MST/UBN	2	20%	0

Unit	Acres	Harvest Treatment	Natural Fuels	Detrimental Soil Existing Acres	Detrimental Soil Estimated (Follow Treatment)	Acres To Subsoil*
255	**99**		UBN	3		0
411	**75**		UBN	1	20%	0
412	**25**	HTH	MST	0	20%	0
430	**100**	HTH	MST/UBN	4	20%	0
446	**121**	HTH	MST/UBN	1	20%	0
447	**95**	HTH	MST/UBN	15	25%	4.8
452	**36**		MST	1		0
453	**151**		MST	1		0
454	**100**	HTH	MST	2	20%	0
455	**35**	HTH	MST	5	20%	0
	3,048					**12.0**

***acres to subsoil: predicted acreage needing subsoiling rehabilitation in order to meet DLRMP standards and guidelines for the soil resource.**

Unit 113 has no current detrimental soil impacts and is likely to meet LRMP standards following harvest and yarding operations. This unit was conservatively predicted to exceed the 20% level if machine piling occurs, depending on the amount of slash piled and operator diligence to project design criteria limiting travel to existing areas of impact.

Unit 131 currently has a high level of existing detrimental soil conditions exceeding LRMP standards and will require mitigation subsoiling to either maintain this level or reduce it towards the 20% standard as required by regional interpretation of the Forest LRMP standards.

Units 114 and 447 currently exhibit 11% and 15% pre-activity levels of detrimental disturbance, respectively, as a result of commercial machine harvest thinning that have occurred within the last 20 years. Although past monitoring has shown that successive entries incur an average of 5% additional detrimental impact, the extent to which existing skid trails and landings are re-utilized will determine the level of additional impacts incurred during this entry. These unit are conservatively predicted to exceed the 20% standard following harvest and fuels treatment activities and may need mitigation subsoiling. Both units will be monitored following implementation of harvest and fuels treatments in order to determine the need for mitigation restoration to meet LRMP standards.

All noncommercial fuels reduction units in which pre-commercial thinning, mowing and/or underburning would occur would meet LRMP standards and guidelines for the soil resource following implementation. As discussed in the direct effects section, mowing operations have been monitored in the past and do not incur cumulative detrimental impacts on the soil resource. Areas where mowing passes overlap off-trail tracks from the harvesting equipment may result in slight increases in soil strength, however, these increases are expected to be within acceptable levels of change.

CULTURAL RESOURCES

SUMMARY

Alternative 2 can avoid risk of impacts leading to adverse effects by avoiding work within the boundaries of known sites and by similarly avoiding impacts to sites which projected inventory and monitoring work discover within the project area.

INTRODUCTION

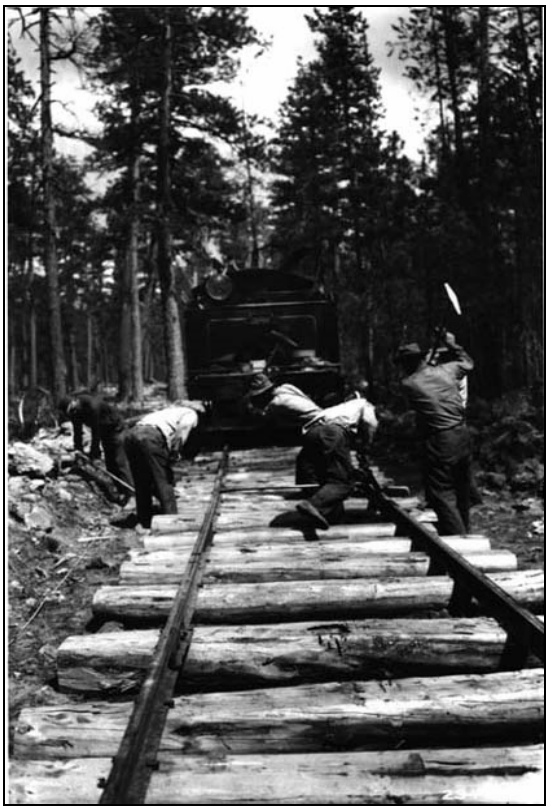
The cultural resources in the project area consist primarily of archaeological evidence of short term and intermittent prehistoric use and the archaeological traces of timber harvesting in the first half of the 20th century.

Some of the oldest archaeological sites in North America occur in Central Oregon, dating from about 10,000 to 9500 years ago. In the project area, such sites are only found below the ash and pumice fall deposits from the Mt. Mazama eruption. Surface evidence of prehistoric sites in the project area dates no earlier than about 7,700 years before the present. There is considerable evidence of prehistoric use of resources and land. Known prehistoric sites do not include permanent or even long-term settlements, due in part to the absence of surface water. Instead, the sites suggest the area was used for procuring resources and as a travel corridor between the Deschutes River and the obsidian sources at Newberry Crater, the High Lava plains, and desert playas to the east. During the past 7,700 years the environment in the project area has cycled through major climatic changes so the prehistoric record could yield information about how subsistence and technology changed in response to climatic shifts.

Western expansion of Euro-American population began to affect traditional cultures in the project area by at least 1850, but the biggest impact to the area's resources came as a result of logging. The arrival of the joint Oregon trunk/Deschutes Railroad into Bend in 1911 gave the market access that was needed to sustain large scale commercial timber operations. The logging initially began west of Bend and then moved south when the supply of trees was depleted. By the mid-1920's, track extended to La Pine and from that vicinity railroad logging radiated to the east and north into the project area. By the end of the 1930s, railroad logging (Figure 17) became outdated and expensive and was replaced by diesel trucks, a more efficient method of hauling timber.

Railroad logging brought a new class of woods-workers into logging operations. The archaeological remains of such camps, such as the Shevlin-Hixon Rim Rock Camp (1928-1932), in the project area are a record of life in the camps. These camps contain evidence of daily life and the physical organization of camp life. Evidence of the railroad logging systems is more ephemeral, consisting of segments of railroad grades and trash dumps across the landscape. Taken together, these traces help us understand how and where the historical railroad logging systems in the project area operated.

Figure 17: Laying Track for Shevlin-Hixon Logging Company



EXISITING CONDITION

The Area of Potential Effect (APE) of the South Bend Project consists of the EA units rather than the entire project area. The cultural resources technical report provides detailed information on the acreage and location of acceptable survey by EA unit (Project Record, Cultural Appendix,).

Portions of the project area have been surveyed for cultural resources. Some of these surveys date to the early 1980's. No surveys conducted prior to 1988 meet current standards. Cultural resource records indicate that 12 surveys have been completed (Project Record, Cultural Report, Table 1, page 3).

Five recorded heritage sites are situated within the project area. All of the known sites would be avoided and would not be impacted by the project work. All historic sites are associated with railroad logging, transportation, or homesteading. Any undiscovered sites found during project layout or implementation would be protected from project activities until further evaluation.

ENVIRONMENTAL CONSEQUENCES

Alternative 1 (No Action)

Unmanaged fuels in the project area would continue to pose a risk of wildfire. Wildfire and wildfire suppression activities can have significant effects on cultural resources.

The flame and heat from wildfires directly affect archeological materials on the ground surface. High temperature fires have the potential to damage most classes of archaeological artifacts and features. The longer the artifacts and features are in contact with high heat, the greater the damage. Where downed logs burn on top of an archaeological site, the heat effects extend well into the soil column, affecting artifacts that would otherwise be protected by a mantle of insulating soil.

Fire can affect chronological information preserved in prehistoric sites. Fire can physically and chemically alter the datable material, destroying the ability to date the site. Obsidian hydration is another technique that measures the amount of moisture absorbed by obsidian artifacts and exposure to high heat can destroy the dating potential.

Rock art sites are susceptible to damage by fire and can be completely destroyed by the heat and smoke. Painted elements (pictographs) can be smoke damaged while pecked elements (petroglyphs) on basalt can exfoliate in the high heat. Rock art is often located on vertical sides of boulders or cliff faces where the heat of wildfires is often concentrated. These surfaces can become superheated, particularly when vegetation is present against the stone surface.

Fire also damages historic artifacts, increasing the oxidation of metal artifacts, melting glass, and cracking or breaking pottery and altering or removing decorative paints. Organic materials such as wood, shell, bone, antler, horn, leather, and cloth would be burned or otherwise damaged if exposed to flame or smoke. In addition to the effects of fire, suppression of wildfires with the use of mechanized equipment could damage archaeological sites.

Prehistoric and historic sites are often protected from artifact looting by obscuring vegetation. When wildfire removes this vegetation, sites and artifacts become more vulnerable to artifact theft and vandalism. Since artifact theft from public lands is a substantial problem in Central Oregon, this effect is of particular concern in this project area.

Alternative 2 (Proposed Action)

Alternative Two consists of proposed treatments to reduce the fuel continuity, which would reduce the rate of spread and intensity of a wildfire. The Bend-Ft. Rock Ranger District is proposing to reduce forest surface, ladder and aerial fuels within 1 ½ miles of the Forest boundary south of Bend, Oregon and east and west of Highway 97.

In most units, multiple treatments are proposed within each treatment unit to reduce existing fuels. Thirty percent of each unit would remain in an untreated condition following treatment. There is the potential that the thinning slash could be removed as biomass; otherwise slash would be piled and burned or scattered in areas of low fuel loadings. Pruning of lower limbs is proposed in some stands to increase the distance between surface and crown fuels. Units identified for under burning were designed to use existing fuel breaks, such as roads and lava flows to reduce the need for the construction of hand fire lines. No machine fire lines would be constructed but there may be some hand constructed fire lines. Fuels treatments would receive priority for implementation along private land boundaries.

Management of timber and vegetation for fuel reduction or merchantable wood products typically involves activities that cause ground disturbance—and where ground disturbance co-occurs with cultural resources, damage to the cultural resource can occur. These activities include prescribed fire and underburning with mechanical pretreatment, tree falling, slash pile burning, thinning from below with mechanized equipment, and underburning.

The standard practice for protection of significant or unevaluated cultural resources is to avoid surface disturbance within the boundaries of individual cultural resources.

Not all of the project area has been surveyed, meaning that undiscovered and unrecorded cultural resources could be situated within areas in which ground disturbing activities would occur. The risk of adverse effects on this class of undiscovered and unrecorded cultural resources is high. The Regional Programmatic Agreement for implementation of Section 106 of the National Historic Preservation Act requires either intensive inventories or sample surveys with approved designs within the Area of Potential Effect (APE). In the instance of the South Bend project, the APE consists of the EA units.

Avoiding Effects of Alternative 2 (Proposed Action)

The 5 heritage sites can be managed through a program of avoidance using the standard site avoidance practices of the Deschutes National Forest. There would be no effect on these sites if the site avoidance practices are appropriately implemented.

Avoidance of sites within the unsurveyed areas requires a continuing program of monitoring during the entry and implementation for project implementation and implementation of the site avoidance practices referenced above. This monitoring should consist of intensive coverage in high probability areas and a small sample of the low probability areas-which comprise most of the unsurveyed lands within the EA units. High probability areas include the perimeter of lava flows extending outward for 40 meters. Other high probability areas may be identified by District Archaeologist during monitoring.

BOTANY – SENSITIVE PLANTS

MANAGEMENT DIRECTION

This biological evaluation documents the consideration of Threatened, Endangered, and Sensitive (TES) plants for this project. It is prepared in compliance with the Forest Service Manual (FSM) 2672.4 and the Endangered Species Act of 1973 (Subpart B; 402.12, section 7 consultation).

FINDING

Effects of activities are evaluated for TES plant species on the current Regional Forester's Sensitive Species List (FSM 2670.44, July 2004) that are documented or suspected to occur on the DNF. The proposed action would have no impact on Proposed, Endangered, Threatened, or Sensitive plant species. Refer to Project Record, Botany BE, Appendix A, page 5 for a list of these species.

EXISTING CONDITION

There are no known TES plant species within or adjacent to the project units. The nearest known TES plant sites lie about two miles west of the project (*Artemisia ludoviciana* ssp. *estesii*, in riparian habitat (which this project does not have) and about five miles to the northwest of the project (*Castilleja chlorotica*). The project area does not offer high-probability habitat for any known TES plant species; the most likely to occur would be the green-tinged paintbrush (*Castilleja chlorotica*). This species is most often found in shallow, rocky soils; the soils within the project tend to be quite sandy without the rough rocky texture that this species prefers.

A TES plant survey is not required for this project, because so much has already been covered by previous surveys, and other, informal visits to the area have not found any TES plant sites. Roughly 75% of South Bend HFRA units have received an "official" sensitive plant survey sometime within the past 17 years. These projects were surveyed: North Boundary Fuelbreak (1994), Natural Fuels Reduction (1996 and 1997), High Desert Learning Center (1993), and Black Bark (1990). There have also been numerous visits to the area during the summer by Forest Service botanists for other reasons, when TES plants would have been noticed. No TES plants have been found in the area. The field survey forms from those surveys are on file at the Bend/Ft. Rock Ranger District.

Bryophytes, lichens, and fungi added to the Forest's sensitive plant list in July 2004 do not have potential habitat within the project area (Refer to Project Record, Botany BE, Appendices B-D).

No habitat for Threatened, Endangered, Proposed, or Candidate plant species (these species, and their habitats, are listed in Appendices C and D) exists within the project area, with the possible exception of *Botrychium lineare*, a Candidate species. Its range distribution is very wide and its habitat varies just as widely. However, it has not been found on the Deschutes National Forest, (nor more specifically in the project area), after 15 years of project-level surveys, which include complete lists of plants encountered. The nearest known site lies in northeastern Oregon, in Wallowa County.

ENVIRONMENTAL CONSEQUENCES

Direct, Indirect, and Cumulative Effects: None have been identified, because TES plant species or high-probability TES plant habitat do not exist within the project.

BOTANY – INVASIVE SPECIES

MANAGEMENT DIRECTION

A Record of Decision for Preventing and Managing Invasive Plants was signed in October 2005, and incorporates its standards into the Forest Plan of the Deschutes National Forest. Three of those standards specifically address prevention of weed introductions (#'s 1, 2, and 7, Refer to Project Record, Noxious Weed Risk Assessment, Appendix B, page 11) into projects of the type that the South Bend HFRA project represents. These standards obligate the Forest Service to incorporate weed prevention into its planning documents and implementation phase.

Forest Service Manual (FSM) direction requires that Noxious Weed Risk Assessments be prepared for all projects involving ground-disturbing activities. For projects that have a moderate to high risk of introducing or spreading noxious weeds, Forest Service policy requires that decision documents must identify noxious weed control measures that will be undertaken during project implementation (FSM 2081.03, 29 November 1995).

FINDINGS

The South Bend HFRA Project poses a **HIGH** risk of weed introductions or spread. Refer to discussion regarding Risk Ranking in this section.

INTRODUCTION

Aggressive non-native plants, or noxious weeds, can invade and displace native plant communities causing long-lasting management problems. Noxious weeds can displace native vegetation, increase fire hazards, reduce the quality of recreational experiences, poison livestock, and replace wildlife forage. By simplifying complex plant communities, weeds reduce biological diversity and threaten rare habitats. Refer to Project Record, Noxious Weed Risk Assessment, Appendix A, page 9 for potential and known weeds for the Deschutes National Forest.

In addition to noxious weeds, which are designated by the State, there is a group of non-native plants that are also aggressive though are not officially termed "noxious". These species are also considered in this assessment.

EXISTING CONDITION

Roads adjacent to units within the project were inventoried for noxious weeds by two trained Forest Service employees in July 2007. They found many weed sites, most of which were previously known.

At present, two toadflax sites have biocontrol insects on them, located in units 135 and 137. These insects eat at the plants, slowing down their rate of spread and significantly reducing the amount that are able to reach the active flowering stage. There would likely be more biocontrols placed on sites within units prior to project implementation.

Noxious Weeds Of Concern For The Project Area

Figure 18: Photograph of Dalmatian Toadflax

Dalmatian toadflax (*Linaria dalmatica*) looks like bright yellow snapdragons with leathery leaves clasping the stem and grows easily in dry rangeland sites, gravel pits, and along roadsides. It is a perennial plant and stands 2-4 feet tall. One plant can produce up to 500,000 seeds per year, and they remain viable in the soil for up to 10 years. Pulling this plant would usually result in more plants sprouting from its root system, unless all root parts are removed from the soil, which is often difficult to do.

Spotted knapweed, *Centaurea maculosa*, is a very aggressive plant that grows along most major highways in Central Oregon**.** It is a perennial forb in the sunflower family that lives for 3-5 years. It is very competitive on disturbed dry to mesic sites because it is able to germinate in a wide range of conditions and it grows early in spring before many native plants. Seeds may be dispersed on animals and humans, and by being caught up in vehicles. Distribution over large areas is linked to transportation systems. Known sites along Highway 97, among other places, are currently being treated under the Deschutes National Forest Noxious Weed Control Environmental Assessment (1998).

Table 67: Known Noxious Weed Populations within Project Area

Site	Invasive Specie	Location	Associated Unit(s)
1	Spotted knapweed; Russian thistle	Highway 97	Adjacent to 447, 430
2	Spotted knapweed	Unnumbered road west of Highway 97 running NE/SW	Adjacent to 221, 222, 411, 116, 131, 452, 113, 412, 455
3	spotted knapweed (2 sites)	Unnumbered road	Within 221

Site	Invasive Specie	Location	Associated Unit(s)
4	Spotted knapweed; Dalmatian toadflax	Road 1801-100	Adjacent to 251, 252
5	Dalmatian toadflax (7 sites)	Roads 1800-199 and Road 1800-100	Adjacent to or within 133, 137
6	Intermittent small populations Spotted knapweed; Dalmatian toadflax	Road 18	Within or adjacent to 137, 134, 141
7	Dalmatian toadflax (2 sites) Spotted knapweed (2 sites)	Road 1800-019 (powerline road)	Adjacent to or within 138, 139
8	Dalmatian toadflax (5 sites)	Unit 135 adjacent to Forest Boundary	135
9	Dalmatian toadflax (3 sites)	Road 1800-640, 643	136

Currently, only manual treatments (i.e. pulling by hand) are allowed on sites #2-5 and #7-9; herbicides are authorized and are occurring along the Highway 97 corridor (site #1) and Road 18 (site #6).

RISK RANKING

The following factors/vectors (if contained in project proposal) are considered in the determination of the level of risk for the introduction or spread of noxious weeds and are ranked in order of weed introduction risk:

1. Heavy equipment (implied ground disturbance)
2. Importing soil/cinders
3. OHV's
4. Grazing (long-term disturbance)
5. Pack animals (short-term disturbance)
6. Plant restoration
7. Recreationists (hikers, mountain bikers)
8. Forest Service project vehicles

Ranking

___X___ HIGH

Needs to be a combination of the following three factors:

1. Known weeds in/adjacent to project area.
2. Any of vectors* #1-8 in project area.
3. Project operation in/adjacent to weed population.

_____ MODERATE

1. Any of vectors #1-5 present in project area.

_____ LOW

1. Any of vectors #6-8 present in project area.

OR

2. Known weeds in/adjacent to project area without vector presence.

Discussion of Ranking

A risk ranking of HIGH is appropriate for this project because heavy equipment would be brought into the area, bringing a risk of importing weed seeds or seed parts. There are known noxious weed populations within the project area. Implementing fire into populations is likely to

encourage growth. If fill material is used, this increases the risk of weed seeds being imported into the project area. Mitigations (EA page) would reduce the risk, but not eliminate.

ENVIRONMENTAL CONSEQUENCES

Alternative 1 (No Action)

Direct and Indirect Effects: There are no anticipated direct or indirect effects from implementation of this alternative, because there would be no project activity.

Cumulative Effects: The Forest Service is proposing to implement the Sunriver HFRA and Oz projects near the south end of the project area sometime within the next year, which involves heavy equipment and the attendant potential for weed introductions. These projects carry the potential to introduce or spread weeds, mainly because heavy equipment would be used, despite regulations that require washing of vehicles prior to entry onto National Forest system lands.

Alternative 2 (Proposed Action)

Direct and Indirect Effects: The heavy machinery used to implement this project carries the risk of introcuding or spreading weeds. Mitigation measure #1 (flagging out sites) and measure #3 (cleaning equipment) would help reduce, but not eliminate, this risk.

Burning over dalmatian toadflax would likely cause the above-ground portions to die back but would not kill the plant, and its vigor may even be promoted by fire (USDA Forest Service Fire Effects database). The same is likely true for mowing it. For that reason, mitigation #'s 1 and 2 are present in this document. Following these mitigations would help reduce the intensity of any fire that runs through those sites, but would not eliminate it, and thus would not entirely eliminate the risk of creating more vigorous sites.

Regarding spotted knapweed (there are fewer sites of this species in the project area than toadflax), there are few published studies on fire effects, but what information is available indicates that it is enhanced by burning. Additionally, its seeds are likely to "survive all but severe fire" (USDA Forest Service Fire Effects database, 2002). Mowing over knapweed is likely to only remove the above-ground portions, but not affect the below-ground taproot, from which knapweed can easily resprout. Mitigation #'s 1 and 2 are designed to lessen the impact of project mowing and burning, but would not entirely remove the risk of spreading the weeds.

If fill material is used for the project, it is possible for weed seeds to be brought into the project via that material. If this is needed for this project, it is important for the material to be inspected prior to its being brought in. The inspection would be able to detect any weeds growing in it, but not any weed seeds imbedded in it. For this reason, it is recommended to monitor the project sites for weed introductions after project completion.

Cumulative Effects: The Forest Service will implement the Oz project within the next year; two units that are located adjacent to the south boundary of Unit 255. The activities in these projects will use heavy equipment, adding potential for weed introductions despite regulations that require washing of vehicles prior to entry onto National Forest system lands. Implementation is rated as high risk for weed introduction and spread. Mitigation measures would reduce but not eliminate the risk.

FISHERIES AND WATER RESOURCES

SUMMARY

This biological evaluation (BE) describes and displays the effects to sensitive aquatic species associated with the *South Bend Hazardous Fuels Reduction Project Environmental Assessment* on the Bend/Ft. Rock Ranger District, Deschutes National Forest.

Summary of Findings for Proposed, Threatened, Endangered, and Sensitive Species: Redband trout

Alternative 1 – NI – No Impact
Alternative 2 – NI – No Impact

The following table displays the species considered in the analysis of the South Bend Hazardous Fuels Reduction Project. **There are no threatened or endangered aquatic species or habitat present within the project area.** There are no other Region 6 sensitive aquatic species or habitat present in the project area other than the species listed below.

Species	Scientific Name	Status	Occurrence
Columbia Basin Redband Trout	*Oncorhynchus mykiss gairdneri*	S	D

Status

S	Sensitive species from Regional Forester's list

Occurrence

HD	**Habitat Documented** or suspected within the project area or near enough to be impacted by project activities
D	Species **Documented** in general vicinity of project activities

Effects Determinations

Sensitive Species

NI	No Impact
MII	May Impact Individuals but Will Not Likely Contribute to a Trend Towards Federal Listing
WIFV	Will Impact Individuals with a Consequence that the Action May Contribute to a Trend Towards Federal Listing
BI	Beneficial Impact

Essential Fish Habitat: There would be no effects to Essential Fish Habitat from either alternative. Although the Upper Deschutes 4th field watershed (17070301) is mapped by the National Marine Fisheries Service as Essential Fish Habitat for chinook salmon, there are no present or historical records of chinook populations above Big Falls on the Deschutes River, over 60 miles downriver from the project area.

MANAGEMENT DIRECTION

Inland Native Fish Strategy (INFISH): The project area is east of the owl line, and lies within the management area of the INFISH, which amended the Deschutes National Forest Land and Resource

Management Plan in 1995. There are no perennial or intermittent streams within or immediately adjacent to the proposed units or project area. Ephemeral channels may exist, but have no surface connection to any perennial streams. The nearest perennial water body is the Deschutes River, approximately 1.75 miles west of Unit 107. A lava flow, approximately 1.5 -2.0 miles wide, lies between the project area and the Deschutes River. There are no lakes, ponds, reservoirs, or wetlands within or adjacent to the treatment units.

Management direction within INFISH requires Riparian Habitat Conservation Areas (RHCAs) to be delineated for watersheds. These are portions of watersheds where riparian-dependent resources receive primary emphasis, and management activities are subject to specific standards and guidelines. There are no riparian areas within or adjacent to the treatment units, therefore no RHCAs have been designated.

Deschutes National Forest Management Plan: Management direction is to maintain or enhance riparian areas and the riparian-dependent resources (water quality and quantity, fish, and certain wildlife and vegetation that owe their existence to riparian areas) associated with these areas (Standard and Guideline RP-2). There are no known riparian areas, perennial, or intermittent streams within or immediately adjacent to the proposed units.

There are no Oregon Department of Environmental Quality 303(d) listed streams or lakes within or immediately adjacent to the units.

EXISTING CONDITION

There are no streams or lakes within or immediately adjacent to the units; there are no redband trout or other fish populations. The nearest unit is located approximately 1.75 miles from the Deschutes River which does contain redband trout. Native mountain whitefish and introduced brown trout are also present.

The proposed units are within the 6th field sub-watersheds of Bessie Butte, Green Mountain, and Benham Falls, which are components of the larger 147,978 acre 5th field Pilot Butte watershed.

The project area is within the Upper Deschutes Basin. Groundwater flow direction in the basin is influenced by complex, underlying geology, and is not closely associated with the surface topography in some areas. Generally, groundwater flow direction in the project area is in a western to northwestern direction toward the Deschutes River (Gannett, 2001).

A large proportion of the precipitation in the Upper Deschutes Basin falls in the Cascade Range, the principal groundwater recharge area for the basin. East of the Cascade Range, there is little or no recharge from precipitation (Gannett, 2001). Precipitation in the project area, primarily snowfall, is approximately 15-20 inches annually. In the Cascade Range recharge area, annual precipitation may exceed 200 inches. Evapotranspiration of groundwater is rare in the Upper Deschutes Basin (Gannett, 2001). Groundwater level fluctuations in the basin are driven primarily by decadal climatic cycles (Gannettt, 2001). Runoff is a relatively small component of the total water budget in the basin due to the high infiltration rates of the highly permeable volcanic soils (Gannett, 2001).

ENVIRONMENTAL CONSEQUENCES

Alternative 1 (No Action)

Direct and Indirect Effects: There would be no direct or indirect effects to water or fisheries resources, including redband trout as there are no fish populations, streams, lakes, wetlands, or riparian areas within the project area.

Alternative 2 (Proposed Action)

Direct, Indirect, and Cumulative Effects: Commerical harvest would occur on slightly more than 425 acres, or 0.33% of the watershed, not measurably affecting peak flows, timing of peak flows, or water yield in the Deschutes River.

Changes in evapotranspiration from harvest would have little hydrologic effect since evapotranspiration from groundwater is rare in the Upper Deschutes basin. High infiltration rates limits volume of precipitation that can be evapotranspired as it moves through the soil to the groundwater.

- There would be no effects to surface water resources, fisheries populations or habitat (including redband trout), or riparian areas, since there are none of these resources in or immediately adjacent to the project units.
- There would be no effects to Essential Fish Habitat from any alternative. Although the Upper Deschutes 4th field watershed is mapped by the National Marine Fisheries Service as Essential Fish Habitat for chinook salmon, there are no present or historical records of chinook populations above Big Falls on the Deschutes River, over 60 miles downriver of the project area.
- There would be no effects to any ODEQ 303(d) listed waterbodies (Deschutes River), since there would be no effects to water resources.

RIPARIAN MANAGEMENT OBJECTIVES COMPLIANCE

Since there are no known stream systems within the project area, there would be no effects to the Riparian Management Objectives listed under INFISH.

RECREATION

INTRODUCTION

Recreation use is expected to rise approximately five (5) percent per year. This is similar to the expected population increase of Central Oregon and the increase in popularity of the area as a recreation destination. Dispersed recreation sites and activities are located in some areas where shrub and tree density is substantial. The density of the vegetation provides fuels that provide an immediate threat, in the event of wildfire, to these dispersed recreation areas.

EXISTING CONDITION:

Developed Recreation – There are no developed recreation sites within the planning area.

Dispersed Recreation – Substantial recreation use occurs within the Wildland/Urban interface zone, primarily from Deschutes River Woods and Woodside Ranch. This includes all modes of transportation, winter and summer. Use is low to moderate.

Dispersed recreation sites and activities include: dispersed camping, driving for pleasure (4-wheeling included), OHV use, mountain biking, and shooting,. Numerous Forest roads and user created roads and trails provide access for these uses. Dispersed campsites are primarily used in the fall, receiving moderate to no use during the summer season. \

Users use both Forest system or non-system roads to recreate on. There are a number of trails and roads within the South Bend planning area. These are not, for the most part, captured and documented. There are no official system trails within the planning area, although there are numerous trails which have been created over time by mountain biking, hiking and OHV use. There are significant areas of lava flows directly to the north, west and south, outside of the planning area, which host little recreation, other than dispersed exploration and some over the snow use in high snow winters.

Resource vandalism and trash dumping are problems in this area due to the proximity to the Bend urban area.

Alternative 1 (No Action)

Direct and Indirect Effects: Day use activities would continue to increase, especially along the urban interface zone. There would be no changes to dispersed recreation opportunities or physical features. The use of and possible creation of user created trails would continue, although this area is limited in size.

The largest increases would be with motorized use, summer and winter, as motorized recreation is one of the fastest growing recreation uses. There could be a marked increase in the creation of trails and play areas by OHVs.

Dispersed campsites would continue to be utilized, likely with increased use with an associated increase in population and use of the Forest. These campsites are generally utilized in the summer months and fall.

There would continue to be the degradation of plants and soils from the use of user created roads, trails, and primitive dispersed campsites. Illegal practices, typical of activities in this zone; such as garbage and refuse dumping, shooting and others would increase.

People driving on the Forest would continue to increase as the need for motorized access with an aging population increases. The increase in gas prices could moderate any increase in use.

User trails would continue to develop as use of the area increases. As common and logical routes are used repeatedly a trail develops. They would continue to be used increasingly as more people discover them. These trails are generally a combination of the easiest and shortest routes from one place to destinations such as Green Mountain and the views provided. These areas are likely areas to receive increased user trail development, especially from mountain bikes and OHVs.

There would be no changes to the existing special uses and utilities, and no negative impacts expected with any of the alternatives.

Alternative 2 (Proposed Action)

Direct and Indirect Effects: There would not be any new intentional recreation opportunities created. The existing dispersed sites and user created trails are not managed and would not be protected from treatment activities. Logging facilities, including log landings, could be placed where sites exist, effectively obliterating them.

Road closures and decommissioning could effectively close dispersed sites to vehicular access for camping. Overall access to this area would be reduced, although there would continue to be many opportunities for motorized access.

Cumulative Effects: Closing sites reduces options of dispersed campers. Other projects have made the decision to close dispersed campsites (6-50%) in areas outside of this project area. South of this project, the Sunriver HFRA will change nearly half of the existing dispersed sites to boat in or walk-in sites only, eliminating vehicular access, not use of the sites.

The primary reasons for the closures have been 1) they are located on a road that has been recommended for closure or decommissioning and 2) many are adjacent to water, affecting riparian vegetation, causing unacceptable resource damage. There is no water or riparian vegetation associated with this project.

The trend has been to analyze campsites to determine if they are doing unacceptable resource damage. More dispersed campsites are likely to be closed in the future, likely resulting in an increased use of remaining sites. It is probable that new sites would be created if topography allows. People also go to attractive destinations, usually relating to water. In this project area, which is the interface between public and private land, it is unknown if there would be a substantial increase in dispersed camp sites.

Other day use activities that would be affected by the proposed action, both short and long-term, could be picnicking, shooting outside of the closed shooting area, driving for pleasure, and other route related activities. These activities could be changed by reducing vehicular access. The result could be the displacement of use to other locations within or outside of the planning area.

SCENIC VALUES

MANAGEMENT DIRECTION

The USDA Forest Service established a Handbook for Scenery Management System (SMS--USDA FS 1995) to protect and enhance scenic resources which may be diminished by human activities, such as vegetation management, recreation and/or administrative facility development. The analysis takes into consideration the balance between Social (human) and Ecological (natural) needs within the analysis area.

The Forest Service implementing regulations, currently establish a variety of Scenic Quality Standards (SQO's for Scenic Views—MA 9). These standards include:

- Natural Appearing Landscape with High Scenic Integrity Level (formerly Retention, MA 9, SV-1; NNVM, M-76).
- Slightly Altered Landscape with Medium Scenic Integrity Level (formerly Partial Retention, MA 9, SV-2).
- Altered Landscape with Low Scenic Integrity Level (formerly Modification or General Forest, MA 8, GFO) within the Foreground as well as in the Middleground landscape.

INTRODUCTION

Scenery Management Objectives are defined in terms of Scenic Integrity Levels which describe existing conditions and whether the landscape is visually perceived to be "complete" or not. The most complete or highest rating for Scenic Integrity Levels means having little or no deviation from the landscape character that makes it appealing and attractive to visitors and local residents. In addition to describing existing conditions, Scenic Integrity Levels also describe the level of development allowed and ways to mitigate deviations from the area's landscape character.

Usually the most effective way to meet Scenic Integrity Levels is to repeat visual form, line, color, texture, pattern, and scale common to the scenic values of the landscape character being viewed. For example, in natural and natural appearing landscapes, deviations such as created openings can sometimes be visually enhanced through repetition of size, shape, spacing, surface color, edge effect, and pattern of natural openings common to the existing landscape character. Adding structures or additions to existing structures in the landscape can often be accomplished by repeating architectural form, line, color, texture, pattern, and scale that visually relates to the surrounding site features. When repetition is designed to be accurate and well placed, the deviation may blend so well that change is not evident. Refer to LRMP, MA 9, Scenic Views Allocation; and the Scenery Management System (SMS--USDA FS 1995) handbook for more detail.

Scenic values are often based upon local knowledge of an area's unique characteristics and how people relate to a particular landscape or setting. Measuring these values is often subjective and communicated through the overall quality of the visitor experience. The key to realizing these values is to understand the traditions and connections visitors have developed over time to a certain place. The measure used in this analysis is the number of acres (or percentage) of improved or enhanced scenery.

Visitors often have definite expectations of scenic views and other sensory experiences. These expectations are mainly based upon aesthetics and can be expressed through reactions to changes in the landscape or to patterns of land use. Visible and perceptible changes in noise levels, intensity of

illumination, new building structures or lighted signs, surface changes such as paving or concrete, cut and fill grade changes, and removal of native vegetation are especially noticeable in developed areas surrounded by a forest setting.

Recent population changes and growth of development in Bend have brought more pressure and greater potential for disturbance to scenic quality and negative impacts to visitor recreation experiences in semi-primitive and primitive settings. Light pollution from adjacent urban areas, dust, noise, and erosion problems from increased traffic on Forest roads, and higher density recreation activities have all occurred in recent years to impact the visitor's recreation experience in other areas on the Forest. On the other hand, greater risk from fire has occurred due to higher numbers of residents and visitors to the project area's recreation sites and trails.

SCOPE OF THE ANALYSIS

Scenic view analysis is confined to the project area and the transportation corridors that access it with an emphasis on the maintenance and enhancement of those features that give the project area its sense of place. Vegetation management activities that have taken place during previous years including thinning, underburning and mowing have been beneficial at maintaining and enhancing scenic quality.

Cataloguing these activities is not necessary because they have been included in the existing condition. There are no other on-going or reasonably foreseeable activities within the project area that would negatively change scenic quality.

AFFECTED ENVIRONMENT

There are a total of 3,309 acres within Scenic Views, mostly including foreground areas within travel corridors which are classified as High Integrity or Retention for Scenery Management Objectives. Access is mostly from Highway 97.

The project area is located adjacent to the southern urban growth boundary of Bend. This Wildland Urban Interface setting represents the need to balance resort/residential community lifestyle with safety from the threat of wildfire and with preserving natural resource areas for native plants and wildlife habitat.

The characteristic landscape of the project area is of high density stands of ponderosa and lodgepole pine. These thickets are dark and overgrown lacking the open air and more uplifting views provided by the healthier appearance of larger diameter ponderosa pine and native grasses.

The project area may seem as a "natural appearing landscape" to the casual forest visitor. However, the current condition is far from being natural. Decades of historic timber harvest and fire suppression have led to the current condition of an unnatural, mostly high density forested landscape. The development of larger trees is being suppressed by the densely stocked stands and the changes in the fire regime and other natural disturbances throughout the project area. The densely stocked forests with a high canopy closure percent has led to the exclusion of the open park-like stands historically found within the area.

DESIRED CONDITION

The desired future condition for the Project Area is to enhance scenic views through treatments resulting in a more open landscape characteristic of historic old growth forests with larger diameter

ponderosa pine visible. The removal of smaller trees and the reduction of fuels would insure long-term survival rates by providing open space areas around larger diameter ponderosa pine. Safety conditions would be improved through the improved access and visibility along roads designated for evacuation or firefighter access in both residential and recreation areas. Enhanced views would be a much more natural appearing mosaic of sun and shade.

Ponderosa pine in foreground views (MA 9-4) would be managed to maintain or create a visual mosaic of numerous, large diameter, yellow-barked trees with stands of younger trees offering scenic diversity as seen from sensitive viewer locations, such as from a travel corridor. Ponderosa pine viewed as middleground (M9-15, M-80) would be managed to provide a strong textural element. The presence of a few individual large trees with full crowns is an important part of this landscape element. Immature stands are also an essential component in the landscape because they help provide a strong color contrasts and eventually become the replacements for the larger old growth trees that perpetuate the desired coarsely-textured character. Visible openings are desirable where the natural landscape contains similar openings, or where natural-appearing openings can provide additional diversity in the landscape where lacking.

ENVIRONMENTAL CONSEQUENCES

Important Interactions

The proposed activities were designed to create an altered and different forest character that would increase forest health, enhance short and long-term scenery and improve the recreational experience. The effect on scenic resources from the two alternatives, specifically on landscape character, scenic quality, and scenic integrity level, can be classified into two specific categories. The first is short-term effects (0 to 5 years), and the other is long-term effects (from 5 years and beyond). The effect from the proposed management activities would be most evident to the visiting public within the foreground landscape (0 to ½ mile corridor) and some part of the middleground landscape (1/2 to 5 miles). This effect analysis takes into account short, long-term, and cumulative effects.

Alternative 1 (No Action)

Direct and Indirect Effects of Alternative 1: *Measure: Acres (or percentage) of improved or enhanced scenery* Under this alternative, none of the existing vegetation community within the project area would be managed. Natural and ecological processes, such as insects and diseases, wind and snow damage, dead and down tree accumulations, would continue, exacerbated by continuing fire suppression.

No action would be taken that would reduce the risk at a landscape scale of a large, stand replacement fire. Vegetation health, growth, and vigor would continue to decline on those dense stands at high risk of beetle attack.

The Deschutes National Forest LRMP objectives and the Desired Future Condition for Scenic Views (LRMP, MA 9) are not expected to be met as originally intended. An analysis of stand replacement wildfires within the subwatershed suggests that if current trends continue the entire project area would revert back to early seral stage stands over the next five decades.

Cumulative Effects: There would be no cumulative effects with this alternative because there would be no vegetation management activities that could affect scenic quality. With the exception of 203 acres of reasonably foreseeable thinning and underburning, scenic quality within the project area

would continue to trend down as fuels levels, stand density, and stand mortality continue to increase from on-going fire suppression and motorized access.

Alternative 2 (Proposed Action)

Direct and Indirect Effects: Under Alternative 2, the management of existing vegetation to reduce fuel loading and to highlight individual large ponderosa pine trees would take effect. Mechanical shrub treatments (mowing), prescribed fire (underburn), tree thinning (commercial and noncommercial thinning), and hand piling would be utilized to complete management activities as proposed. Upland fuel reduction treatments would reduce the overall wildland fire risk of a stand replacing wildfire that could severely affect both short and long-term scenic resources (i.e. scenic quality, scenic integrity level, and landscape character). Fuel treatments would create a mosaic of shrub and grass communities with scattered regeneration within the understory.

Short-term effects such as opening up stands through burning, mowing, and piles of thinning slash may be noticeable to the viewer. Implementing mitigation measures such as removal of slash piles and locating landings and skid trails away from main travel corridors would make these treatments less visible to the viewer especially when clean-up is completed within two years. Long-term effects from proposed treatments would become less noticeable due to natural changes in the landscape over time such as vegetation growth.

The largest potential for negative effect on scenery generated by the proposed management activities may be from logging disturbance, fuels treatment activities, and timing of such management activities. Logging of green trees, as well as prescribed burning and mowing, may reduce scenic quality and recreation experience during the short-term period. The time period of concern is during the summer peak recreation season, between the month of June and August. Summer logging activities may reduce or impede recreation access and experience. The low elevation of the project area combined with soils that are well drained and hold up well during late fall and winter make it an ideal area for winter logging operations, which could help reduce recreation/logging conflict as well as minimize impacts on the landscape. To eliminate recreational and visual conflicts, vegetation management activities involving mechanized tree removal and mowing would occur outside of the normal recreation season of May 20 to September 1. To further eliminate or minimize short-term effects on scenic views the following highly effective mitigation measures (see also Chapter 2) would be used:

- Minimize the use of paint where feasible, especially within the immediate Foreground landscape. Where paint is needed along scenic routes, utilize backside tree marking to minimize visibility.
- Flush cut stump (8 inches or less) within immediate Foreground landscape (0 to 300 feet).
- Where possible, design and locate skid trails and landings at least 300 feet away from Highway 97.
- Slash treatment within scenic corridor to be completed within a two year period.
- Keep scorching of tree crowns during prescribed burning to approximately 1/3 of live crown ratio.
- Removal of all boundary flagging as part of the post treatment activities, within one and two years period, respectively, for SV-1 and SV-2 along scenic corridors.

Prescribed burning and/or natural fuels mowing activities are proposed under this alternative. Compared to Alternative 1, both treatment types would reduce fuel loading, improve and enhance naturally appearing landscape characteristics, scenic quality, and scenic integrity level. Mowing of shrub components in the landscape has the potential to have a direct affect on short-term scenic quality within the project area. Retaining clumps and small islands of the existing shrub layer distributed

throughout the mowing unit (mosaic pattern) is designed to mitigate this visual effect as well as provide visual diversity in the post treatment landscape.

Approximately 1,007 acres (39 percent of the Scenic Views Management area) would be treated under this alternative and would result in beneficial short and long-term alteration of the landscape character that is expected to be noticeable to casual Forest visitors. Scenic views are expected to move toward the desired conditions as originally intended. Over all, the long-term enhancement of landscape character, scenic quality, and scenic integrity level is expected while meeting scenic quality standards and guidelines.

Cumulative Effects: Short-term effects such as opening up stands through burning, mowing, and piles of thinning slash may be noticeable to the viewer. Implementing mitigation measures such as removal of slash piles and locating landings and skid trails away from main travel corridors would make these treatments less visible to the viewer especially when clean-up is completed within two years. Long-term effects from proposed treatments would become less noticeable due to natural changes in the landscape over time such as vegetation growth.

The cumulative effects benefiting from past and proposed future activities would be improvements to scenic quality and forest health and lower stand replacement wildfire risk.

Measure #1 Acres of improved or enhanced scenery. The combination of Alternative 2 and the past projects in the area, as reflected by the existing condition, contribute toward a more desired forest conditions that meet both short and long-term scenic views. Alternative 2 would prescribe underburn and/or thin 1,335 acres in addition to 203 acres (Oz CE) of reasonably foreseeable projects. To date, none of the previous underburns or thinning projects has been determined to be visually unacceptable within the project area.

Based on the provisions for conducting underburns under prescribed conditions there would be no negative cumulative effects on scenic quality from underburning or thinning. Mowing of shrub components in the landscape has the potential to have a direct affect on short-term scenic quality within the project area. As noted before, 30 percent of the net treatment acres in the EA units would not be treated. Retention clumps and small islands of the existing shrub layer would be distributed throughout the mowing areas to help mitigate this visual effect. There would be no negative cumulative effects on scenic quality from mowing within the project area.

LRMP/OTHER MANAGEMENT DIRECTION CONSISTENCY

The landscape character goal for the project area is to move towards the historic ponderosa pine condition that was dominated by open, park-like stands with large yellow bark ponderosa pine greater then 30 inches in diameter. Vegetative management within MA 9 is designed to perpetuate the desired visual condition by accelerating the development of LOS stage ponderosa pine (MA 9-11 to 9-17). This would be achieved by thinning from below with variable spacing to control insects and disease (MA 9-96) and highlighting rock outcrops (MA 9-16) and individually scattered large yellow barked trees (MA 9-6) in an interdisciplinary integrated (MA 9-7, 17, 26) silvicultural prescription (EA Appendix A) for each unit.

Black bark stands in the EA units would have variable density thinning, interspersed with no treatment screening clumps to gradually introduce both horizontal and vertical diversity. Whole tree removal and concurrent handpiling of thinning slash would ensure that cleanup activities would be completed after the work has been completed in a timely manner to meet visual quality standards (M9-8, LRMP, Amendment #12, S-1).

RANGE

This analysis meets the direction provided by the Forest Service Manual (FSM 2200) and the Deschutes National Forest Land and Resource Management Plan (LRMP). It specifically addresses the South Bend project's effects upon an overlapping Grazing Allotment.

INTRODUCTION

The project area overlaps a portion of the north pasture of the Bessie grazing allotment (Table 68). The allotment lies east of Highway 97 and is adjacent to and south of the Bend urban growth boundary. The allotment was last actively grazed in 1991 and has been vacant since that time. Records indicate that grazing occurred as early as the 1930s. The area that is now the Bessie Allotment was established in 1936 as a community allotment. At that time, it was established to provide range for cattle and horses that belonged to adjacent landowners. Prior to 1936 the area had been grazed by varying numbers of trespass horses and bands of sheep trailing through the Bessie Butte sheep driveway.

An Environmental Assessment (E.A.) and Animal Management Plan (AMP) were completed for the Bessie Allotment in 1981. This area is considered both winter and transitional range for mule deer. The analysis in 1981 determined that moderate use by livestock would be a positive influence on bitterbrush conditions, encouraging longer leader length and higher palatability.

Table 68: Bessie Grazing Allotment and Status

Allotment	Total Acres	Acres of Allotment Within South Bend Project Area	Permitted Livestock Type	Last Year Actively Grazed/Status
Bessie	24, 457	3,712	Cattle	1991/Vacant

CURRENT ALLOTMENT CONDITIONS

Within the project area 30% is considered excellent potential range for livestock, 32% moderate, 34% poor, and 4% very poor. These ratings are based on climax community conditions and may not reflect current conditions on these portions of these allotments. Management activities often stimulate substantial increases in available forage for short periods of time.

No livestock water is available and must be hauled onto the allotment. Improvements include approximately 15.5 miles located inside the project area. The allotment would only be utilized as a "grass bank," providing a temporary backup pasture in the event of the loss of other pastures due to catastrophic events such as wildfire. The grazing season would extend from May 15 to July 31 for sheep and goats and from May 15 to September 15 for cattle and horses. The maximum number of days grazing would be allowed during those periods would be 60. A rest-rotation grazing system would be used.

Sheep and goats could be utilized to manage vegetation within utility corridors (gas, powerline, etc.), road rights-of-way, and to extend the effectiveness of fuel reduction treatments. Sheep and goats are herd animals controlled with either temporary fences or the use of herding animals.

There is approximately 10 1/2 miles of existing fence within the project area not being maintained, all in poor to critical condition. The exception is along the private land boundary where some landowners are maintaining the existing fence or have replaced it with their own fence.

Most of the pasture is in good or moderate forage condition, especially portions that have recently been treated to manage fuels along the urban interface. The treated areas have generally increased forage availability by stimulating plant growth through reduction of competition and nutrient release. In other areas, forage species, such as Idaho fescue, have not been utilized for the past ten years, resulting in reduced plant vigor and changes in structure.

Trees occupy the over story. Monitoring indicates that vegetation, in areas other then fire or management, has been stable in shrub cover and an increase in grass cover. Where a tree canopy is present it has generally increased in size and cover.

VEGETATION

Grazing has likely had an effect on fire frequency and rate of spread in the South Bend Area since at least the 1930s. According to an article published in "Conservation Biology, Volume 11, No. 2, April 1997" a "large number of authors have suggested that fire began to decline in frequency and forests began to increase in density soon after livestock were first introduced into the Interior West.

Annual utilization, current and trend study plots, and 3-way study enclosures are used to monitor annual and long term vegetation conditions. Vegetation has been recorded since the 1950's for the Bessie Allotment. Study enclosures, established in the 1950s and 1960s, on the east side of the Bend /Fort Rock Ranger District have been monitored to examine the effect of livestock and deer exclusion on tree density. The enclosures were to track range condition as affected by livestock or livestock/deer exclusion. Shrubs inside the enclosures generally exhibit a slightly taller growth form but often have large percentages of decadent material in their crowns. It appears that the shrubs provide greater forage area inside the enclosure than in either the livestock or control areas. The number of trees appears similar in most enclosures with a slight increase in trees in some of the livestock/deer enclosures. Tree density seems more to be a factor of past stand management activities and/or specific micro site differences as opposed to livestock grazing.

A review of historic data from current trend study plots indicate a trend for shrubs to increase on these sites. Grasses have tended to be stable or increased in conjunction with the changes in the shrub component. In forested areas the tree canopy has increased, often in both percent cover and in the number of stems per acre. In shrublands, a few sites have been invaded by pine or juniper. Soil conditions have remained fairly stable with some increase in bare soil as plant communities mature on some sites.

Some of the CT study plots are located in areas of past forest management. Two transects have had recent mechanical shrub treatment (mowing). Shrub recovery in activity areas and wildfire sites is taking in excess of eight years on the Cinder Cone Allotment. Miller (2001) estimated that shrub recover was likely to occur 20 years or longer after a wildfire in mountain big sagebrush communities. Recovery is variable depending on the micro site and the climate over the recovery period. Grasses and forbs respond well to these disturbances increasing their production initially and sustaining their achieved level of success well into mature vegetation conditions in shrubland areas.

Due primarily to its abundance and palatability to cattle, Idaho fescue is the primary grass species available for foraging. Idaho fescue is a perennial bunch grass that begins new growth early in the spring, produces seed in mid July, and goes dormant in the fall. Idaho fescue is the key indicator species used for pasture management.

Livestock grazing, if it would occur, would be allowed to remove up to 50% of the annual growth of Idaho Fescue. The annual removal of vegetation combined with the mixing and incorporation of organic materials into the soil, provides for hazardous fuels reduction.

Cheatgrass exists throughout most of the project area but is primarily confined to small isolated locations of historic disturbance. Fire may have contributed to the transition of these sites to cheatgrass. The warm climate and low precipitation probably makes these sites more vulnerable to cheatgrass (Miller 2004). Small areas, primarily watersets and water troughs that have been heavily used by livestock over a long period of time, are compacted and have plant communities that contain cheatgrass and fewer species of plants than adjacent areas. One area has been used for a waterset, comprising approximately 2 acres. The number of these areas is minimized through management to control impacts.

FIRE AND FUELS

Livestock grazing can cause changes in the condition of vegetation annually and over the long term that benefit the fire management program. In 1996 the Skeleton fire (outside the project area) started from a lighting strike on private land near the Forest Boundary. The fire traveled onto the historic Coyote Allotment (vacant since 1991) and progressed eastward to pasture two on the Cinder Hill Allotment. Pasture two had been grazed that season and the cows had been moved off to another pasture prior to the fire event. The fire was able to travel through the pasture under extreme fire conditions with one exception. There was a range treatment unit implemented in the fall of 1986 that had been grazed prior to the fire that did not burn; the Skeleton fire simply went around it. The range treatment occurred with the objective of removing the large decadent shrub component and improving forage conditions. This unit, after annual grazing use served as an effective fuel break, some ten years after treatment. Attempts were made to backfire the unit as the fire approached but it would not burn despite the extreme fire behavior being exhibited by both the Skeleton Fire and the Evans West Fire (burning concurrently in pasture one of the Cinder Hill Allotment).

DESIRED CONDITION

Where forage occurs as a result of site disturbance and/or timber canopy removal on a continuing basis (LRMP, M8-14, page 4-118).

Through the general forest management allocation where timber stands are managed on a continuing basis the desired condition for forage production would be one where transitory range is maximized by maximizing tree spacing, minimizing the shrub component, minimizing reforestation needs, providing appropriate range improvements to properly distribute livestock utilization, and provide for range improvements that effectively manage livestock to reduce conflicts with other resources such as recreation, the Newberry National Volcanic Monument allocation, and special uses.

ENVIRONMENTAL CONSEQUENCES

Alternative 1 (No Action)

Direct and Indirect Effects: This alternative would allow vegetation conditions to continue to change in a direction that would not be beneficial to livestock forage production. Without management activities or wildfire to reduce vegetative competition, canopy closure would increase and forage species such as Idaho Fescue and Bitterbrush would decline. The expected result would be decreased availability of forbs, grasses and shrubs.

The exception would be areas where grazing would be implemented. In these areas vegetation conditions would improve for short periods of time depending on the grazing system applied and the duration of the grazing activities.

Alternative 2 (Proposed Action)

Direct and Indirect Effects: Reduction in bitterbrush through fuels treatment can provide greater amounts of available livestock forage over the long-term. Short-term, decreasing available bitterbrush through fuels treatment could indirectly affect potential livestock stocking levels. Livestock utilize bitterbrush to some degree, depending on factors, including season of use, animal preference, and availability of preferred quality forage. Cattle prefer to graze open areas that have palatable grasses and forbs. Cattle tend to utilize treatment areas such as prescribed burn units, mow units, and thinning areas where grass species increase their production after treatment. This preferential grazing would offset some cattle utilization of the remaining bitterbrush.

The South Bend project would overlap portions of two Allotments. Cooperative efforts by permittees, range personnel and fire personnel can mitigate potential effects by properly managing the scale, timing and frequency of both grazing and fuel treatments.

Proposed actions would increase available and palatable forage. Reduction in bitterbrush production by fuels treatment generally benefits grazing as it provides greater amounts of available forage. Cattle prefer to graze open areas that have palatable grasses and forbs. Cattle would tend to utilize treatment areas such as prescribed burn units, mow units, and thinning areas where grass species would increase their production after treatment. This preferential grazing would to some degree offset cattle utilization of bitterbrush that remains.

Re-entry and treating additional vegetation in a unit that was previously treated would alter livestock grazing patterns as they respond to a new more open vegetative condition and use of the area would likely increase. Successive years or months of treatment and/or multiple types of treatment such as mow/burn would alter the response of vegetation to the treatments and could extend recovery time.

ECONOMIC ANALYSIS

Table 69: Table of Economic Analysis

Alternative	Alternative 1 (No Action)	Alternative 2 (Proposed Action)
Volume Hundred Cubic Feet (CCF)	0	6,525 CCF
Total Discounted Benefits [1]	0	$178,692
Costs		
Environmental Analysis	$60,000	$60,000
Sale Preparation		$4.00/ccf
Sale Administration		$2.45/ccf
Sale Area Projects		
Subsoiling		$1,500
Noxious Weed Monitoring		$2,500
Pre-commercial thinning		$54,600
Close Roads		$5,050
Remove Flagging		$500
Sale area Improvement Costs		$133,150
Natural Fuels Treatments		
Mechanical Shrub Treatment		$77,805
Ladder Fuel Reduction		$81,250
Hand piling		$69,000
Underburning		$410,200
Pile Burning		$25,165
Total Natural Fuels Costs		***$663,420***
Summary		
Benefit/Cost Ratio [1] without fuels treatments		0.74
Present Net Value [1] without fuels treatment	($60,000)	($62,442)
Jobs maintained or created [2]	0	33
Estimated Employee Income [3]	0	$1,049,763

[1] Assumes 4% discount rate.

[2] Calculated using figures for the Deschutes National Forest from Appendix B-5 of the FY 1997 Timber Sale Program Annual Report. Excluding firewood from the volume harvested on the Deschutes National Forest, an estimated 9.6 jobs per million board feet were maintained or created.

[3] Derived by multiplying (a) the number of jobs maintained or created by (b) $31,811, the average 1999 salary in Central Oregon for lumber and wood products jobs. Source of salary information: Oregon Covered Employment & Payrolls by County and Industry, Oregon Employment Department, and US Bureau of Labor Statistics.

Although the past decade has seen a substantial reduction in employment within the lumber and wood products industry, this industry is still an important contributor to local economies. In 1999 in Crook County 1,510 people were employed in the lumber and wood products industry and in Deschutes County 4,770 people[i].

Over the last 10 years, an annual average of approximately 68.2 MMBF of timber has been sold from the Deschutes National Forest. In the near future, the amount of timber offered for sale is expected to be near this annual average. The Deschutes National Forest is expected to continue offering timber for sale and is expected to continue making contributions to the local economy as a result of timber harvest activities. Timber proposed for harvest with Alternative 2 would be approximately 4.5 percent of the Forest's annual average timber sale program. This is expected to be sold in the course of more than one year.

The economic effects of the fuels treatments beyond the scope of the timber sold are dependent on the risk and probability of wildfire. There would be continued recreational use of the area. If a wildfire starts in the area or approaches the area from outside the Wildland Interface boundary, there is a low risk of loss of recreation activity because of people's sense of place. Wildfire has occurred in other areas where control has occurred with little change of recreation use of the area, except for the period during recovery immediately following wildfire. This value of avoidance is difficult to valuate with probabilities of extensive wildfire risk.

ENVIRONMENTAL JUSTICE

Civil Rights legislation and Executive Order 12898 (Environmental Justice) direct an analysis of the proposed alternatives as they relate to specific subsets of the American population. The subsets of the general population include ethnic minorities, people with disabilities, the elderly, and low-income groups.

Environmental Justice is defined as the pursuit of equal justice and protection under the law for all environmental statutes and regulations, without discrimination based on race, ethnicity, or socioeconomic status. The minority and low-income population and groups, living in counties that surround the project area, work in diverse occupations. Some minorities, low-income residents, and Native Americans may rely on forest products or related forest activities for their livelihood. This is especially true for those individuals that most likely reside in the rural communities adjacent to National Forest Lands.

Alternative 1 (No Action)

Direct and Indirect Effects: This alternative would continue the local economic situation as described under the heading "Economic and Social." This alternative would continue the local economic situation as described in the section titled "Economic and Social Analysis" in Chapter 3 of this EA. Opportunities for employment of minority and low income workers may arise through contract activities and other various associated forest work activities (such as annual thinning and various small business contracts) related to work outside the project area. There are no known disproportionately high effects to any ethnic minorities, people with disabilities, and low-income groups.

Alternative 2 (Proposed Action)

Direct and Indirect Effects: There would be no change in access and no known adverse effects that would be disproportionately high to any ethnic minorities, people with disabilities, and low-income groups as a result of implementation of the action alternative in the South Bend HFRA project. Within the social context presented, the action alternative developed for this project has the potential to bring in workers from the outside to perform logging and post harvest activities such as small tree thinning and handpiling.

Opportunities for employment of minority and low-income workers may occur through the various activities, such as thinning and hand piling of small diameter material. The action alternatives developed for this project have the potential to bring in workers from the outside to perform thinning and related activities.

The primary services needed by the workers would be food and shelter. Local businesses that can supply food (grocery stores and restaurants) and other services would capture most of the money being spent by the workers in the area. Since these businesses have supported similar workforces in the past, capitol expansion would probably not be required. It is not likely that businesses would need to increase their employment.

OTHER DISCLOSURES

Short-Term Uses and Long-Term Productivity

NEPA requires consideration of the relationship between short-term uses of man's environment and the maintenance and enhancement of long-term productivity (40 CFR 1502.16). As declared by Congress, this includes using all practicable means and measures to foster and promote the general welfare, to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generations of Americans (NEPA Section 101).

Maintaining the productivity of the land is a complex, long-term objective. The action alternatives meet the purpose and need to protect the long-term objective of the project area through the use of specific Forest plan Standards and Guidelines, mitigation measures, and BMPs. Long-term productivity could change as a result of the various management activities proposed in the alternatives. Timber management activities would have a direct, indirect, and cumulative effect on the economic, social, and biological environment. Those effects are disclosed in Chapter 3 of this analysis.

Soil is a key factor in ecosystem productivity, and this resource would be protected in all alternatives to avoid damage that could take many decades to rectify. Sustained growth of trees, wildlife habitat, and other renewable resources all rely on maintaining long-term soil productivity.

Each alternative would provide wildlife habitat that is necessary to contribute to the maintenance of viable, well-distributed populations of existing native and non-native vertebrate species. The abundance and diversity of wildlife species depends on the quality, quantity, and distribution of habitat, whether for breeding, feeding, or resting. Management Indicator Species are used to represent the habitat requirements of all wildlife species found within the project area. By managing habitat of indicator species, the other species associated with the same habitat would also benefit. The alternatives vary in risk presented in both fish and wildlife habitat capability.

The no action alternative would likely continue to provide slower tree growth rates, affecting the long-term productivity, for both resources, such as wildlife, and economics, of timber resources. The action alternatives would likely provide an environment that would protect trees and enhance associated growth rates, attaining late and old structure more quickly and providing structural diversity for wildlife.

Unavoidable Adverse Effects

Several expected adverse effects, including some that are minimal and/or short term, were identified during the analysis. Resource protection measures or mitigations were identified and considered for each of these as a means to lessen or eliminate such effects on specific resources. See mitigation measures in Chapter 2 and Appendix A, Implementation Guidelines. Resources that have been determined to have potential adverse effects (resulting from any of the alternatives) are documented within the appropriate Environmental Consequences sections of each resource in Chapter 3.

Irreversible And Irretrievable Commitment Of Resources

NEPA requires that environmental analysis include identification of ". . . any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented." Irreversible and irretrievable resource commitments are related to the use of nonrenewable resources and the effects that the use of these resources have on future generations. No significant irreversible or irretrievable commitment of resources would occur under Alternative 2 (Proposed Action) or Alternative 3.

Irreversible: Those resources that have been lost forever, such as the extinction of a species or the removal of mined ore. The proposed activities would result in a commitment of rock for road reconstruction.
Irretrievable: Those resources lost for a period of time, such as the temporary loss of timber productivity in forested areas that are kept clear for use as a power line rights-of-way or road.

The proposed activities would result in few direct and indirect commitments of resources; these would be related primarily to thinning operations. A temporary, short-term loss of the shrub component would also be lost

There would be an irretrievable loss of firm wood fiber over the long-term under Alternative 2 (Proposed Action), with the removal of commercial size ponderosa pine firm wood fiber.

The action alternatives are not expected to create impacts that would cause irreversible damage to soil productivity. There is low risk for mechanical disturbances to cause soil mass failures (landslides) due to the inherent stability of dominant landtypes and the lack of seasonally wet soils on steep slopes. Careful planning and the project design elements would be used to prevent irreversible losses of the soil resource.

The development and use of temporary roads and logging facilities is considered an irretrievable loss of soil productivity until their functions have been served and disturbed sites are returned back to a productive capacity. The action alternative includes soil restoration activities (subsoiling) that would improve the hydrologic function and productivity on detrimentally disturbed soils. There would be no irretrievable losses of soil productivity associated with reclamation treatments that reduce the amount of detrimentally compacted soil committed to temporary roads, log landings, and primary skid trails.

Prime Lands

The Secretary of Agriculture issued memorandum 1827 which is intended to protect prime farm lands and rangelands. The project area does not contain any prime farmlands or rangelands. Prime forestland is not applicable to lands within the National Forest System. National Forest System lands would be managed with consideration of the impacts on adjacent private lands. Prime forestlands on adjacent private lands would benefit indirectly from a decreased risk of impacts from wildfire. There would be no direct, indirect, or cumulative adverse effects to these resources and thus are in compliance with the Farmland Protection Act and Departmental Regulation 9500-3, "Land Use Policy".

Human Health And Safety

No significant adverse effects to public health or safety have been identified. The effects of implementation of the action alternative are well known, not highly controversial, and do not involve any unique or unknown risks. Effects meet or exceed state water and air quality standards.

Thinning And Burning

An elevated wildfire risk would remain a concern along public escape routes. Fine airborne particulate matter could increase the incidence of respiratory problems during wildfires. Proposed activities would improve public health and safety by: 1) the reduction of the risk of wildfire moving from public to private lands; 2) the reduction of the risk of entrapment from wildfire; and 3) the reduction of the risk of increased airborne particulates from wildfire. Refer to discussion on Air Quality beginning on EA page 75.

CHAPTER 4

COORDINATION AND CONSULTATION

CHAPTER 4 – COORDINATION, CONSULTATION, and LITERATURE CITED

COORDINATION

Forest Service Interdisciplinary Team participating in the analysis and the preparation of the EA.

Maurice Evans	Fire/Fuels Specialist
Barbara Schroeder	Silviculturist
Barbara Webb	Wildlife Biologist
Peter Sussman	Soil Scientist
Charmane Powers	Botanist
Marv Lang	Recreational Planner
Robin Gyorgyfalvy	Landscape Architect
Lucy Hamilton	Archaeologist
Steve Bigby	District Road Manager
Tom Walker	Hydrology
Kelly Bahr	Geographical Information Systems
David Frantz	Co-Team Leader and Writer/Editor
Gery Ferguson	Co-Team Leader and Writer/Editor
Beth Peer	NEPA Advisor

CONSULTATION

The Confederated Tribes of Warm Springs, Burns Paiute Tribe, and the Klamath Tribe received notification of this project through the scoping process. This included telephone calls and the scoping letter.

The Oregon Department of Fish and Wildlife Service (ODFW) has been involved in Informal discussions at various times throughout the analysis process.

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APPENDIX A

SILVICULTURE

- **Proposed Treatments, Prior Treatments, Plant Association, And Existing Condition Group**

APPENDIX A

Thinning Prescription:
Generally thin from below, varying spacing to ensure the best, most dominant trees with the least amount of dwarf mistletoe are retained. The smallest diameter trees in the stand and/or the shortest trees are generally priority for removal. Exceptions would be where trees with the least amount of dwarf mistletoe have smaller diameters or are lower in the canopy than more heavily infected trees. In these cases acceptable to retain the smaller diameter and/or shorter trees in the stand. Limit removal of trees to those less than 21 inches dbh.

Thin from below to 50 to 70 square feet of basal area per acre, generally retaining no fewer than 40 to 55 trees per acre. Generally retain no more than 80 to 100 trees per acre where diameter of leave trees is less than 10 inches dbh. Where removal of trees from the lower crown class will not reduce stocking to desired levels, remove trees from the dominant and codominant crown classes, retaining the best trees of those same crown classes. Basal areas of up to 80 square feet of basal area per acre can be retained where desirable leave trees are greater than 16 inches dbh, especially where these trees are starting to exhibit orange bark or other "old-growth" characteristics. Basal area as low as 20 square feet can be retained to remove trees with Hawksworth dwarf mistletoe rating of 5 or 6 (Hawksworth and Wiens 1996).

Pruning Prescription:
Trees that are a priority for pruning include those whose crowns are low and close to surface fuels. Pruning to include the removal of live and dead branches, retaining no less than 50 percent live crown ratio.

PROPOSED TREATMENTS, PRIOR TREATMENTS, PLANT ASSOCIATION, AND EXISTING CONDITION GROUP.

Unit	Proposed Treatments	Prior Treatments[1]	Plant Association[2]	Existing Condition Group[3]
107	Thin/Hand pile/Mow	Small portions of unit planted (1966)	CPS2-13	1
110	Thin/Prune/Hand pile/Mow	Much of unit planted (1966)	CPS2-13	2
113	Thin/Machine pile/Mow	**Central portion:** Planted (1966)	CPS2-13	2
114	Thin/Hand pile/Mow	**Eastern 1/3:** Clearcut (1969) reforestation completed (1973) **Western 2/3**: None recorded.	CPS2-13	2
115	Thin/Hand pile/Mow	**Eastern 1/3:** Clearcut (1969), Reforestation completed (1971). **Western 2/3:** None recorded.	CPS2-13	2
116	Mow	None	CPS2-12 CPS2-13	2
119	Thin	Precommercial thin (1972)	CPS2-13	1
120	Thin	Precommercial thin (1971)	CPS2-13	1
131	Thin/Prune/Hand pile/Mow	Clearcut (1969), Reforestation completed (1971)	CPS2-13	2
132	Thin/Hand pile/Mow/Underburn	**East central:** Clearcut (1968), Reforestation completed (1983) **Southern 1/4:** Reforestation completed (1977) **Remainder of unit:** None recorded	CPS2-17	3
133	Mow/Underburn	**Portions of eastern 3/4:** Clearcut (1968), Reforestation completed (1987) **Western 1/4:** None recorded	CPS2-11	3
134	Mow/Underburn	**Portions of western 3/4:** Clearcut (1968), Reforestation completed (1987). **Eastern 1/4:** None recorded	CPS2-11 CPS2-17	3
135	Mow/Underburn	None recorded	CPS2-11	3
136	Mow/Underburn	None recorded	CPS2-11	3
137	Mow/Underburn	**Central portion of unit:** No treatments recorded. **Portions of the remainder:** Clearcut (1968). Reforestation completed (1987)	CPS2-11	3
138	Mow/Underburn	None recorded	CPS2-11 CPS2-17	3
139	Mow/Underburn	**Much of unit:** Clearcut (1968). Reforestation completed (1987) **Some areas of unit:** No treatments recorded.	CPS2-11 CPS2-17	3
141	Mow/Underburn	**Portions of unit:** Clearcut (1968). Reforestation completed (1987) **Remainder of unit:** No treatments recorded.	CPS2-11 CPS2-17	3
153	Underburn	**Northwestern 1/4:** Planted (1977) **Southern 1/3:** Precommercial thin (1978)	CPS2-17	3
221	Thin/Prune/Hand pile/Mow	None recorded	CPS2-13	3
222	Prune/Mow	None recorded	CPS2-13	3
251	Mow/Underburn	Precommercial thinned for dwarf mistletoe and pruned (1960)	CPS2-11	1
252	Underburn	Precommercial thinned and pruned for	CPS2-12	1

Unit	Proposed Treatments	Prior Treatments[1]	Plant Association[2]	Existing Condition Group[3]
		dwarf mistletoe (1960)	CPS2-17	
254	Thin/Prune/Hand pile/Mow/Underburn	Planted (1977)	CPS2-13	2
255	Underburn	Precommercial thinned (1966)	CPS2-13	1
411	Mow/Underburn	None recorded	CPS2-13	1
412	Thin/Hand pile/Mow	None recorded	CPS2-13	1
430	Thin/Hand pile/Mow	Precommercial thinned and pruned for dwarf mistletoe (1960)	CPS2-12	1
446	Thin/Mow/Underburn	**Western 1/2:** Precommercial thin (1978) **Eastern 1/3:** Portions clearcut (1968). Reforestation completed (1987). **Remainder of unit:** No treatments recorded.	CPS2-17	1
447	Thin/Mow	**Central 3/4 of unit:** precommercial thin (1990) **Remainder of unit**: None recorded.	CPS2-12 CPS2-13	1
452	Mow	None recorded	CPS2-13	2
453	Mow	**Much of unit:** Precommercial thin (1960) **Southern 1/4 of unit:** One portion clearcut (1969) with reforestation completed by 1971. Another portion precommercial thin (1986). **Northwestern 1/4:** Clearcut (1969) with reforestation completed by 1971.	CPS2-13	1
454	Thin/Hand pile/Mow	Small area precommercially thinned (1960). Small area planted (1966)	CPS2-13	2
455	Thin/Hand pile/Mow	**Western 1/2:** Planted (1966)	CPS2-13	2
456	Mow/Underburn	None recorded	CPS2-11	3

[1] Activities recorded in the GIS activity data base and historic atlases for Bend and Fort Rock Ranger Districts.

[2] Plant associations from Volland (1985).
CPS2-11: Ponderosa pine/bitterbrush/fescue
CPS2-12: Ponderosa pine/bitterbrush/needlegrass
CPS2-13: Ponderosa pine/bitterbrush-manzanita/needlegrass
CPS2-17: Ponderosa pine/bitterbrush-manzanita/fescue

[3] Existing condition group. Based on size/structure values classified from remotely sensed satellite imagery data (2004) and prior treatments.

Group 1: Stands classified as forested and having either: a) greater than 50 percent in single-story structure or b) a history of prior thinning treatments.

Group 2: Stands classified as predominantly forested and generally having less than 50 percent in single-story structure. Stands are a mosaic of single and multi-story structure with a relatively small proportion of each stand classified as shrub (20 percent or less).

Group 3: Stands with greater than 20 percent of the area classified as shrub, rock or sparse vegetation and remainder classified as forested with a mixture of single or multi-story structure.