Watershed Analysis

Elk Creek/Umpqua River Watershed Analysis

Fifth Field Watershed
HUC #1710030

Version 3.0

March 2004

Roseburg District

BLM

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Elk Creek/Umpqua River Watershed Analysis
(Upstream of Elkton, OR)

Fifth Field Watershed
HUC #17100303

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<u>Core Team Members</u>

AC Clough	Fisheries Biologist
Dan Couch	Team Lead
Dan Cressy	Soil Scientist
Dan Dammann	Hydrologist
Craig Ericson	GIS, ARC-INFO Specialist
Elizabeth Gayner	Wildlife Biologist
Pete Howe	Engineer
Julie Knurowski	Botanist
Al James	Silviculturist
Randy Lopez	Engineer
Gary Passow	GIS, ARC-INFO Specialist

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1. Overview of Elk Creek Watershed

A. Previous Assessments and General Description

This iteration of watershed assessment covers the entire fifth-field Elk Creek watershed and replaces all the previous assessments. Elk Creek drains from its headwaters in the lower Cascades east of the Interstate-5 highway to its confluence with the Umpqua River near the city of Elkton. This assessment is meant to bring all the previous separate assessments together into one document. Other assessments that cover portions of the Elk Creek are listed in the Previous Watershed Assessments Appendix. The South Coast – Northern Klamath Late-Successional Reserve Assessment (LSRA), completed in May of 1998, will be the LSRA to guide management activities for the Late-Successional and Riparian Reserves within Elk Creek.

Size and Location: The Umpqua River system includes the North, South, and lower Umpqua River, which encompasses approximately 4,680 square miles and flows 200 miles from the Cascade crest through the Oregon Coast Range to the Pacific Ocean. The Elk Creek fifth-field watershed drains an area of approximately 187,000 acres (290 square miles) and stretches approximately 22 miles in the direction of flow from east to west (Figure 1-1 and Figure 1-2). The watershed stream system mostly consists of sixth order and smaller streams that flow into Elk Creek.

Specific Description: Elk Creek consists of ten sixth-field subwatersheds, including (from east to west): Headwaters Elk Creek, Upper Elk Creek, Upper Pass Creek, Lower Pass Creek, Yoncalla Creek, Billy Creek, Brush Creek, Middle Elk Creek, Big Tom Folley Creek, and Lower Elk Creek (Figure 1-2). Elevations range from about 100 feet at the confluence of Elk Creek and the Umpqua River near Elkton in the west portion of the watershed, to 2,670 feet at the eastern portion at Ben Moore Mountain. The mountains average approximately 2,000 feet. The major rural towns within this watershed include Elkton, Rice Hill, Yoncalla, Drain, and Curtin. The major highways through the watershed include Interstate-5 and state highway 38.

Climate and Vegetation: Average annual rainfall ranges from 50 to 60 inches depending on the elevation. Precipitation predominantly occurs in the form of rain for elevations below 2,000 feet and rain/snow mix for elevations above 2,000 feet. Early and mid-seral forests dominate the majority of the watershed (Figure 2-1).

B. Ownership and Federal Land Use Allocations

Roseburg BLM District manages approximately 45,000 acres (24 percent) of the Elk Creek watershed. The major private landowners are shown in Table 1-1. Figure 1-3, Table 1-2 and Table 1-3, and Chart 1-1 and Chart 1-2 show the breakdown of federally-administered and private land. For the federally-administered lands the following is a description of the relevant resource management plan (RMP) land use allocations.

1. Late-Successional Reserve

The management objectives for Late-Successional Reserve (LSR) are intended to benefit a diversity of old-growth associated species. Portions of LSRs #264, #266, and #267 occur in this watershed. Figure 1-3 and Table 1-3 show where and to what extent this land use allocation occurs within Elk Creek. Figure 2-2 and Table 2-4 show all BLM reserves, including the above Late-Successional Reserves, by forest seral age classes. The South Coast-Northern Klamath Late-Successional Reserve Assessment (LSRA) will

Table 1-1 Elk Creek Key Private Landowners (Landowners, Greater Than 2,000 acres)

Prominent Private Landowners	Acres	Ownership of Watershed (%)
Lone Rock/Juniper Properties	19,125	10
Seneca Jones Timber Co.	17,912	9
Whipple/Bear Creek Timber Co./Rocking C Ranch LLC, et.al.	9,010	5
Sunkist (Fruit Growers Supply Co.)	5,541	3
Roseburg Resources Co. et. al.	5,402	3
Giustina	5,106	3
Woolley et. al.	3,810	2
Weyerhaeuser Co	3,296	2
Sunnydale Land Co.	2,220	1
Louise G. Brunswick Trust	2,187	1
TOTAL	**73,609**	**39%**

be used as the guidance for activities in all Late-Successional and Riparian Reserves in this assessment. Elk Creek contains approximately 18,700 acres of Late-Successional Reserves.

2. Riparian Reserves and Other Administratively Withdrawn Areas (BLM)

The areas shown on Figure 1-3 and Table 1-3 include Riparian Reserves, pre-1994 Northern spotted owl Residual Habitat Areas, an unmapped marbled murrelet reserve, and areas withdrawn because they are considered “not suitable” as defined by the Timber Production Capability Classification (TPCC).

The Riparian Reserves were established on federal lands as one component of the Aquatic Conservation Strategy to protect the health of the aquatic system and its dependent species and provide incidental benefits to upland species. The reserves were designated to help maintain and restore riparian structures and functions, benefit fish, riparian-dependent wildlife and botanical species, enhance habitat conservation for organisms dependent on the transition zone between uplands and riparian areas, improve travel and dispersal corridors for terrestrial animals and plants, and provide for greater connectivity of late-successional forest habitat (ROD, B-13). The site-potential tree height of 200 feet was determined from 24 district inventory plots within the Elk Creek watershed.

The following Riparian Reserve widths were used for estimating the total amount of Riparian Reserves: 200 feet for non-fish bearing streams and 400 feet for fish bearing streams. Streams were classified as fish bearing based on fish presence/absence inventories and undocumented professional observations. Actual projects would use on-the-ground stream information to establish Riparian Reserves.

There are 96 known northern spotted owl activity centers within Elk Creek. Many of these sites are scattered throughout Late-Successional Reserves on BLM. Twelve Residual Habitat Areas were established in this watershed under the Northwest Forest Plan (NFP). These areas are reserves protecting approximately 100 acres of the best spotted owl suitable habitat identified as close to the nest site or activity center for all known (as of January 1, 1994) spotted owl activity centers on BLM Matrix lands, and are expected to provide some protection for suitable owl nesting groves.

Areas designated as "not suitable" for timber production (TPCC withdrawn) are much smaller and scattered. Elk Creek contains approximately 12,500 acres of Riparian Reserves and other administratively withdrawn areas. Within all of the reserves (Late-Successional, Riparian, and other administratively withdrawn areas) there are approximately 4,900 acres of old growth (greater than 200 years) and approximately 8,100 acres of late-mature seral (81-200 years) forest age class (Table 2-3).

3. Connectivity/Diversity Block (BLM)

The objective of the Connectivity/Diversity Block land use allocation is commercial harvest on a 150-year cycle while providing a bridge between larger blocks of old-growth stands and Riparian Reserves. This provides habitat for breeding, feeding, dispersal, and movement of old growth-associated wildlife. Elk Creek contains approximately 11,500 acres of Connectivity/Diversity Block lands which include associated Riparian Reserves. Figure 2-2 and Table 2-6 show the forest age classes within this land use allocation. Because of the north-south landscape connections, the interdisciplinary team grouped the Connectivity/Diversity Block lands into blocks east and west of the Interstate-5. These areas are expected to provide broad landscape habitat connections for Late-Successional Reserves north and south of this watershed in the Cascades to the east and in the Coast Range in the west. Approximately 7,170 acres are east of the Interstate-5 highway and the other 4,350 acres are scattered in the western portion of Elk Creek.

4. General Forest Management Area (GFMA) (BLM)

The objective of these lands is to manage on a regeneration harvest cycle of 60 to 110 years, leaving a biological legacy of six to eight trees per acre to assure forest health. Approximately 6,500 acres of GFMA occur in Elk Creek. Figure 2-2 and Table 2-5 show the forest age classes within this land use allocation.

C. Management Direction and Key Questions

1. Upcoming Decisions Expected In Elk Creek

Within the next ten years, it is likely that decisions will be needed regarding the following broad topics. These areas have been used to help guide the key questions, the information to answer those questions, and the resulting recommendations.

- Noxious weed control
- Commercial thinning in GFMA and Connectivity/Diversity Block lands
- Regeneration harvest in GFMA and Connectivity/Diversity Block lands
- Density management in Late-Successional and Riparian Reserves for fish & wildlife objectives
- Aquatic habitat enhancement
- Road rehabilitation/restoration (decommission or improvement candidates)
- Culvert replacement or removal (for fish passage or have high risk of failure)

A major assumption in the development of these topics is that the Roseburg District Resource Management Plan (RMP) has given some prescriptive measures through the land use allocations. Because the RMP sets standards and guidelines on each land use allocation and the kinds of activities that can occur in those land uses, this watershed analysis seeks to provide information to assist decision making within those overarching planning parameters.

2. Elk Creek Watershed Core Questions

Forest Vegetation
What is the current distribution of early, mid, late-mature, and old-growth forest seral stages (acres & percent)?

Special Status Plants Species and Noxious Weeds
1. What is the occurrence of federally-listed botanical species? What is the occurrence of bureau-sensitive (Survey and Manage, state listed) botanical species?
2. What are the relative abundance, distribution, and trends of non-native plants and noxious weeds?

Wildlife Habitat and Species
What is the occurrence of federally listed terrestrial species and their designated core areas under the RMP? What is the occurrence of Special Status Species (Bureau Sensitive, Survey and Manage, state listed) terrestrial species?

Geology and Soils Sedimentation Analysis
1. What erosion processes have been dominant in the watershed and where generally are the higher risk areas?
2. Where are BLM road erosion, drainage network, and stability problems most likely to impact aquatic resources?

Water Quality and Hydrology
What is the current list of 303(d) water quality limited streams? Where has monitoring taken place and what data is available?

Fish and Aquatic Habitat
1. What is the known current distribution of fish species within the watershed (e.g., map of fish distribution by species) including federally listed, candidate aquatic species, their critical habitat, and Essential Fish Habitat?

2. What are the known human-created barriers to fish migration and their locations within the watershed? What is the relative mileage of potential fish habitat above these barriers that is not currently accessible by anadromous fish?

3. What is the total estimated fish habitat for salmonids?

4. How are stream and riparian habitats distributed throughout the analysis area?

5. To what extent are the lower gradient stream reaches properly functioning or degraded, and how have instream and off-stream habitats and biological communities been affected by management activities using ODFW aquatic habitat inventory data as an indicator?

6. What monitoring data is available and what additional information is needed and why?

3. Elk Creek Watershed Key Questions

Forest Vegetation
Where are opportunities within the next 5-10 years for BLM commercial thinning and regeneration harvest activities in GFMA and Connectivity/Diversity Block lands?

Special Status Plants Species and Noxious Weeds
Where should noxious weed control be concentrated in Elk Creek watershed and why?

Wildlife Habitat and Species
Where can density management be used to help meet wildlife objectives in Late-Successional and Riparian Reserves?

Geology and Soils Sedimentation Analysis
Which BLM roads can be managed to reduce sedimentation effects to fish?

Water Quality and Hydrology
How are federal activities and plans affecting 303(d) listed streams?

Fish and Aquatic Habitat
Where have instream restoration activities taken place and how have they affected fish production? Where are riparian stand enhancements (silvicultural treatments) and instream restoration activities most likely to be most beneficial?

Figure 1-1 Elk Creek/Umpqua River Watershed Analysis, Vicinity Map

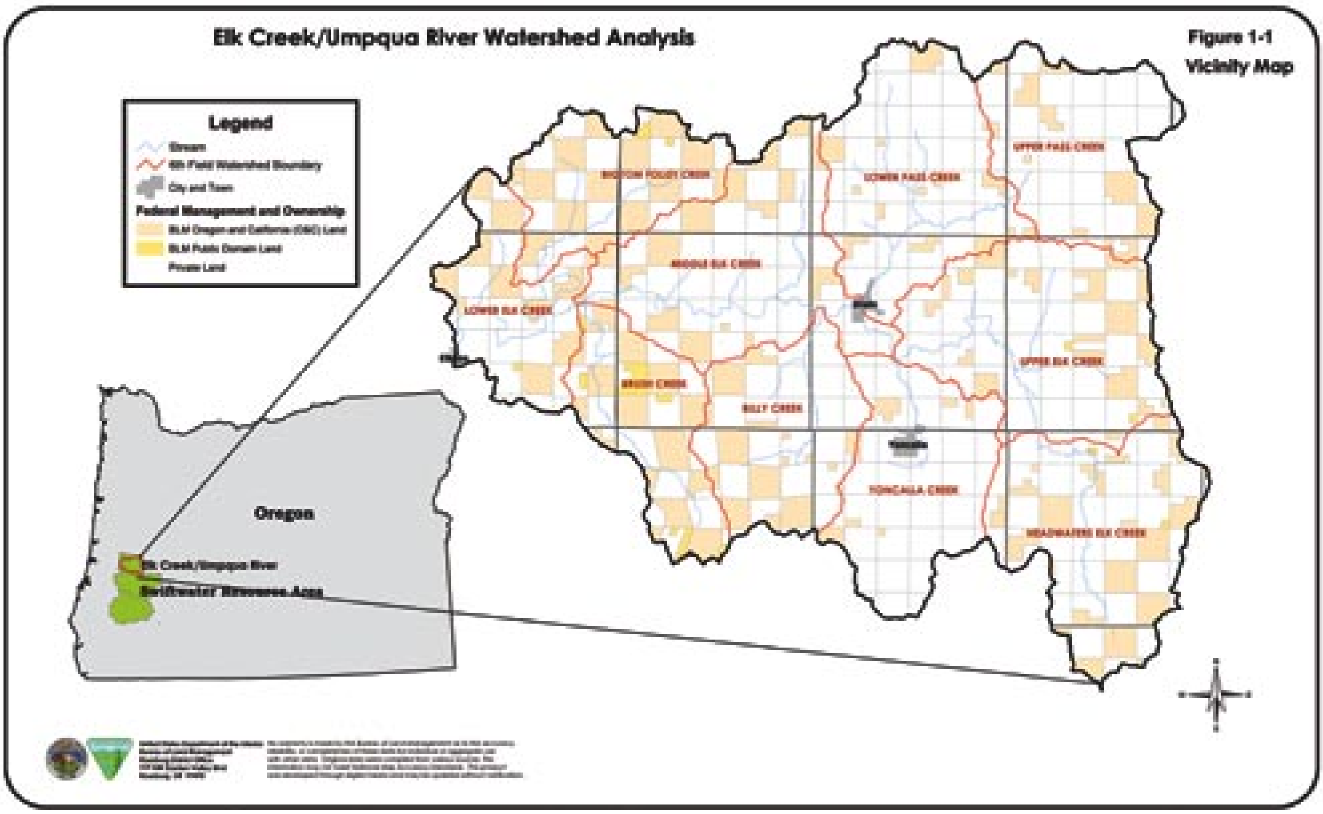


Figure 1-2 Elevation in Feet with Major Streams

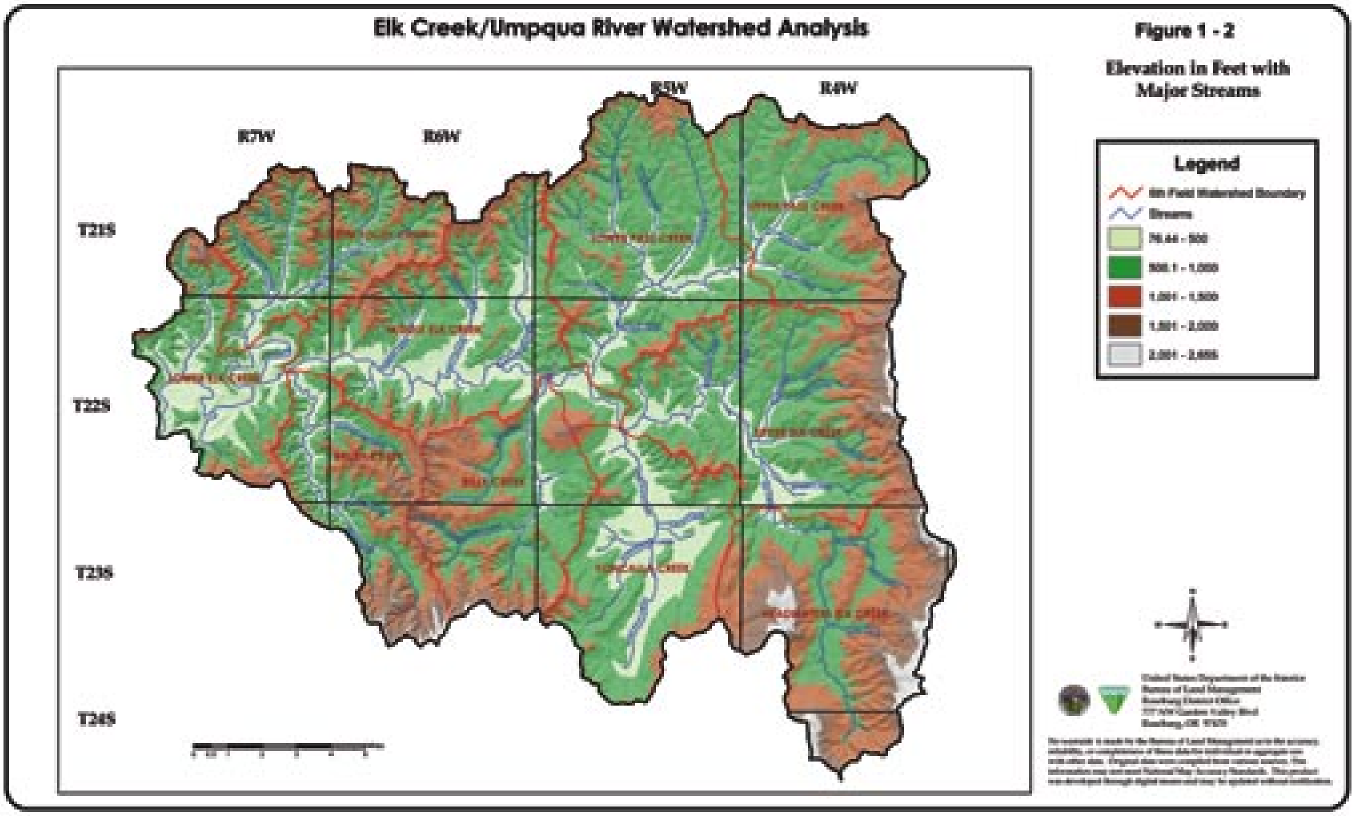


Figure 1-3 Elk Creek Watershed Federally Managed Lands and Ownership

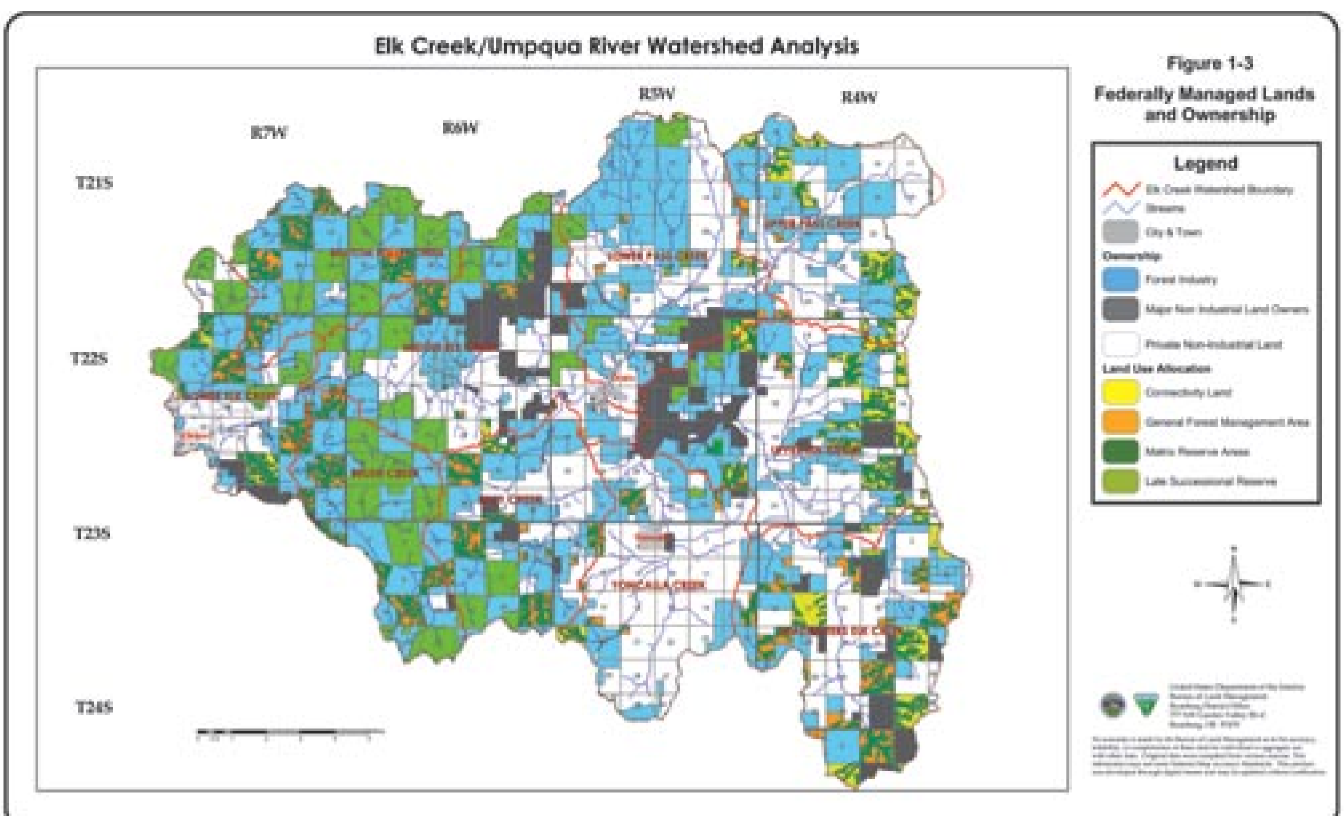


Table 1-2 Elk Creek, Public and Private Lands

	BLM		Industrial Private Lands		Private Lands		TOTAL
Subwatersheds	**acres**	%	**acres**	%	**acres**	%	**ACRES**
Big Tom Folley Creek	7,190	51%	6630	47%	370	3%	14,190
Billy Creek	4,260	26%	6890	42%	5,200	32%	16,350
Brush Creek	7,180	53%	5990	45%	287	2%	13,457
Headwaters Elk Creek	6,360	28%	5820	26%	10,437	46%	22,617
Lower Elk Creek	4,390	35%	3620	29%	4,580	36%	12,590
Lower Pass Creek	2,160	10%	10190	45%	10,178	45%	22,528
Middle Elk Creek	5,260	22%	7300	30%	11,610	48%	24,170
Upper Elk Creek	4,670	19%	6320	25%	13,987	56%	24,977
Upper Pass Creek	2,540	15%	6590	38%	8,245	47%	17,375
Yoncalla Creek	990	5%	3670	20%	13,706	75%	18,366
TOTAL	**45,000**	**24%**	**63020**	**34%**	**78,600**	**42%**	**186,620**

Chart 1-1 Elk Creek, Public and Private Lands

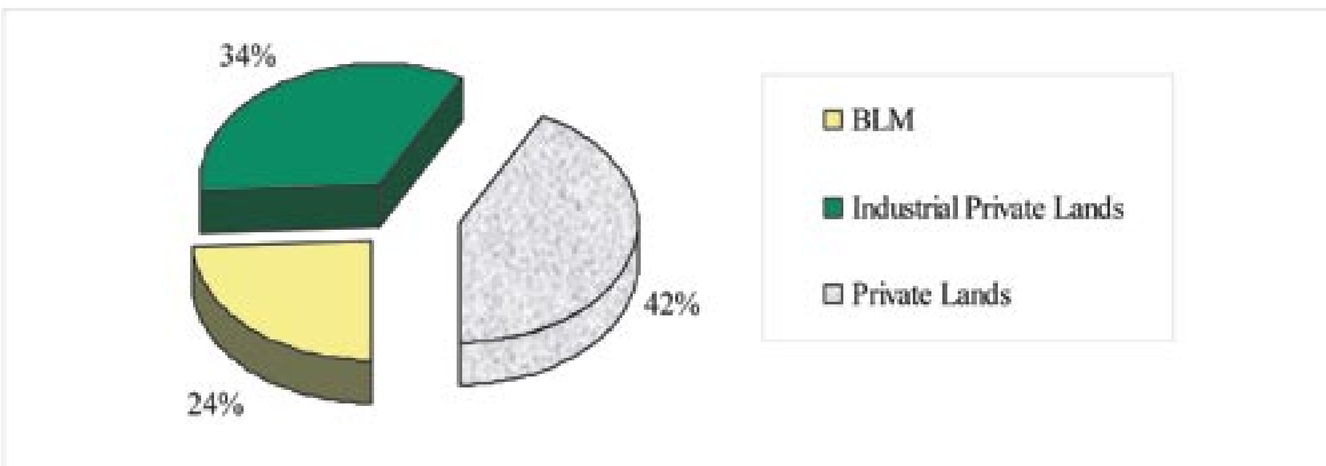
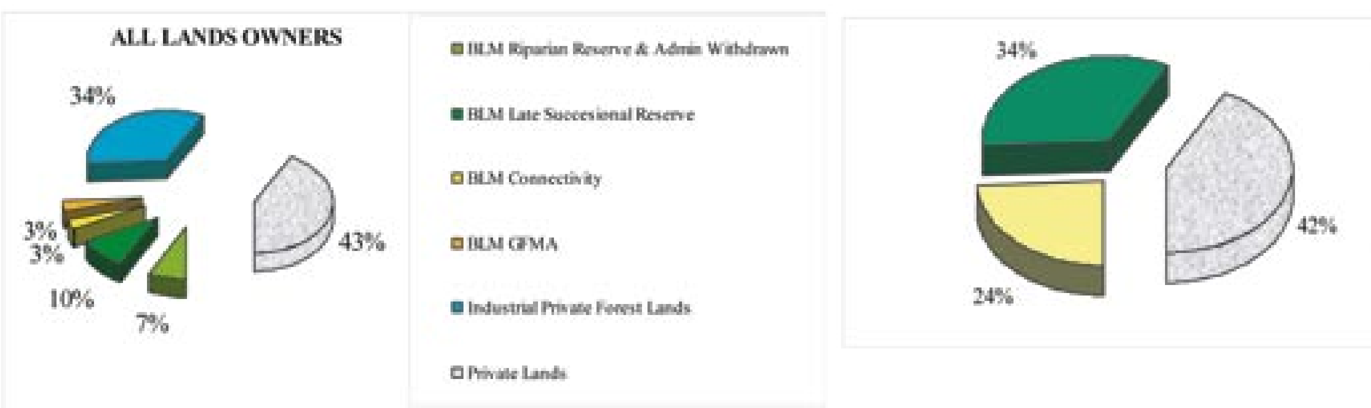


Table 1-3 Elk Creek BLM Land Use Allocations and Private Lands

	BLM Riparian & Other Reserves*		BLM Late Successional Reserve		BLM Connectivity		BLM GFMA		Industrial Private Forest Lands		Private Lands		TOTAL
Subwatersheds	acres	%	acres	%	acres	%	acres	%	acres	%	acres	%	**ACRES**
Big Tom Folley Creek	1,750	12%	4,460	31%	0	0%	980	7%	6630	47%	370	3%	14,190
Billy Creek	1,870	11%	1,410	9%	200	1%	780	5%	6890	42%	5,200	32%	16,350
Brush Creek	1,680	12%	4,690	35%	0	0%	810	6%	5990	45%	290	2%	13,460
Headwaters Elk Creek	2,740	12%	0	0%	1,700	8%	1,920	8%	5820	26%	10,440	46%	22,620
Lower Elk Creek	1,330	11%	2,240	18%	340	3%	480	4%	3620	29%	4,580	36%	12,590
Lower Pass Creek	320	1%	1,420	6%	210	1%	210	1%	10190	45%	10,180	45%	22,530
Middle Elk Creek	800	3%	3,860	16%	70	0%	530	2%	7300	30%	11,610	48%	24,170
Upper Elk Creek	2,070	8%	590	2%	1,900	8%	110	0%	6320	25%	13,990	56%	24,980
Upper Pass Creek	990	6%	0	0%	1,410	8%	140	1%	6590	38%	8,250	47%	17,380
Yoncalla Creek	430	2%	80	0%	220	1%	260	1%	3670	20%	13,710	75%	18,370
TOTAL	13,980	7%	18,750	10%	6,050	3%	6,220	3%	63,020	34%	78,620	42%	186,640

Chart 1-2 Elk Creek BLM Land Use Allocations and Private Lands



2. Major Forest Types

A. Fire History

1. Fire Regime and Occurrence

BLM lands account for twenty-four percent of the watershed and include portions of Late-Successional Reserves #264, #266, and #267 (Figure 1-3, Table 1-3, and Chart 1-1). Most of these areas were analyzed in the South Coast - North Klamath Late-Successional Reserve Assessment (LSRA). As part of this assessment, fire histories were investigated in the Tioga Creek LSR #261, which is located near the Elk Creek watershed and can be expected to have very similar fire frequencies. Average fire return intervals at the drainage scale were calculated between 50 and 75 years (prior to the advent of fire suppression). Perhaps more telling is the frequency of the more destructive stand-replacement fire events. In the Southwest Oregon assessment area, the time since the last major stand-replacement fires range from 31 years for the Oxbow Burn area to more than 439 years for one site in the South Tioga Creek headwaters. Based on a broad analysis of changes in forest age classes between 1850 and 1940 in the Oregon Coast Range, Teensma (1991) concluded that stand-replacing fires occurred irregularly, at intervals from 150 to 350 years. Teensma speculated that many of the fires were of human origin, both prior to and during European settlement.

Over the last 35-year period, lightning has been the predominant fire cause (60-70 percent), with logging and human causes responsible for the other fires. Lightning occurrence levels for the BLM lands are considered low, on average only one fire per year resulted from this ignition source. Because of rapid initial attack by the DFPA, the majority of all fires were confined to less than one acre in size.

2. Fire Risk

Wildfire presents the greatest risk of late-successional habitat loss. The LSRA reports there is presently a moderate-to-high fire hazard level in LSR #264. This is assumed to be similar throughout Elk Creek because of the similar vegetation types. The report goes on to say, "Fine fuel levels are the primary concern. Fires have been suppressed for much of this century. Stand density and associated live and dead fuels have accumulated to a point that they are often outside the range of 'historic' variability." With these fuel build-ups, stand replacement fires would occur on a more frequent basis than occurred historically with higher frequency, lower intensity fires.

Stands with the shortest fire return intervals (generally southerly aspects) are at greatest risk of loss. Because of the increased fuel loadings, characteristics of fires in these Late-Successional Reserves are changing. Before intensive fire suppression, fires tended to be of lower intensity and more frequent. Fire suppression as well as some management treatments has caused fuels to build up so fires now tend to be less frequent but burn at a higher intensity. High intensity fires are a greater risk for late-successional habitat loss. Because of the intermixed private-public lands within Elk Creek, BLM will continue to exercise a full suppression policy in fighting wildfires. Human caused fires and the build-up of untreated slash and debris are the biggest threat to the Late-Successional Reserves.

B. Current Forest Vegetation

1. Stand Structure Classification and Seral Stage

Figure 2-1and Figure 2-2 represent broad vegetative classifications. The following describes the classifications based on their common vegetative structural and compositional characteristics. For the purposes of this analysis, these classifications are slightly different than the definitions in the Roseburg District's RMP. See the VEGETATION APPENDIX for the expanded definitions.

Early seral: In general, stand age for early seral is considered to be less than 30 years, and the average diameter of trees is less than 10 inches.

Mid-seral: In general, mid-seral stands range in age from about 30 to 80 years, and average tree diameters range from about 10 to over 20 inches.

Late-mature seral: For the purposes of this analysis, 'late-mature seral' will refer to stands between 81 and 200 years of age and may contain *some* of the stand characteristics of old-growth forests.

Old Growth: For the purposes of this analysis, 'old growth' will refer to stands greater than 201 years of age and contain *most* of the following stand characteristics:

- Deep multiple canopy layers
- Diverse tree size, form and condition
- Canopy gaps and natural openings
- Large snags in various stages of decay
- Coarse woody debris
- Species diversity

2. Unmanaged Forest Stand Development

Fire and other disturbances lead to regeneration of Douglas-fir by removing the overstory shade and creating a bare mineral seedbed. If not for naturally occurring stand-replacing fires, the forest would consist predominantly of shade tolerant conifers. McArdle (1949) described Douglas-fir forests of the Pacific Northwest that originated following severe fires as uniform and even-aged, often unbroken over thousands of acres; others are small patches surrounded by timber of another age, or rarely are a composite of several age classes. More recent studies in coastal old-growth forests show a range of age that spans hundreds of years, with the growth rates of individual trees indicating stand densities of about 40 to 50 trees per acre (Tappeiner 1997). The term *even-aged* probably does not accurately define most natural stands. A better term may be *single cohort* and is defined as all the trees that have resulted after a single disturbance event (Oliver et al. 1990).

Within the last 200 years, fire has been an important disturbance factor for unmanaged forest stands in Elk Creek. Following a major fire event, the openings created are rapidly reestablished with the plants that existed prior to the disturbance. Within Elk Creek, the majority of forest stands that are greater than 60 years of age on BLM lands resulted from major fire events.

3. Managed Forest Stands

Management of forests has replaced fire as the dominant disturbance regime. Logging, road building and planting have converted much of the original forest into young Douglas-fir plantations. To some extent clear cutting and burning mimics a major disturbance event, but there are many differences. A network of logging roads is needed for logging, reforestation, and forest protection. Except in the cases where wood product market forces made it unprofitable to remove certain types of timber, prior to the Northwest Forest Plan most of the merchantable material was removed in the harvest operation. The limbs and tops of trees are often burned following harvest to create openings for planting seedlings and to reduce the fire hazard. This left very little coarse woody debris on the forest floor. Typically between 450 and 650 seedlings per acre are planted in order to grow 250 to 300 trees per acre at the first commercial entry. Pre-commercial thinning is often required about 15 years after planting. Past management plans were designed to produce stands that were uniform and even-aged. There are fewer dead and defective trees and less coarse woody debris in managed stands than what is normally found in unmanaged stands.

The majority of the early and mid-seral forest stands described above resulted from clear-cut harvesting prior to 1995. Across the entire watershed it is estimated that 114,000 acres (approximately 60 percent) are managed forest stands (Chart 2-3). It is estimated that approximately 20,000 acres of BLM lands within Elk Creek watershed were clear-cut harvested, the vast majority of these occurring between 1945 and 1995.

4. Current Conditions and Arrangement of Forest Stands

Within Elk Creek, private lands are interspersed with federal lands throughout the watershed. Most of the private lands are managed as tree farms to produce wood fiber on forest rotations of between 40 and 50 years. On BLM lands natural stands are interspersed with younger, managed plantations.

Figure 2-2 shows the BLM forest inventory in three broad age classes. Stands greater than 81 years of age can vary in structure and composition and function like old growth. The only management that has occurred in these stands is occasional roadside salvage and fire suppression. Within Elk Creek, approximately 11,100 acres of BLM lands are considered late-mature seral and approximately 6,100 acres are considered old growth (Figure 2-2, Table 2-2).

Forests on BLM lands that are less than 80 years of age are mostly managed stands. Mid-seral stands between the ages of 31 and 80 make up about 13,600 acres. Most of these stands were established following clear-cutting practices of the mid 1900s. Stands less than 30 years of age are considered early seral and amount to about 8,700 acres (Table 2-2).

There is an investment in managed stands that includes all or some of the following: reforestation and plantation maintenance, pre-commercial thinning, and fertilization and pruning. The majority of the managed stands are fairly uniform Douglas-fir plantations that were designed to support a commercial thinning.

On BLM lands within Elk Creek, about 13,000 acres have been pre-commercially thinned to an average of 210 crop trees per acre. These stands typically include additional trees including hardwoods that do not count as crop trees. About 4,800 acres have been fertilized and about 1,900 acres have been commercially thinned.

C. Vegetative Trends Based on Land Management Objectives

Based on forests between 31 and 80 years of age on BLM lands (Table 2-2), approximately 16,000 acres could potentially benefit from some sort of density management. Allowing these stands to self-thin will result in trees with small live crowns, weak stems, and poorly developed root systems. Tall skinny trees are susceptible to wind throw and more likely to break under snow loads. Trees that have developed over long periods of competitive stress are more likely to be killed by insects and disease (Waring 1985, Smith 1962). Stands left in this condition are slow to respond to improved growing conditions and never attain potential growth rates, (Oliver 1990, Smith 1962). When this process occurs in managed stands of Douglas-fir, down wood and snags are made up predominantly of the smaller trees. Accumulations of dead wood consisting of small trees increases fire intensity and rate of spread. The risk of stand damage from fire is increased (Waring 1985, Graham 1999).

Chart 2-1 shows a comparison in a Coastal Oregon Productivity Enhancement Program study area of live crowns in young managed stands eight years after different thinning treatments. The untreated stands show little understory diversity and very small crowns. Untreated stands are at a greater risk for damage from insects, fire and strong winds. It is likely that the plan objectives will not be met in the near term for untreated stands. The return on the investment to produce these stands at commercial thinning densities will also be lost.

Land use allocations under the NFP have a direct bearing on the type and timing of silvicultural treatments. Treatment priorities and prescriptions within the Late-Successional and Riparian Reserves are described in the South Coast - Northern Klamath Late-Successional Reserve Assessment (LSRA). Priority is given to stands that have been regenerated following past timber harvest. Density management (tree thinning) treatments in stands less than 90-years old to maintain or accelerate stand development toward achievement of late-seral characteristics are recommended. A standard prescription is outlined under Desired Conditions (LSRA, p. 82). A similar prescription is necessary in the Riparian Reserves.

The RMP ROD states that 25 to 30 percent of any particular Connectivity/Diversity Block is to be maintained in late-successional habitat. This watershed analysis has designated blocks to be east and west of Interstate-5. Within the Connectivity/Diversity Block and associated Riparian Reserves approximately 24 percent of forest stands east of Interstate-5, and approximately 42 percent of forest stands west of Interstate-5 are late-successional habitat (Chart 2-8). Approximately 750 acres of forest stands 80 years and older could be regeneration harvested in the 4,350 acre Connectivity/Diversity Block west of Interstate-5 and still maintain 25 percent late-successional habitat within the block. Harvesting this amount represents a little less than **two** percent of BLM lands in Elk Creek. For the Connectivity/Diversity Block east of Interstate-5, harvesting of late-successional habitat (forest stands greater than 80 years of age) would need to be deferred until enough mid seral stands have developed into late-successional habitat.

Chart 2-1 COPE Report Research, Mid Seral Forest Stand Response with Different Thinning Prescriptions

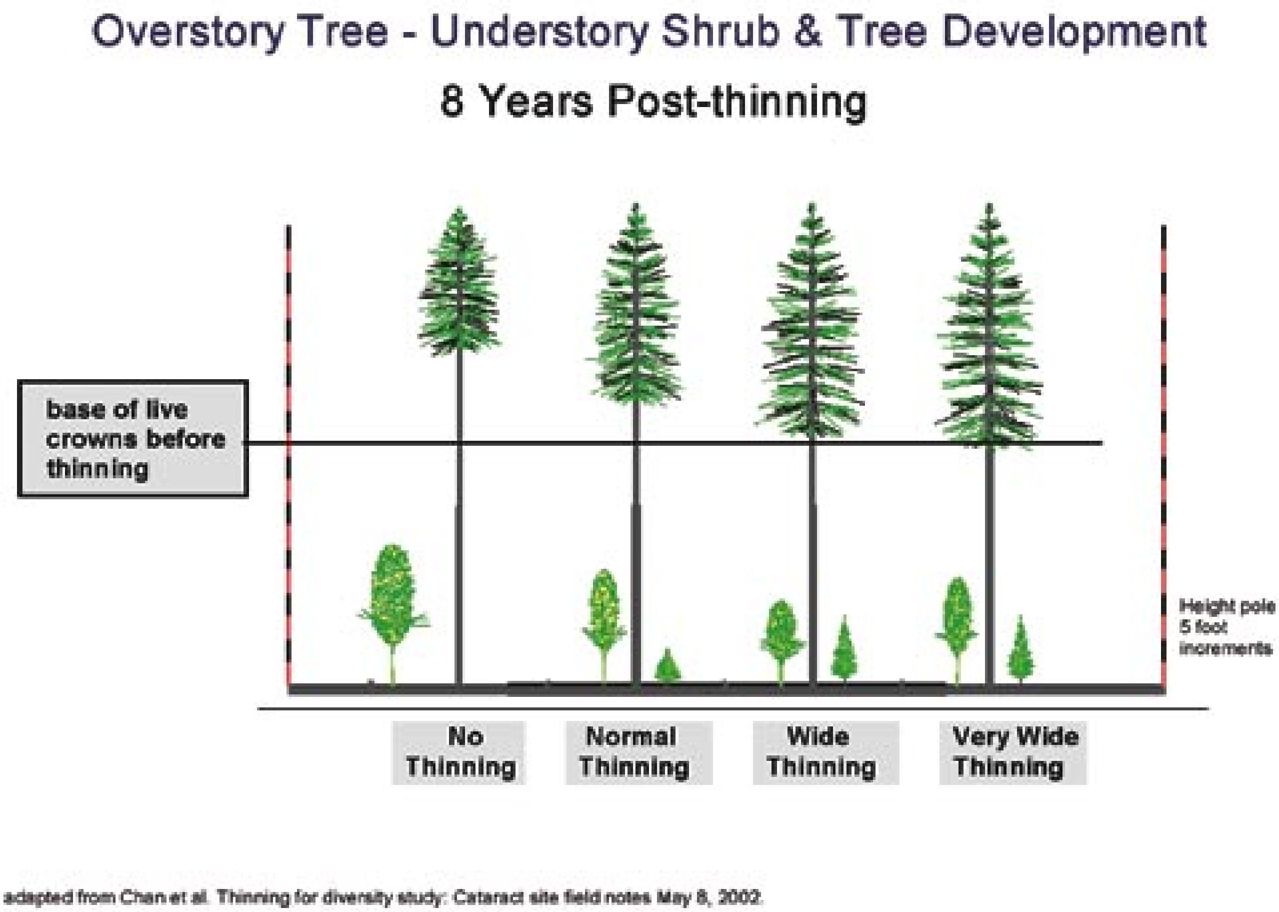


Figure 2-1 1999 Aerial Photography and 6th Field Watershed Boundaries

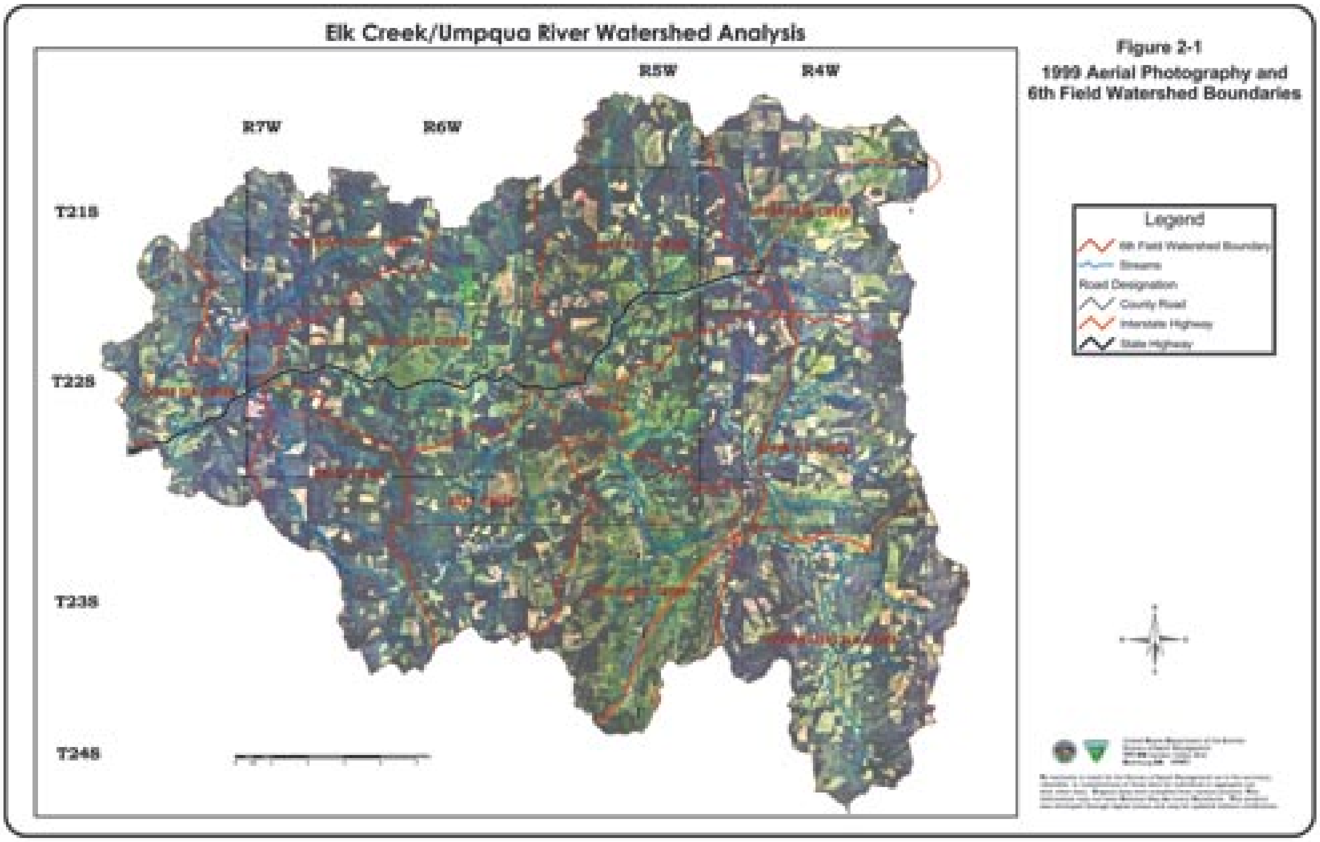


Table 2-1 Vegetation Change, Federal and Private Harvesting Since 1972

Year Harvest/ Age Class	Total		Federal		Private	
	Acres	%	Acres	%	Acres	%
1972-1984 30-19 years	6,570	3	2,410	1	4,160	2
1984-1991 19-12 years	12,860	7	4,270	2	8,590	5
1991-2002 12-0 years	18,260	10	460	0.2	17,800	10
TOTAL 30 YEAR HARVEST	**37,690**	**20%**	**7,140**	**3%**	**30,550**	**17%**

Chart 2-2 Vegetation Change, Federal and Private Harvesting Since 1972

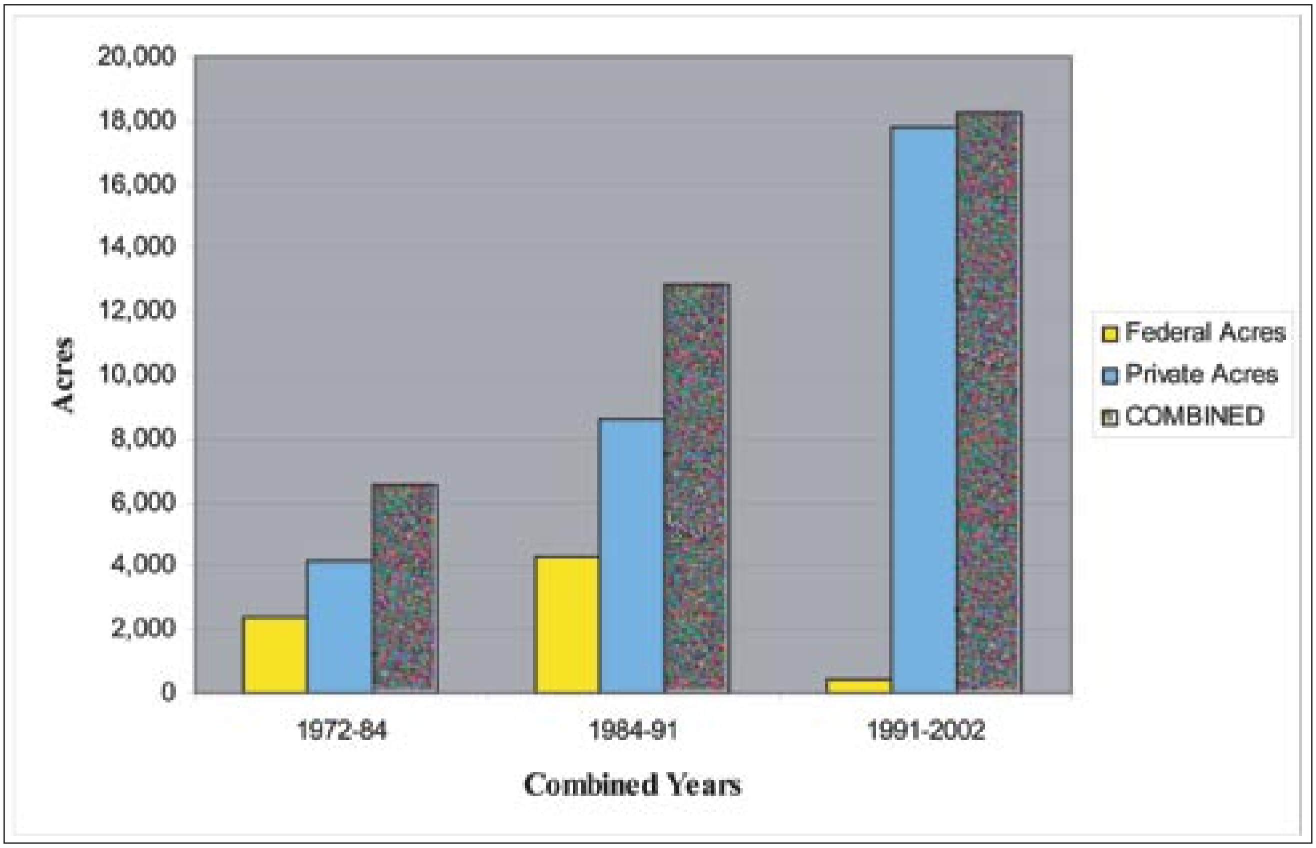


Table 2-2 Elk Creek Estimated 2002 Vegetation, Acres

Vegetation Class	Total	
	Acres	%
Early Seral Forest (0-30 years)	40,000	21
Mid Seral Forest (30-80 years)	74,000	40
Late Seral Forest (80+ years)	20,000	11
Hardwoods/Brush	38,000	20
Agricultural Lands	13,400	7
Water	1,450	1
Urban Areas	150	0
TOTAL	**187,000**	**100%**

Chart 2-3 Elk Creek Estimated 2002 Vegetation, Acres

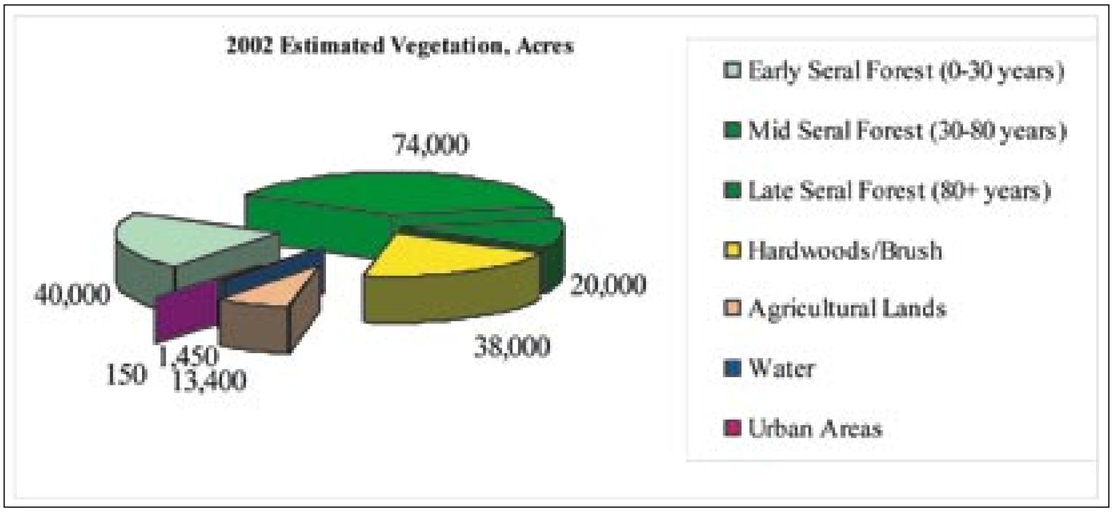


Figure 2-2 LSR, C/D Block, and GFMA – Forest Age Class on BLM Lands

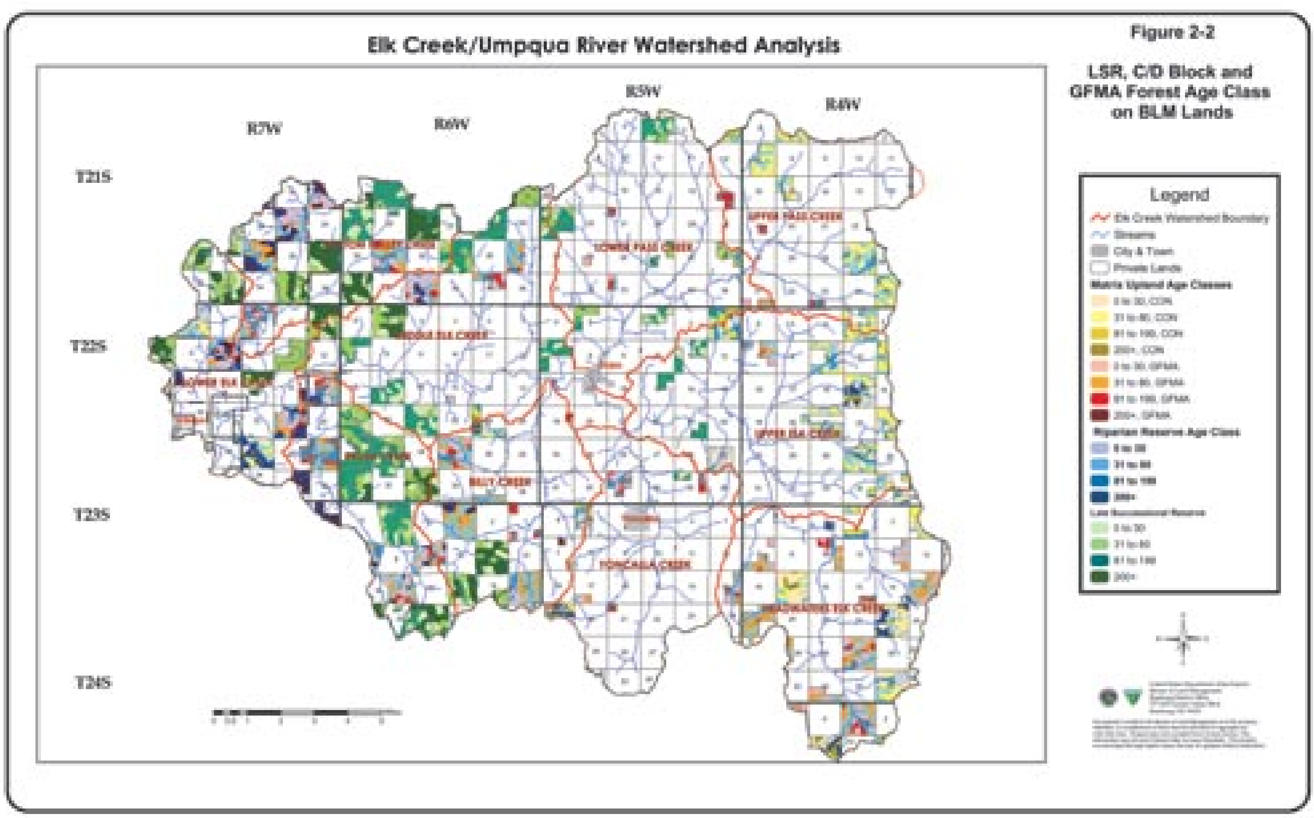


Table 2-3 Elk Creek ALL BLM, Forest Age Classes, Watershed/Subwatershed

Subwatersheds	Forest Age Classes by Subwatershed and Watershed								TOTAL
	0-30 yrs acres	Subwatershed %	31-80 yrs acres	Subwatershed %	81-200 yrs acres	Subwatershed %	201+ yrs acres	Subwatershed %	ACRES
Big Tom Folley Creek	1,855	26%	1,645	23%	1,360	19%	2,320	32%	7,180
Billy Creek	880	21%	1,955	46%	565	13%	855	20%	4,255
Brush Creek	1,255	17%	2,100	29%	2,640	37%	1,180	16%	7,175
Headwaters Elk Creek	2,130	34%	2,970	47%	760	12%	475	7%	6,335
Lower Elk Creek	1,160	26%	1,845	42%	65	1%	1,320	30%	4,390
Lower Pass Creek	510	24%	455	21%	1,190	55%	0	0%	2,155
Middle Elk Creek	1,380	26%	1,425	27%	1,965	37%	485	9%	5,255
Upper Elk Creek	1,470	32%	1,760	38%	1,245	27%	180	4%	4,655
Upper Pass Creek	160	6%	1,790	71%	565	22%	20	1%	2,535
Yoncalla Creek	405	41%	120	12%	330	34%	125	13%	980
TOTAL	**11,205**		**16,065**		**10,685**		**6,960**		**44,915**

Chart 2-4 Elk Creek Forest Age Classes, All BLM Lands

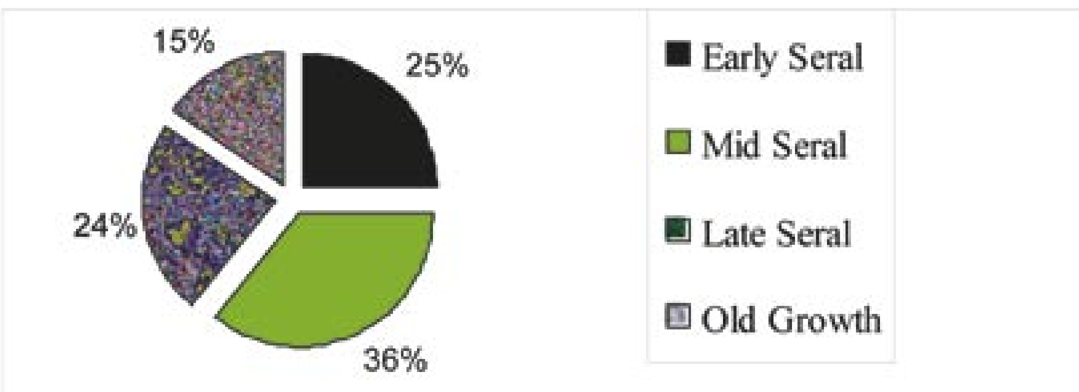


Table 2-4 Elk Creek ALL BLM RESERVES, Forest Age Classes

Subwatersheds	Forest Age Classes by Subwatershed and Watershed								TOTAL
	0-30 yrs acres	Subwatershed %	31-80 yrs acres	Subwatershed %	81-200 yrs acres	Subwatershed %	201+ yrs acres	Subwatershed %	ACRES
Big Tom Folley Creek	1,535	25%	1,270	20%	1,225	20%	2,175	35%	6,205
Billy Creek	670	20%	1,505	46%	320	10%	780	24%	3,275
Brush Creek	1,085	17%	1,830	29%	2,420	38%	1,035	16%	6,370
Headwaters Elk Creek	750	27%	1,350	49%	390	14%	250	9%	2,740
Lower Elk Creek	865	24%	1,485	42%	50	1%	1,170	33%	3,570
Lower Pass Creek	380	22%	380	22%	980	56%	0	0%	1,740
Middle Elk Creek	1,190	26%	1,255	27%	1,780	38%	435	9%	4,660
Upper Elk Creek	875	33%	780	29%	905	34%	95	4%	2,655
Upper Pass Creek	55	6%	660	67%	265	27%	10	1%	990
Yoncalla Creek	225	45%	35	7%	190	38%	55	11%	505
TOTAL	**7,630**		**10,550**		**8,525**		**6,005**		**32,710**

Chart 2-5 Elk Creek Forest Age Classes within BLM Reserves

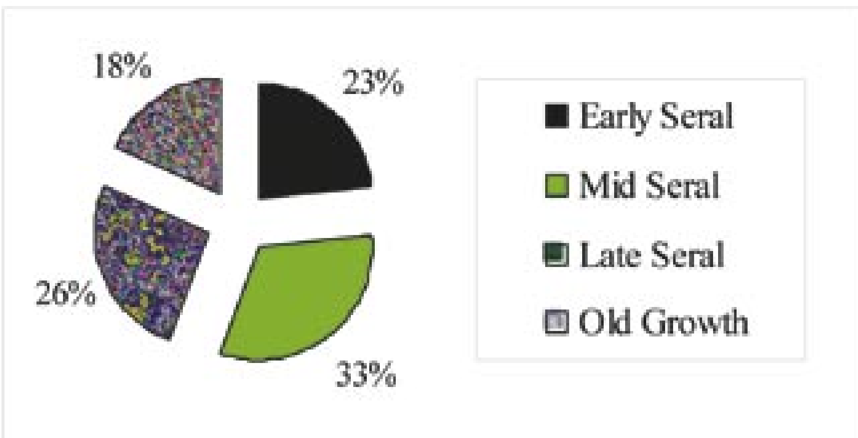


Table 2-5 BLM GFMA (Upland Outside Riparian Reserves), Forest Age Classes

Subwatersheds	Forest Age Classes by Subwatershed and Watershed								TOTAL
	0-30 yrs acres	Subwatershed %	31-80 yrs acres	Subwatershed %	81-200 yrs acres	Subwatershed %	201+ yrs acres	Subwatershed %	ACRES
Big Tom Folley Creek	320	33%	375	38%	135	14%	145	15%	975
Billy Creek	160	21%	410	53%	185	24%	25	3%	780
Brush Creek	170	21%	270	34%	220	27%	145	18%	805
Headwaters Elk Creek	615	32%	1,075	56%	225	12%	5	0%	1,920
Lower Elk Creek	170	36%	190	40%	5	1%	110	23%	475
Lower Pass Creek	80	38%	70	33%	60	29%	0	0%	210
Middle Elk Creek	185	35%	170	32%	150	28%	25	5%	530
Upper Elk Creek	35	32%	55	50%	20	18%	0	0%	110
Upper Pass Creek	0	0%	10	7%	130	93%	0	0%	140
Yoncalla Creek	95	37%	45	17%	120	46%	0	0%	260
TOTAL	**1,830**		**2,670**		**1,250**		**455**		**6,205**

Chart 2-6 Elk Creek Forest Age Classes within BLM GFMA

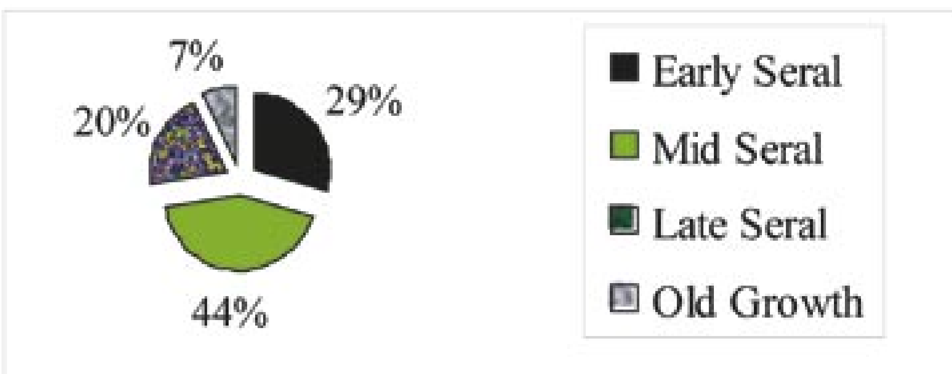


Table 2-6 BLM Connectivity/Diversity Block Lands (Upland Outside Riparian Reserves), Forest Age Classes

Subwatersheds	Forest Age Classes by Subwatershed and Watershed								TOTAL
	0-30 yrs acres	Subwatershed %	31-80 yrs acres	Subwatershed %	81-200 yrs acres	Subwatershed %	201+ yrs acres	Subwatershed %	ACRES
Big Tom Folley Creek	0	---	0	---	0	---	0	---	0
Billy Creek	50	25%	40	20%	60	30%	50	25%	200
Brush Creek	0	---	0	---	0	---	0	---	0
Headwaters Elk Creek	765	46%	545	33%	145	9%	220	13%	1,675
Lower Elk Creek	125	36%	170	49%	10	3%	40	12%	345
Lower Pass Creek	50	24%	5	2%	150	73%	0	0%	205
Middle Elk Creek	5	8%	0	0%	35	54%	25	38%	65
Upper Elk Creek	560	30%	925	49%	320	17%	85	4%	1,890
Upper Pass Creek	105	7%	1,120	80%	170	12%	10	1%	1,405
Yoncalla Creek	85	40%	40	19%	20	9%	70	33%	215
TOTAL	**1,745**		**2,845**		**910**		**500**		**6,000**

Chart 2-7 Forest Age Classes within BLM Connectivity/Diversity Block Lands (Outside Riparian Reserves)

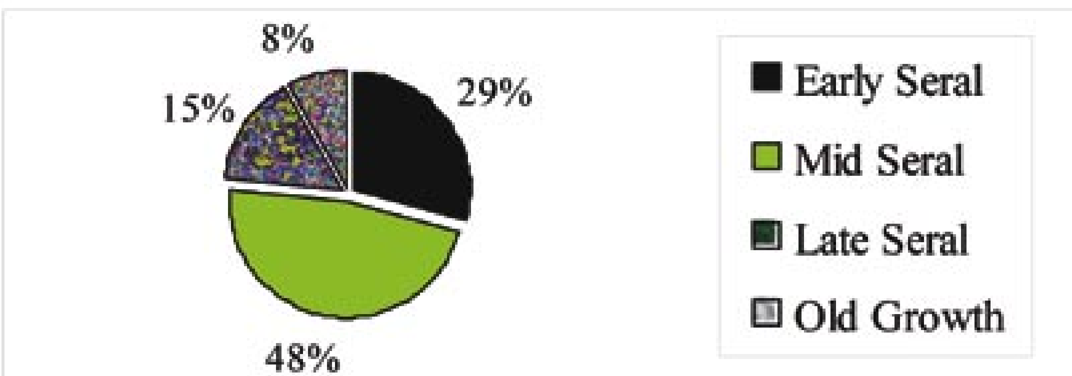


Chart 2-8 Connectivity/Diversity Block Lands (<u>Including</u> Riparian Reserve) Acres and Percent West and East of Interstate-5

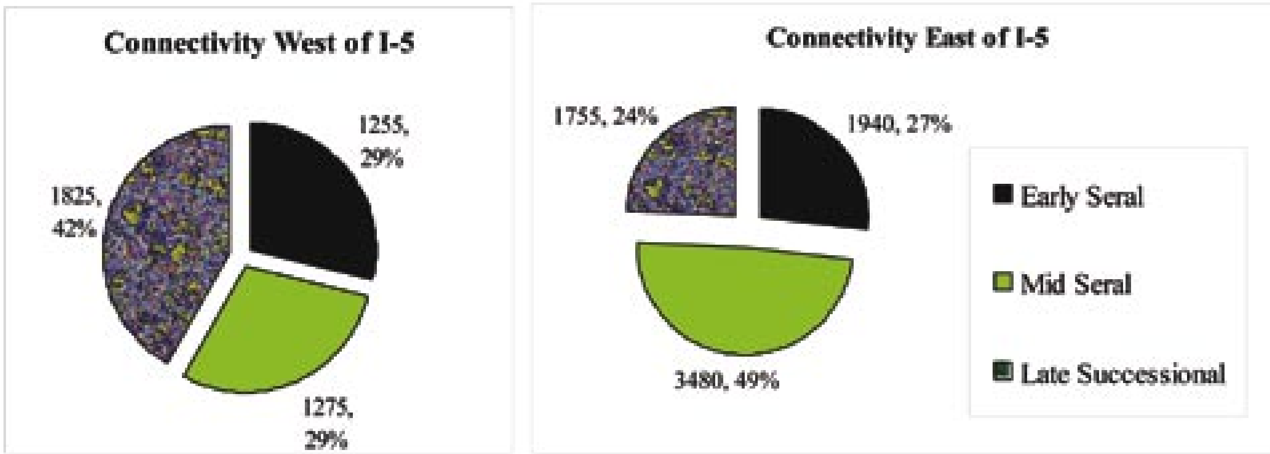
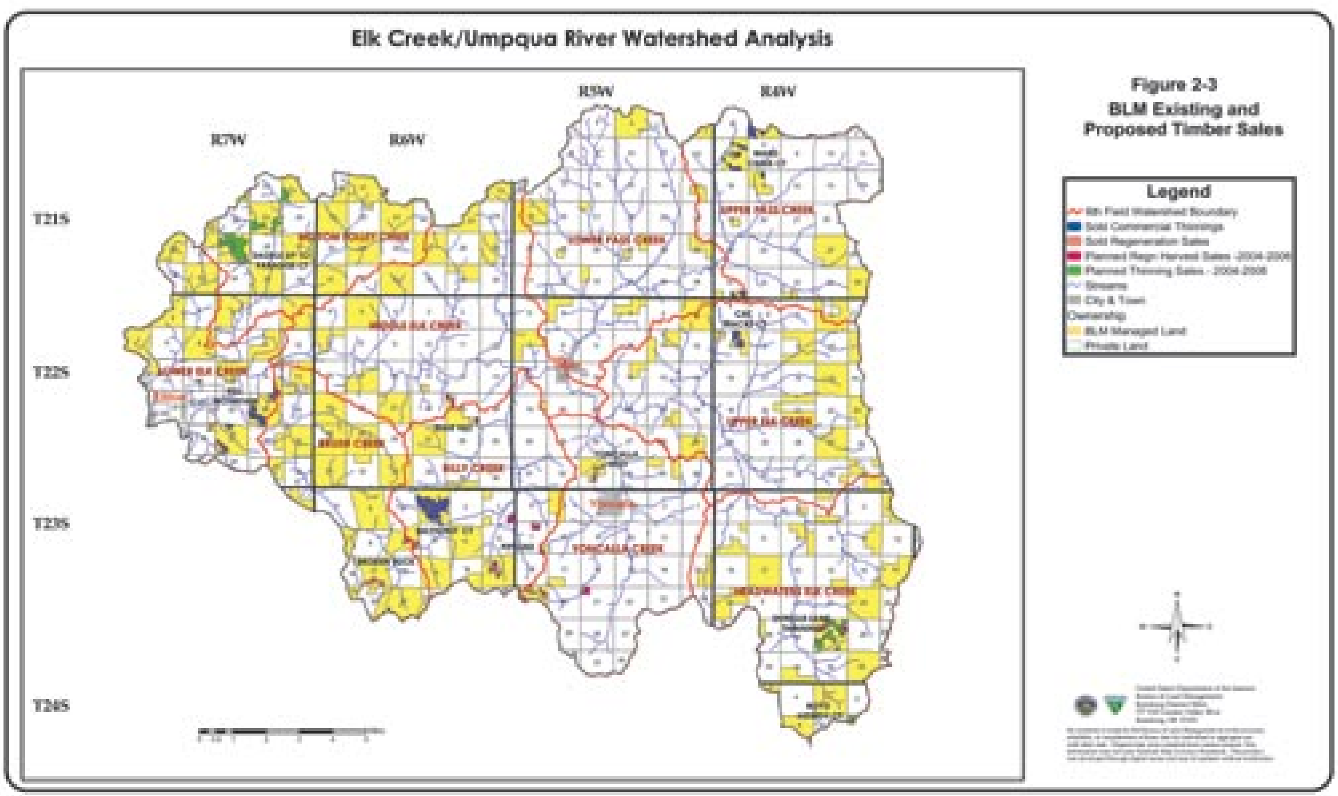


Figure 2-3 BLM Existing and Proposed Timber Sales



3. Noxious Weeds and Special Status Botanical Species

A. Noxious Weeds and Control in Elk Creek

A noxious weed is any plant designated by the Oregon State Weed Board that is injurious to public health, agriculture, recreation, wildlife or any public or private property. Many have become firmly established on public and private land throughout the Roseburg District. The BLM manages designated noxious weeds that are non-native to western Oregon. The objective of the Roseburg District weed control program is to:

(1) Maintain established noxious weed populations below the level that causes either undue and unnecessary environmental degradation or impairs the public land's economic productivity, and

(2) Eradicate invading noxious weeds before they become established on public lands (USDI 1995).

The Elk Creek Watershed has 106 recorded sites for seven different noxious weed species. These noxious weed populations are listed in the Botany Appendix table. They are managed in the following ways:

Diffuse knapweed (*Centaurea diffusa*) is known only from a 1992 historical record from ODA. This site is within T. 21S., R. 04W. It has been included here because it is high priority and if found would be aggressively treated.

Portuguese broom (*Cytisus striatus*) is the highest priority weed in the watershed. The primary infestation is limited to one township (T. 22S., R.04W.) on the east side of the watershed. The Cox Creek Weed Management Area was established to address the eradication of Portuguese broom across all ownership. The Douglas County Soil and Water District carries the primary responsibility for eradicating Portuguese broom in this weed management area. Due to the presence of broom plants in the area with the characteristics of both Portuguese and Scotch brooms, many believe that Scotch broom hybridizes with Portuguese broom. For this reason Scotch broom populations in close proximity to Portuguese broom are included in the eradication program. Three Portuguese broom sites (T. 22 S., R.06 W., sec. 21; T. 23 S., R. 04 W., sec. 17; and T. 23 S., R.04 W., sec. 26) occurring outside of the Cox Creek Weed Management are also undergoing intensive treatment. Treatment sites are expected to be monitored for many years to ensure success of the eradication program.

One site of gorse (*Ulex europaeus*) exists in T. 22 S., R. 04 W., sec. 7. This site is small and well isolated from other gorse sites. After the initial control is attained, a monitoring schedule is expected to be established appropriate for the species and the site.

Scotch broom (*Cytisus scoparius*) is ubiquitous and the district manages a program to reduce the impacts of this species.

The two English ivy (*Hedera helix*) populations in the watershed are on private property with low likelihood that they will impact BLM lands.
Two buffalo burr (*Solanum rostratum*) populations occur in the watershed, they are small and isolated. Management recommendation for small isolated populations is to treat the sites and a monitoring schedule will be established appropriate for the species and the site.

Historical records indicate that rush skeletonweed (*Chondrilla juncea*) is found within the watershed. The historical record is without specific information about locations. If more specific information becomes available, this species will be managed appropriately.

Canada thistle (*Cirsium arvense*), bull thistle (*Cirsium vulgare*), tansy ragwort (*Senecio jacobea*), meadow knapweed (*Centaurea pratensis*), Scotch broom (*Cytisus scoparius*), and St. Johnswort (*Hypericum perforatum*) are all ubiquitous throughout the watershed. The primary method of control for these species is biological. Biological control agents (primarily insects) for these species are widespread and well established throughout the Roseburg District. No effort has been made to quantify the extent or control achieved by biological control agents in this watershed.

B. Special Status And Special Attention Species - Botany

Special Status Species plants include vascular plants, bryophytes (liverworts and mosses), fungi and lichens in the following categories: Federal Listed, Federal Proposed, Federal Candidate, State Listed, Bureau Sensitive, Assessment, and Tracking Species. On the Roseburg District, there are two Federal Listed Species, no Federal Proposed or Federal Candidates, five State Listed, 18 Bureau Sensitive, 24 Bureau Assessment, and 34 Bureau Tracking Species. Special Attention Species include Survey and Manage Species.

There are currently three sites of Special Status Species plants known on BLM-managed lands within Elk Creek and five sites within one air-mile of the watershed boundary. These sites of known special status plant populations were previously identified during surveys for projects already in the planning process. There has been no attempt to conduct comprehensive botanical surveys throughout the watershed. Because surveys have been associated with specific projects, such as timber sales, it is estimated that less than one percent of the watershed has been surveyed for botanical resources or less than three percent of BLM-administered lands.

1. **Federally Listed Species**
   Kincaid's lupine *(Lupinus sulphureus var kincaidii*) is federally listed as "Threatened." The plant itself has not been identified in Elk Creek, but the watershed is within the range of the species and there is potential habitat for this species in the watershed.
2. **State of Oregon Listed, Bureau Sensitive, Assessment and Tracking Species**
   There is only one Special Status Species, firecracker plant (*Dichelostemma ida-maia*), known to occur on BLM-managed lands within the watershed. Firecracker plant is a Tracking Species and management for this species is discretionary. Table 11-2 provides a summary of Special Status Species sites known on the district and within the watershed.
3. **Survey and Manage Bryophyte, Lichen, Fungi and Plant Species**
   As of March 23rd, 2004, Survey and Manage Guidelines for the Northwest Forest Plan have been removed through plan amendment.

4. Wildlife Habitat and Species

A. LSR and Riparian Reserve Management, Wildlife Objectives

The management direction outlined in the Northwest Forest Plan is specifically intended to benefit a diversity of wildlife species, especially those associated with older forests. Late-seral and old growth forests are important to many species because of the variety of microclimates and special habitats that exists within these forests. Habitat requirements for the late-successional forest species can vary significantly by species.

NFP objectives to benefit wildlife species include: (1) maintaining a functional, interactive, late-successional and old-growth ecosystem, (2) providing connectivity between Late-Successional Reserves and providing habitat for a variety of organisms associated with both late-successional and younger forests, (3) enhancing and maintaining biological diversity and ecosystem health to contribute to healthy wildlife populations, (4) protecting special habitats, and (5) protecting, managing, and conserving Special Status Species. The success of the Northwest Forest Plan, with respect to achieving wildlife objectives, is dependent on the integrity and composition of the reserve system, Late-Successional and Riparian Reserves, and connectivity systems and other reserves designated for special status species, and natural areas.

Of the approximate 230 species of terrestrial wildlife that occur in the Elk Creek watershed, approximately 160 species use late-successional or old growth and/or riparian habitats, including 29 species of reptiles and amphibians, 80 species of birds, and 48 species of mammals. Twenty-four of these species are Special Status Species (WILDLIFE APPENDIX).

The criteria for developing appropriate habitat management treatments to meet wildlife objectives within Late-Successional and Riparian Reserves are described in *The South Coast-Northern Klamath Late-Successional Reserve Assessment* (LSRA). To meet those wildlife objectives within the Elk Creek watershed, part of this analysis focuses on density management of early and mid-seral forest stands. The LSRA specifically addresses habitat management within areas requiring density management. Within these stands, structural components of Late-Successional and Riparian Reserves are typically even-aged, single canopied stands lacking vegetative diversity, structural diversity, snags, and coarse woody debris. Treatments within these stands would improve the integrity and functionality of these reserves for terrestrial wildlife species. Implementation of treatments would help treated stands reach desired stand characteristics more rapidly.

For this analysis, late-successional will be used to define late-seral and old-growth stages of forest development (stands greater than 80-years of age). The 1997 IVMP vegetation data was used to determine the amount of late-successional habitat. There are approximately 20,000 acres of late-successional habitat in the watershed (Chart 2-3), of which about 18,000 acres (90 percent) are on federal lands and about 2,000 acres are on private lands (Table 2-2 and Table 2-3). Approximately, 14,500 acres (73 percent) of late-successional habitat on BLM are protected in reserves (Late-Successional, Riparian and other reserves) (Table 2-4).

1. Late-Successional Reserves

The Late-Successional Reserve system was established to provide for a wide variety of late-successional-associated species, from highly mobile vertebrate species like the spotted owl to species with limited mobility and more restricted home ranges such as mollusks. Goals of the Late-Successional Reserve are to protect and enhance conditions of late-successional and old-growth forest ecosystems; and to create and maintain biological diversity associated with native species and ecosystems. Important attributes benefiting late seral ecosystems, which can be influenced by management actions, include: stand composition (species, density, and size), legacy wood (snags and course wood debris), and disturbance processes (fire, wind, or disease). The LSRA outlines the management priorities and guidelines for treatment that interdisciplinary teams need to consider when evaluating projects within Late-Successional Reserves. Management priorities within Late-Successional Reserves include: (1) enlarging existing interior late-successional habitat blocks, (2) improving habitat connections within Late-Successional Reserves, (3) maintaining and improving connectivity habitat between Late-Successional Reserves, and (4) creating additional large blocks of late-successional habitat where they are absent.

Portions of LSR #264, 266 and #267 occur in this watershed (Figure 1-3). These Late-Successional Reserves total approximately 18,700 acres (Table 1-3). The LSRA ranked LSRs #264 and #266 as medium priority for management, identifying these Late-Successional Reserves as having substantial amounts of treatable stands which could either augment existing interior blocks of late successional habitat or create future blocks. For this analysis, since LSR #267 is the same general area, it also is considered a medium priority. In addition, LSR #264 maintains a north-south Late-Successional Reserve link in the Coast Range, and in conjunction with LSR #263, may also provide for some connection east to LSR #222 in the Cascades Province (LSRA, p. 63). BLM Connectivity/ Diversity Block Lands would also provide for some connection between these Late-Successional Reserves.

2. Riparian Reserves and Other Administratively Withdrawn Areas

As described in the Overview, Riparian Reserves were designated to help provide dispersal opportunities for late-seral associated and riparian dependent species. Many terrestrial wildlife species rely on the riparian habitat for forage, nesting/ breeding habitat, and cover. The presence of a variety of overstory and understory vegetative layers and downed wood produces the typically cooler and moister microhabitats, which many terrestrial organisms prefer. These microhabitats near, at, and below ground level are important for the survival of many amphibian species. Riparian Reserves may also serve as natural corridors or migration routes and as connecting corridors between areas of suitable habitats in fragmented environments. Approximately 14,000 acres of the reserve system within the watershed are Riparian Reserves or other administratively withdrawn areas (Table 1-3, Figure 1-3).

B. Special Status Species - Wildlife

On the Roseburg District, approximately 63 terrestrial species, including 46 vertebrate and 17 invertebrate species, are classified as Special Status Species. Forty-five of these species, 36 vertebrate and seven invertebrate species, are known to occur or are expected or suspected to occur within the Elk Creek watershed. Special Status Species, as also described above under Botany, include Federally Threatened (FT), Federally Endangered (FE), Federally Proposed for Listing (P), Bureau Sensitive (BS), Bureau Assessment (BA), Bureau Tracking (BT), or Oregon state listed species (WILDLIFE APPENDIX). Other species of interest are Special Attention Species in the Northwest Forest Plan or Oregon Department of Fish and Wildlife (ODFW) priority species. Species that are of special interest to the general public or other agencies (i.e., ODFW) include bats, elk, neotropical birds, osprey, raptors, and wild turkey.

Those species that are most relevant to management within the Elk Creek watershed are addressed in this section. Brief discussions about the remaining Special Status Species and species of interest can be referenced in the WILDLIFE APPENDIX.

1. Federally Threatened and Endangered and Proposed Species

Three terrestrial species known to occur on the Roseburg BLM District are listed as Federally Threatened, Federally Endangered, Federally Proposed for Listing, or Federally Proposed for Delisting (PD). These species include the American bald eagle (*Haliaeetus leucocephalus*) (FT, PD), marbled murrelet (*Brachyramphus marmoratus*) (FT), and Northern spotted owl (*Strix occidentalis caurina)* (FT). The Roseburg BLM District occurs within the suspected ranges of the Canada lynx (*Lynx canadensis*) (FT), the Fender's Blue butterfly (*Icaricia icarioides fenderi*) (FE), and the vernal pool fairy shrimp (*Branchinecta lynchi*) (FT), but their occurrence has not been documented within the Elk Creek Watershed.

a) Northern Spotted Owl

This watershed is part of the Tyee demography study area, which has been monitored intensively since 1988. Individual Northern spotted owl sites may have been followed since 1985, or before. A Master Site is defined as a location with evidence of continued use by spotted owls, including: breeding, repeated location of a pair or single birds during a single season and/or over several years, presence of young before dispersal, or some other strong indication of continued occupation; a Master Site may include one or more activity centers (nest sites). There are 42 Master Sites, which include 96 known northern spotted owl activity centers, in the Elk Creek watershed (Figure 4-1). Under the Northwest Forest Plan, 12 Residual Habitat Areas were established (1097 acres) within the watershed. A Residual Habitat Area is an unmapped reserve protecting approximately 100 acres of the best spotted owl suitable habitat identified as close to the nest site or activity center for all known (as of January 1, 1994) spotted owl activity centers on BLM Matrix lands. One spotted owl Residual Habitat Area and 16 Master Sites (includes 54 activity centers) occur outside, but within 1.5 miles of the watershed boundary.

The presence of barred owls (*Strix varia*) within this watershed is of concern and may pose a genetic and competitive threat to spotted owls (Taylor and Forsman 1976, Hamer 1988, Dunbar et al. 1991). Surveys on the Roseburg District have shown that when barred owls move into a known spotted owl site, the spotted owls abandon the area. Barred owls were first detected in the watershed in 1989. Currently, there are 20 known barred owl sites in this watershed, of which six of these sites are located within historical spotted owl Residual Habitat Areas. Management implications of barred owl effects on spotted owls are currently being researched.

Within the home range radius of any northern spotted owl site, the LSRA treatment guidelines set a management objective to maintain or enhance the ability of spotted owls to use their home range and to provide their life requirements to survive and reproduce. The guidelines emphasized the need for treatments in managed plantations and thinned stands (early and mid-seral age classes). They also discuss the importance of maintaining the following habitat features: roosting and foraging habitat, connectivity habitat, nesting or potential nesting structures, snags, and course woody debris (LSRA, pp. 70-71).

The Endangered Species Act describes northern spotted owl habitat in three different categories: Suitable, Dispersal, and Critical Habitat. Table 4-1 gives a summary of the amount of that habitat within Elk Creek.

Table 4-1 Acres of Suitable, Dispersal, and Critical Spotted Owl Habitat, BLM Land

Suitable habitat	Dispersal Habitat[1]	Critical Habitat
17,700	24,800	38,400

[1]Dispersal habitat includes habitat that is less than 80 years of age and is currently not suitable habitat. Suitable habitat also functions as dispersal habitat.

(1) Suitable Habitat

Roseburg BLM District biologists identified forest habitat important to the northern spotted owl on BLM-administered lands. This inventory used on-the-ground knowledge, inventory descriptions of forest stands, and known characteristics of the forest structure and was placed in GIS. Four habitat types were described and labeled. Habitat 1 (HB1) describes forest stands that provide nesting, foraging, and resting. Habitat 2 (HB2) describes forest stands that provide foraging and resting components. A few of these stands also contain nesting components. Habitat 1 and 2 together are considered to be suitable northern spotted owl habitat and is estimated to be close to 17,700 acres on BLM-administered lands (Table 4-2). Habitat 3 (HB3) refers to forest stands that have the potential within 50 years to develop into suitable Habitat 2. This habitat type (27,300 acres, Table 4-2) would mostly consist of early and mid-seral stands on BLM lands. Habitat 4 (HB4) refers to areas that would not develop into suitable habitat in the foreseeable future. Table 4-2 shows the number of acres present and Figure 4-1 shows the distribution for these four habitats within the watershed. Approximately 14,500 acres of suitable northern spotted owl habitat are protected in BLM reserves.

(2) Dispersal Habitat

Dispersal habitat refers to forest stands that provide cover, roosting, foraging, and dispersal components the northern spotted owl uses while moving from one area to another (Thomas et al. 1990, USDI 1992a, and USDI 1994). For this analysis, forested stands greater than 30 years of age are considered dispersal habitat. Therefore, there are 45,000 acres of dispersal habitat on BLM lands within the watershed (derived from Table 4-2), of which 27,300 acres are currently non-suitable nesting habitat. Approximately 10,500 acres of dispersal habitat (31 to 80 years of age) are within the reserve system (derived from Table 2-4).

(3) Critical Habitat

Approximately 38,400 acres have been designated as Critical Habitat (CHU-OR 23, 24, 53, 54, 56, and 57) for the recovery of the northern spotted owl within the watershed (FR 57(10):1796-1838) (Figure 4-1). Designated Critical Habitat includes the primary constituent elements that support nesting, roosting, foraging, and dispersal of the northern spotted owl. Critical Habitat also includes habitat that is currently unsuitable, but has the capability of becoming suitable habitat in the future. Of the Critical Habitat, approximately, 14,900 acres are Late-Successional Reserves, 15,700 acres are BLM matrix (Connectivity/Diversity Block or GFMA) lands and the remaining 7,800 acres are private lands. Potential impacts to unsuitable Critical Habitat also need to be evaluated on a site-specific basis to determine effects to Critical Habitat.

Table 4-2 Elk Creek, Acres of Spotted Owl Habitat Types on BLM Land

Habitat 1	Habitat 2	Habitat 3	Habitat 4
14,900	2,800	27,300	100

b) Marbled Murrelet

Information about the biology and inland nest sites indicates the marbled murrelet is unlikely to be found more than 50 miles from the Oregon coast (USDA and USDI 1994a, and USDI 1992c). The Marbled Murrelet Recovery Plan identified Conservation Zones 1 and 2, extending to a distance of 0-35 miles and 35-50 miles from the Oregon coast, respectively. Approximately 14,000 acres (seven percent) of the Elk Creek watershed are located within Zone 1 (0-35 miles from the ocean) and 128,500 acres (68 percent) of the watershed are located within Zone 2 (35-50 miles from the ocean) (Figure 4-2). Any forested area within 50 miles of the ocean containing a residual tree component, small patches of residual trees, or one or more platforms is potential murrelet habitat (Pacific Seabird Group [PSG] 2000).

From 1992 through 2003, the Swiftwater Resource Area has surveyed 68 sites (approximately 3,300 acres) for the presence of marbled murrelets within the watershed. Marbled murrelets have been detected at six sites. Detection is defined as the observation, either visual or auditory, of one or more birds during a survey. An occupied site is where marbled murrelets have been observed exhibiting sub-canopy behaviors, which are behaviors that occur at or below the forest canopy and that strongly indicate that the site has some importance for breeding (PSG 2000). Two occupied sites have been located and four sites have had murrelet detections within the watershed. One occupied site occurs within Zone 1 at 33 miles inland, while the other occupied site occurs within Zone 2 at 40.5 miles inland. Occupied sites are protected with a 0.5-mile radius buffer. Both occupied sites occur on Matrix lands and will be managed as unmapped Late-Successional Reserves, protected with a 0.5-mile radius buffer (USDI 1995).

(1) Suitable Habitat

Suitable habitat for the marbled murrelet includes late-mature seral and old-growth coniferous forests, and younger coniferous forests that have suitable nest structures (PSG 2000). For this analysis, marbled murrelet suitable habitat includes those stands that are 80 years or older using FOI vegetation data. This analysis is an underestimate of suitable habitat due to the younger coniferous forests that are less than 80 years old, but have a residual habitat component that have suitable nest structures. Approximately 17,700 acres of suitable marbled murrelet habitat occurs on BLM-administered lands (Table 4-3) within 50 miles of the Oregon coast. Of that acreage, 2,400 acres and 15,100 acres occur within Zone 1 and Zone 2, respectively.

(2) Critical Habitat

Within this watershed, approximately 15,100 acres have been designated as Critical Habitat for the recovery of the marbled murrelet (CHU-OR 53, 54, 56, and 57) (FR 61: 26256-26320) (Figure 4-2). Designated Critical Habitat includes the primary constituent elements (defined in table below) that support nesting, roosting, and other normal behaviors that are essential to the conservation of the marbled murrelet. Critical Habitat also includes habitat that is currently unsuitable, but has the capability of becoming suitable habitat in the future. BLM management actions are not expected to result in destruction or adverse modification of critical habitat containing primary constituent elements. Potential impacts to unsuitable Critical Habitat also need to be evaluated on a site-specific basis to determine effects to Critical Habitat. Within areas that are currently unsuitable, management activities need to focus on the development of future nesting habitat, and should speed the development of attributes important to marbled murrelets (i.e., large limbs for nesting platforms) that are characteristic of older forests.

All marbled murrelet Critical Habitat within the watershed is located on federal lands. Critical Habitat has been identified as those acres of suitable habitat (and for this analysis includes stands > 80 years of age based on FOI vegetation data) plus that forested habitat within 0.5 miles that is currently unsuitable but is at least 50 years of age (50 years of age at which dominant trees within a stand should reach 100 feet in height – approximately half site potential) (FR 61:26264). Of the 17,500 acres of suitable habitat within the watershed, approximately 86 percent (15,100 acres) is within marbled murrelet Designated Critical Habitat (Table 4-3). Approximately 2,200 acres of Critical Habitat are located in Zone 1 and 12,900 acres are located in Zone 2.

c) American Bald Eagle

Based on information collected during annual inventories (1972 to 2003) by Isaacs and Anthony (2003) of known bald eagle breeding territories in Douglas County, Oregon, no territories have been located within the Elk Creek watershed. There have been bald eagles observed within the watershed; however, nesting bald eagles have not been documented. Suitable nesting habitat occurs along major river corridors. If nests are located within the watershed, future occupied territories will be protected under management guidelines outlined in the Northwest Forest Plan.

2. State of Oregon Listed Species

There are fifteen terrestrial wildlife species listed as threatened or endangered by the State of Oregon, of which four of these species occur within the Elk Creek watershed. These four species include: bald eagle, marbled murrelet, American peregrine falcon, and spotted owl. The marbled murrelet, spotted owl, and bald eagle are also federally listed. The peregrine falcon is no longer Federally Endangered but is listed as "endangered" by the State of Oregon and is discussed in the Bureau Sensitive Species section of the WILDLIFE APPENDIX.

3. Bureau Sensitive Species

Bureau Sensitive designation includes species that could easily become endangered or extinct in a state. They are restricted in range and have natural or human-caused threats to survival. Bureau Sensitive species are not currently federally or state-listed, but are eligible for federal or state listing or candidate status. Bureau manual 6840 policy requires that any Bureau action will not contribute to the need to list any of these species. Of the 17 Bureau Sensitive species on the Roseburg District, there are eight vertebrate and three invertebrate species that are known to occur or are expected or suspected to occur within the Elk Creek watershed. These species are discussed in the WILDLIFE APPENDIX.

4. Bureau Assessment Species

Bureau Assessment species are not included as federal or state listed species but are of concern in Oregon or/and Washington. Only vertebrate animals are given Bureau

Table 4-3 Suitable and Critical Habitats for Marbled Murrelet within Elk Creek

Suitable Habitat with Primary Constituent Elements[1]	Habitat with Secondary Constituent Elements[2]	Critical Habitat
17,500	3,800	15,100

[1]Primary constituent elements of suitable nesting habitat within Critical Habitat include: (1) individual trees with potential nesting platforms, and (2) forested areas within 0.5-miles of individual trees with potential nesting platforms, and that have a canopy height of at least one-half the site-potential tree height (FR 61:26264).
[2]Secondary constituent elements include habitat that is currently unsuitable but is at least 50 years of age.

Assessment status. Twelve terrestrial vertebrate species on the Roseburg BLM District are considered to be Bureau Assessment species. Seven of these species that are known to occur or are expected to occur within the watershed. These species are further discussed in the WILDLIFE APPENDIX.

5. Bureau Tracking Species

Bureau Tracking species are not considered to be Special Status Species for management purposes, until the status of such species is changed to a higher status (i.e. federal or state listed, Bureau Sensitive or Assessment). This list serves as an early warning for species which may become of concern in the future. More information is necessary to determine status of each of these species within the state and to determine if a species needs active management. Of the 31 Bureau Tracking species, 20 vertebrate and five invertebrate species are known to occur or are expected to occur within the watershed. These species are listed in the WILDLIFE APPENDIX for reference.

6. Survey and Manage Species

As of March 23rd, 2004, Survey and Manage Guidelines for the Northwest Forest Plan have been removed through plan amendment.

C. Desired Future Conditions of Late-successional and Riparian Reserves

Desired future conditions for Late-Successional and Riparian Reserves are described in detail within the LSRA. The LSRA describes stand selection criteria and treatment recommendations needed to attain desired stand conditions. Depending upon the effectiveness of initial treatments, future treatments may be implemented to reach desired stand characteristics more rapidly.

Desired future conditions of the Late-Successional Reserves can be achieved by applying various management treatments to restore and maintain important Late-Successional Reserve attributes. These attributes include: canopy complexity, variability in tree size and spacing, vegetative species diversity and structural characteristics, and course wood debris and snags. Stand management to obtain Late-Successional Reserve attributes needs to focus on early and mid-seral forest stands. The LSRA (pp. 77-86) describes the silvicultural actions for attainment of late-successional habitat conditions in density management stands. Silviculture treatments of plantations and thinned stands can accelerate the development of young stands into multi-layered stands with large trees, structural diversity, and diverse plant species (see Chart 2-1). Management treatments within Riparian Reserves would be similar to management treatments implemented in Late-Successional Reserves, focusing on recruitment of snags and course wood debris, promoting vegetative diversity, and increasing structural diversity within the reserve system.

The LSRA identifies average values for snags and course wood debris abundance in naturally regenerated stands (LSRA pp. 28-31, Tables 8 through 11). Table 4-4 summarizes that information. As can be seen from Table 4-4, the average amount of course wood debris in natural mid-seral forest stands is estimated at 1,102 cubic feet per acre.

Stand management within the reserve system (whether needing artificial reforestation and/or subsequent maintenance or release treatments to more rapidly reach late-successional conditions, or to protect site quality) would benefit terrestrial wildlife that are dependent on late-successional or old-growth ecosystems. There are currently approximately 18,200 acres of Late-Successional and Riparian Reserves (Table 2-4) in the watershed that are currently not in a late-successional or old-growth condition, but are capable of developing into those conditions. Functional habitat as described above for late-successional related species is more important than stand age. Through density management, functional habitat (i.e. larger trees with larger limbs and deeper crowns) will be initially started in these mid seral stands within ten years as shown in Chart 2-1.

Table 4-4 Structural Components of Naturally Regenerated Douglas-fir Forests

Structural Component		Young (40-80 yrs)	Mature (80-195 yrs)	Old Growth (195+ yrs)
Downed Wood (>4 in. dia. at the large end; all decay classes)		1,102 cu. ft./ac. (525-1,979)	1,731 cu. ft./ac. (300-3,162)	3,262 cu. ft./ac. (1,382-5,141)
Snags (>4 in. diameter and > 4 ft. tall)	**20+ in. diameter**	7 per ac. (3-31)	7 per ac. (0-14)	7 per ac. (4-10)
	20+ in. dia. and 16+ ft. tall	2 per ac. (0-4)	2 per ac. (0-7)	3 per ac. (2-6)
	< 20 in. dia.	48 per ac. (26-70)	53 per ac. (1-105)	17 per ac. (14-20)

Figure 4-1 Northern Spotted Owl Residual Habitat Areas and Designated Critical Habitat

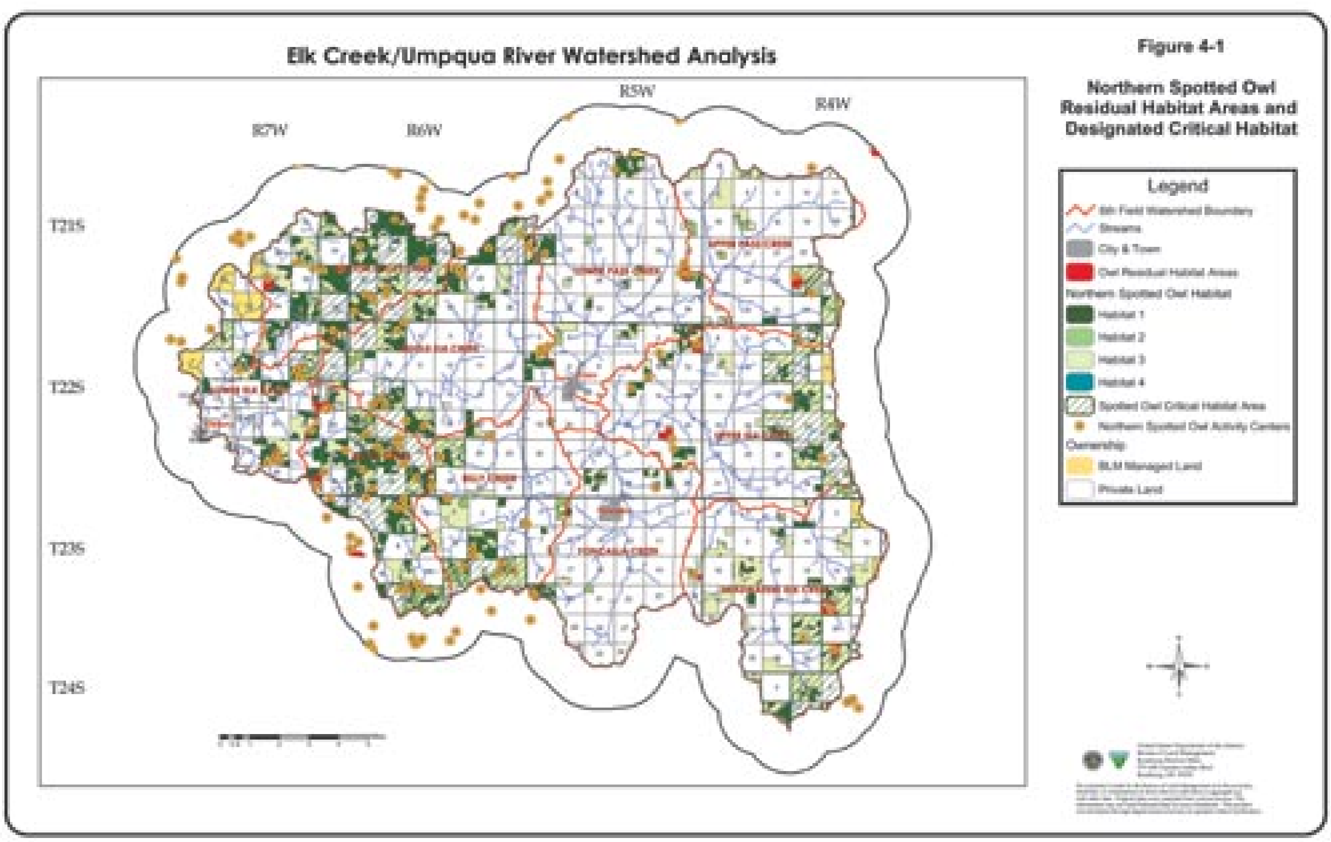
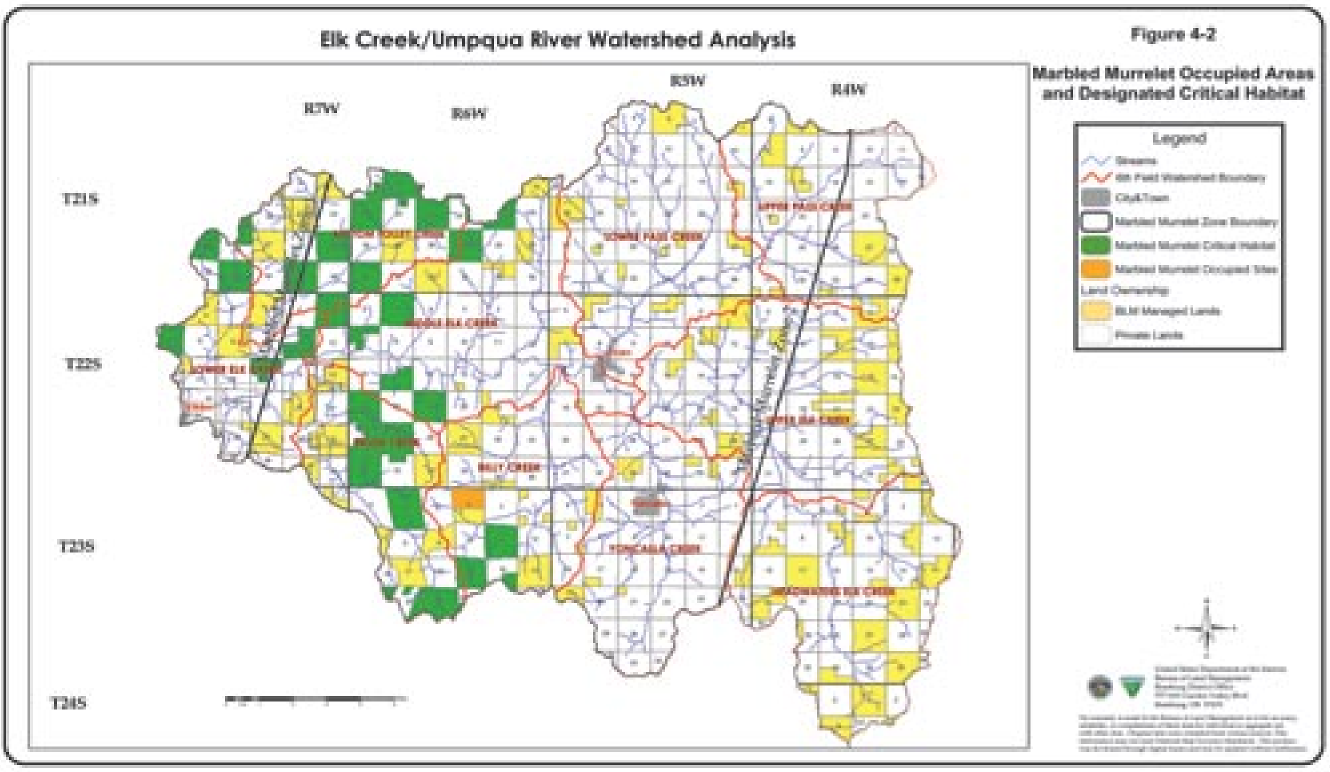


Figure 4-2 Marbled Murrelet Occupied Areas and Designated Critical Habitat



5. Geology and Soils

A. Landslides Summary, Trends With Land Management

Distinct differences in landslide types, frequency, distribution, and effects can be attributed to the varied geomorphology in Elk Creek. A more detailed discussion of the subject and definitions is given in the GEOLOGY AND SOILS APPENDIX. Approximately ninety-two percent of the Elk Creek Watershed is part of the Coast Range geomorphic province. Eight percent along the eastern border of the watershed is part of the Cascade geomorphic province (see Figure 5-1). The Coast Range portion is dominated by the Tyee and Umpqua Formation sandstones and siltstones which have a relatively high frequency of debris avalanches on slopes steeper than 65 percent and debris flows that initiate in confined stream channels with gradients steeper than 35 percent. Debris flows can scour large volumes of earth, rock fragments, and woody debris from upslope stream channels and deliver these materials long distances to the lower gradient streams below. Some have exceeded one mile in length including one that originated in a tributary of the North Fork of Big Tom Folley during the heavy rains of 1996/1997. Widely scattered, infrequent slumps and earth flows occur on the moderate slopes (30 to 60 percent). Earth flows are usually much wider and deeper than debris flows but they have considerably less reach than most debris flows and do not always directly impact stream channels.

In the Siletz River Formation volcanics of the Coast Range and the Colestin Formation volcanics of the Cascades, the average slope steepness is less than that of the Tyee and Umpqua Formations and much of the drainage patterns and topographic features are distinctly different. These differences result in fewer debris avalanches and more slumps and earth flows than in the Tyee and Umpqua Formations. Debris flows appear to be infrequent in these formations.

The aerial photo landslide inventories and field data reveal trends in landslides associated with natural forests, roads and timber harvest over the past 50 years. In general, the main factors effecting landslide occurrence and magnitudes are forest age classes, precipitation levels and storm intensities. Higher concentrations of landslides and large, highly impacting landslides, including debris flows, have been observed under forest canopies. This is especially true on aerial photos taken after the December 1964 flood event, winter of 1996/1997, and several other large storm events. At the watershed scale within forests relatively undisturbed by humans, the short-term effects of landslides to streams are confined to relatively few areas. Landslides and debris flows remove fine sediment, rock fragments (from gravels to boulders), and woody debris from the upslopes and small steep-graded stream channels. These materials are delivered to the larger low-gradient streams. The effects of delivered fines are usually short-term due to the flushing to transport capabilities of most streams. High stream flows move these materials through lower gradient deposition zones. These areas would have otherwise become depleted over time as these materials decayed or moved further down the stream system. The long-term effect is better stream structure for fish habitat.

Timber harvesting and road construction over the past 50 years have substantially increased the frequency and distribution of landslides above natural levels in the Elk Creek Watershed. Chart 5-2 and Chart 5-3 illustrate the changing magnitudes of landslides over the past 50 years and their relationship to management activities in the adjacent Upper Umpqua watershed. This watershed is also similarly dominated by the Tyee formation. At this time for Elk Creek the only available information of landslide frequency and distribution is for the period of 1989 to 1999 (Chart 5-4). However, the 50-year trends in Elk Creek should be similar to those of Upper Umpqua.

Landslide studies largely support that clearcut timber harvesting and road building practices of the past increased the degree of landslide occurrence. In 1977, Swanson found an increase in the landslide erosion rate (volume of material moved) by a factor of 1.9 going from unmanaged forest to clear-cuts in most land types in the Mapleton Ranger District. The factor increased to 4.0 in the most prone landslide type. A Ketcheson field study of a small watershed unaffected by roads found a 3.7 times increase in clear-cuts over undisturbed forest. In the Oregon Coast Range, Dryness (1967) found that 72 percent of landslides greater than 100 cubic yards that occurred during the 1964-65 season were road related. The ODF 1996 storms study found differences in landslide frequency according to forest age grouping. Landslide frequencies were highest in the 0 to 9 year age class followed by the mature forest class (100 years +) and lowest in the 10 to 30 and 30 to 100 year age classes. Tree spacing may account for the differences in landslide frequencies between the 30 to 100 year age class and the 100 year + age class (ODF Issue Paper 2001). This may be due to the reinforcement of soils by roots and the capture of precipitation by forest canopy.

Chart 5-2 and Chart 5-3 indicate an overall downward trend in landslide incidence over the past 50 years that is associated with improved management practices. Fluctuations in this downward trend are due to variations in weather and levels of management activity. Landslide trends associated with roads have declined dramatically due to many of the Best Management Practices. The rate of harvest-related landslides has declined to a lesser degree. Because of Best Management Practices with timber harvest and road building under the Northwest Forest Plan, landslides on BLM-administered lands are expected to continue to decline. Future landslides, mostly during large storm events on BLM lands, are expected to deliver large wood and rock fragments to lower-gradient streams because of BLM riparian reserves. These events would more closely resemble landslides within relatively unmanaged forests (see GEOLOGY AND SOILS APPENDIX for greater detail).

B. Landslide Sediment Sources, Potential Thinning Areas

Within Elk Creek about 27,000 acres (about 15 percent of its area) are on slopes greater than 65 percent. A high percentage of these slopes are potentially unstable. Some are known to be unstable. Within the 10,700 acres of mid seral forests on BLM lands with potential to be thinned (Table 8-1), about 1,000 acres are on slopes greater than 65 percent. Of this, about 700 acres are estimated to be potentially unstable and about 50 acres are unstable based on on-site knowledge of similar ground. It is estimated that 200 to 400 acres of the total area with slopes 30 to 65 percent have the potential for slump and earth flow movements.

Within the 700 acres of mid seral forests with the potential to be thinned that is on potentially unstable ground, the landslide magnitudes and frequencies are greatly reduced compared to their early seral stage that followed clearcut harvesting. This conclusion is based on the following:

- Forest canopy coverage for unthinned mid seral stands are typically 80 to 100 percent. Root coverage closely matches that of the canopy. The canopy intercepts rain and root mass reinforces the soil.
- Field observations by the Swiftwater soil scientist in numerous proposed thin units in mid-seral forest stands revealed low incidences of landslides.
- Landslides could not be detected in the proposed harvest units using the 1994 and 1999 aerial photos (from landslide inventory).
- Landslide frequencies in mid seral stands were substantially fewer than in young clearcuts during the 1996 storm events (ODF Issue Paper 2001).

C. Roads

Roads have been shown to be a major source of human-caused sediment within a watershed. The following focuses on the overall road system and BLM's contribution to road-related sediment within Elk Creek. Table 5-1 summarizes the miles of road within Elk Creek by subwatershed. Chart 5-1 summarizes roads within the entire Elk Creek watershed by key landowners. It includes BLM road miles that have been treated or decommissioned to lower the risk of landslides or reduce sediment. The table and chart also identify BLM roads that currently are higher risk of landslides or sedimentation and in need of correction. Table 5-2 shows the estimated miles of BLM roads that are asphalted, rocked, and naturally surfaced.

Chronic sedimentation from roads can have an impact to aquatic habitat and species. SEDMODL, a Boise Cascade Road Erosion/Delivery Model, was used to estimate and compare relative background and road-related chronic sedimentation rates within Elk Creek (see GEOLOGY AND SOILS APPENDIX for greater detail). Based on the model, overall background chronic sedimentation (from natural sources such as soil creep) is estimated at approximately 13,000 tons per year. This is contrasted to the model predictions of BLM roads contributing approximately 560 tons per year (about 4 percent of background). If the sediment rates on BLM roads, as projected by SEDMODL, were applied to state/county and private roads, state/county roads contribute approximately 750 tons per year (about 6 percent of background) and private roads contribute approximately 1,360 tons per year (about 10 percent of background).

A review was completed by the soil scientist and engineers to identify BLM roads with the highest risk of landslides. There is approximately one stream/road culvert or cross drain per mile on these roads. The volume of fill covering these crossings for the highest risk roads is estimated at 450 tons. A number of these fills may be at risk of failure primarily from culvert deterioration and/or inadequate culvert size. Upland landslides can be one of the sources of debris for plugging these culverts. The risks would be highest during large storm events. Some of these fill failures would have the potential to initiate debris flows. The debris flows produce additional sediment (as high as 300 percent additional sediment – Upper & Middle Smith River II Restoration and Rehabilitation EA, p. 25). Road fill and sidecast material of varying stability exist along some of these same roads. Failures are possible, especially if drainage gets diverted. These failures are capable of delivering large amounts of sediment to streams and in some instances, capable of generating debris flows.

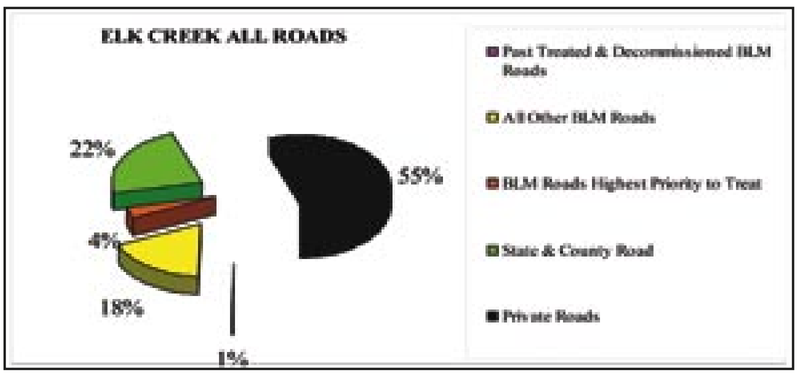
As shown in Chart 5-2 and Chart 5-3, sediment production and landslide risks from the BLM and BLM-private shared roads will likely continue to decline as road drainage issues and surfacing problems are corrected. The Management Opportunities section identifies about 52 miles of BLM-controlled roads that are candidates for treatments to reduce their risks. Treatment of these roads would have the greatest effect at reducing BLM's management-related contributions of sediment in the watershed.

In past watershed analyses, road densities have been used as an indictor of watershed health. However, legal restrictions on roads in the checkerboard public/private landownership of Elk Creek make it prohibitive to reduce road densities sufficient to make measurable changes at the fifth-field watershed scale or at the sixth-field subwatershed scale. Using the BLM roads proposed for decommissioning, the projected change in road densities is displayed in Table 5-3. This shows that the potential changes in road densities are not a good indication of projected watershed health.

Table 5-1 Miles of Road Categories within Elk Creek

Subwatershed	BLM Road Corrections Since 1995		BLM Roads	Miles of Road by Major Landowner			TOTAL ROAD
	Treated	Decommissioned	Highest Priority to Treat	BLM	State & County	Private	Miles
Big Tom Folley Creek	3.4	2.1	8.3	43	21	23	87
Billy Creek	0.5		8.0	37	27	62	126
Brush Creek		0.2	7.2	42	19	23	84
Headwaters Elk Creek			7.9	62	29	58	149
Lower Elk Creek			8.3	36	26	43	105
Lower Pass Creek			0.5	12	33	181	226
Middle Elk Creek		0.4	7.0	33	50	93	176
Upper Elk Creek		0.7	2.5	33	40	136	209
Upper Pass Creek		2.4	0.2	14	35	110	159
Yoncalla Creek			2.3	9	50	84	143
TOTAL	**3.9**	**5.8**	**52**	**321**	**330**	**813**	**1,464**

Chart 5-1 Elk Creek Road Categories



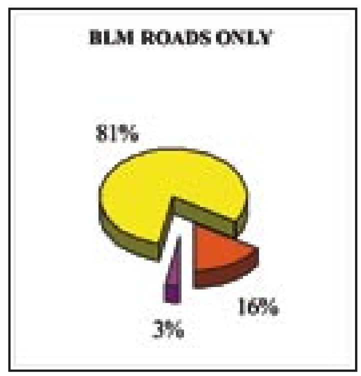


Table 5-2 Total Miles of BLM Road Surfacing Categories

Subwatershed	TOTAL BLM ROADS, SURFACE TYPES		
	Natural	Rocked	Paved
Big Tom Folley Creek	12.9	26.2	4.0
Billy Creek	12.3	25.1	0.0
Brush Creek	4.2	37.7	0.0
Headwaters Elk Creek	15.7	46.0	0.0
Lower Elk Creek	16.7	18.2	1.2
Lower Pass Creek	0.8	10.8	0.5
Middle Elk Creek	9.1	22.1	1.6
Upper Elk Creek	4.8	28.0	0.0
Upper Pass Creek	4.5	9.9	0.0
Yoncalla Creek	1.3	8.0	0.2
TOTAL	**82**	**232**	**8**

Table 5-3 Road Densities Before and After Proposed Road Decommissioning

Subwatershed	Current Road Density Miles per Mile²	Total Watershed Road Miles	BLM Proposed Road Improvement Existing Miles	BLM Proposed Road Decommission Existing Miles	Road Density After Proposed Decommission Miles per Mile²
Big Tom Folley Creek	3.9	87	5.1	3.2	3.8
Billy Creek	4.9	126	7.0	1.0	4.9
Brush Creek	4.0	84	6.7	0.5	4.0
Headwaters Elk Creek	4.2	149	5.5	2.4	4.1
Lower Elk Creek	5.3	105	8.3		5.3
Lower Pass Creek	6.4	226	0.5		6.4
Middle Elk Creek	4.7	176	7.0		4.7
Upper Elk Creek	5.4	209	2.2	0.3	5.3
Upper Pass Creek	5.9	159	0.1	0.1	5.9
Yoncalla Creek	5.0	143	2.3		5.0
AVERAGE/TOTAL	**5.0**	**1464**	**45**	**8**	**5.0**

Chart 5-2 Size Class Chronology of Landslides in Coast Range Predominant with Tyee Formation Geology[1]

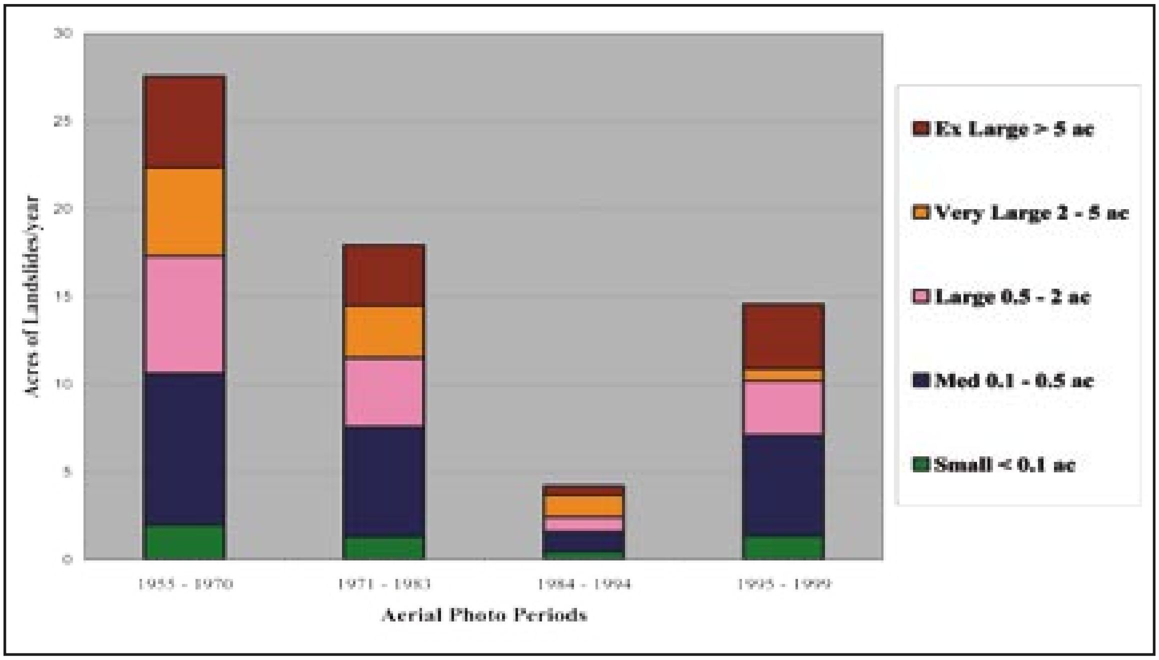


Chart 5-3 Chronology of Landslide and Management Relationships in Radar-Wolf, Cougar and Hubbard Creek Subwatersheds[1]

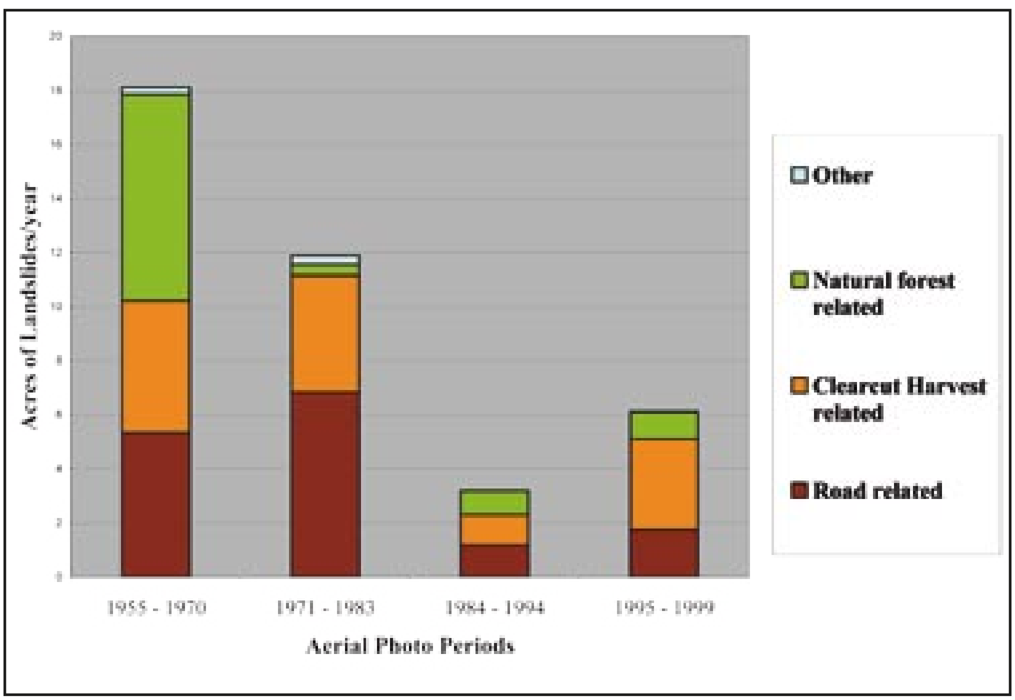


Chart 5-4 Landslide-Management Relationships in Six Elk Creek Subwatersheds[1]

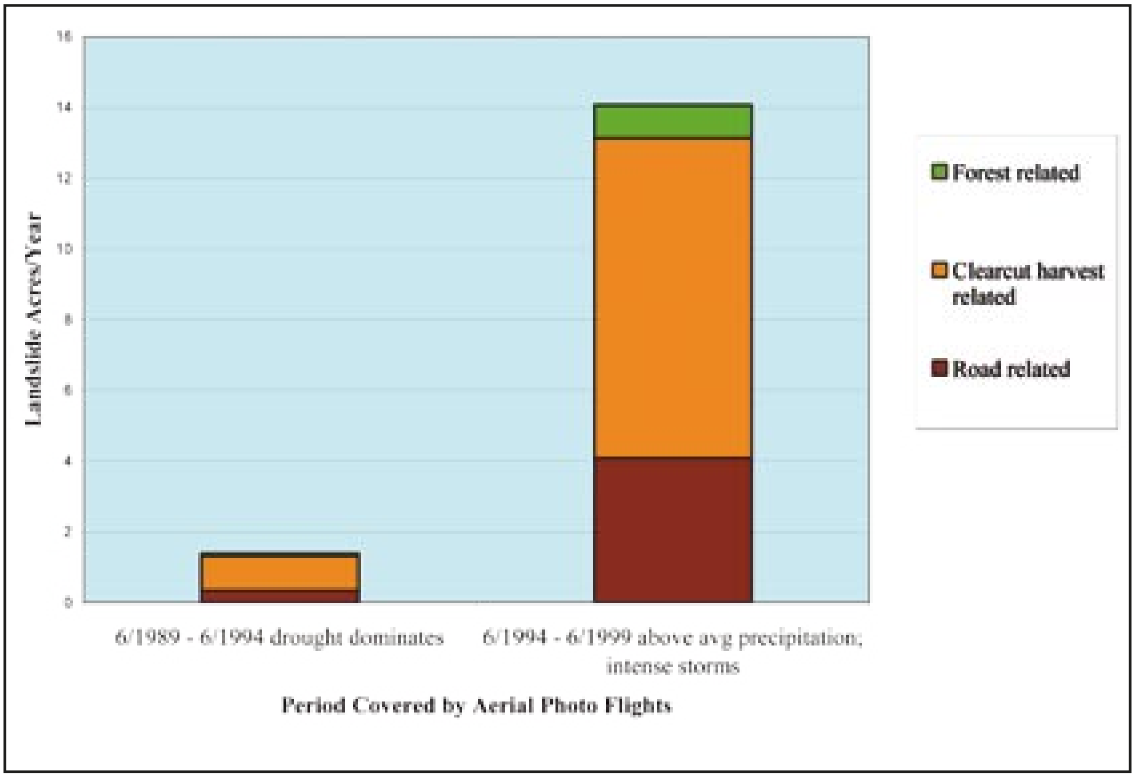
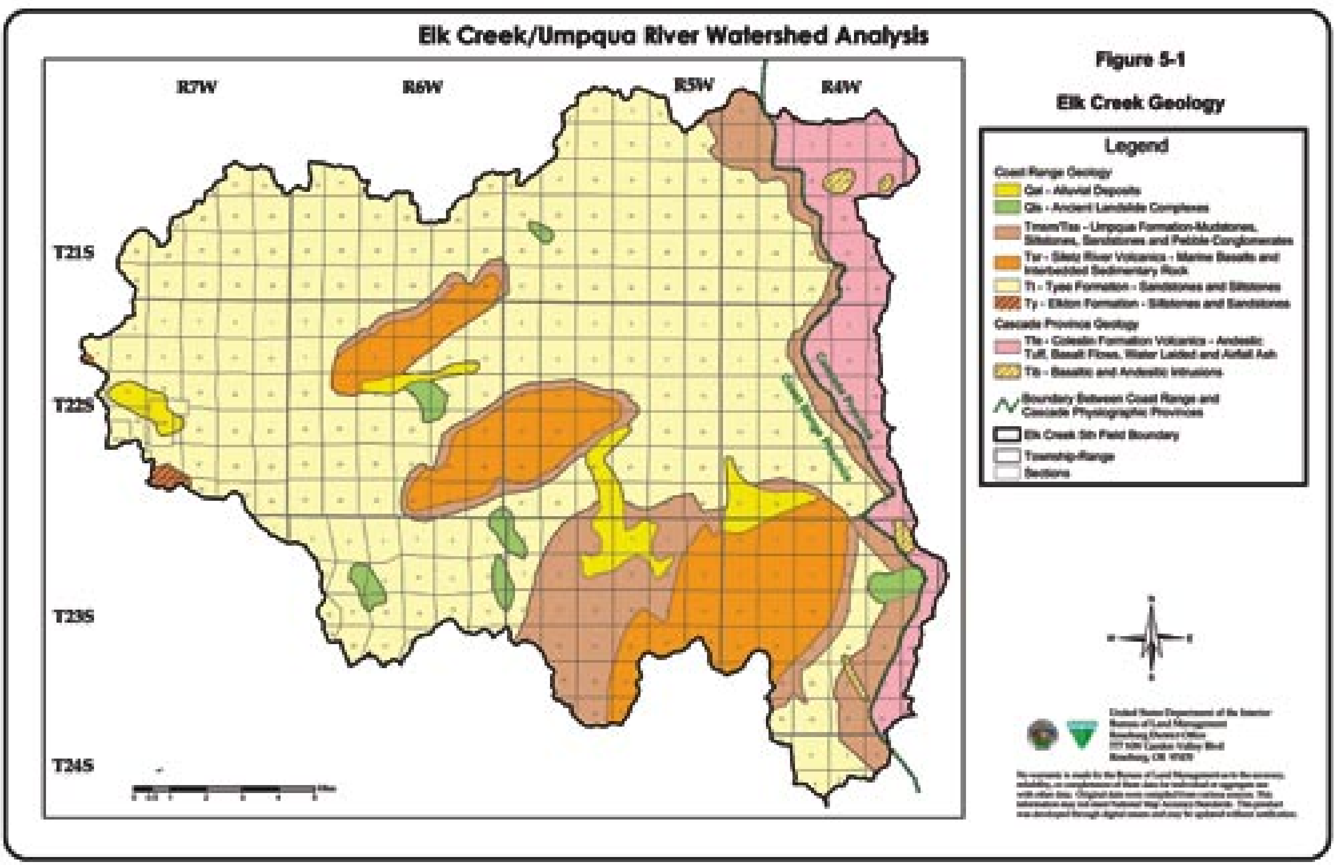
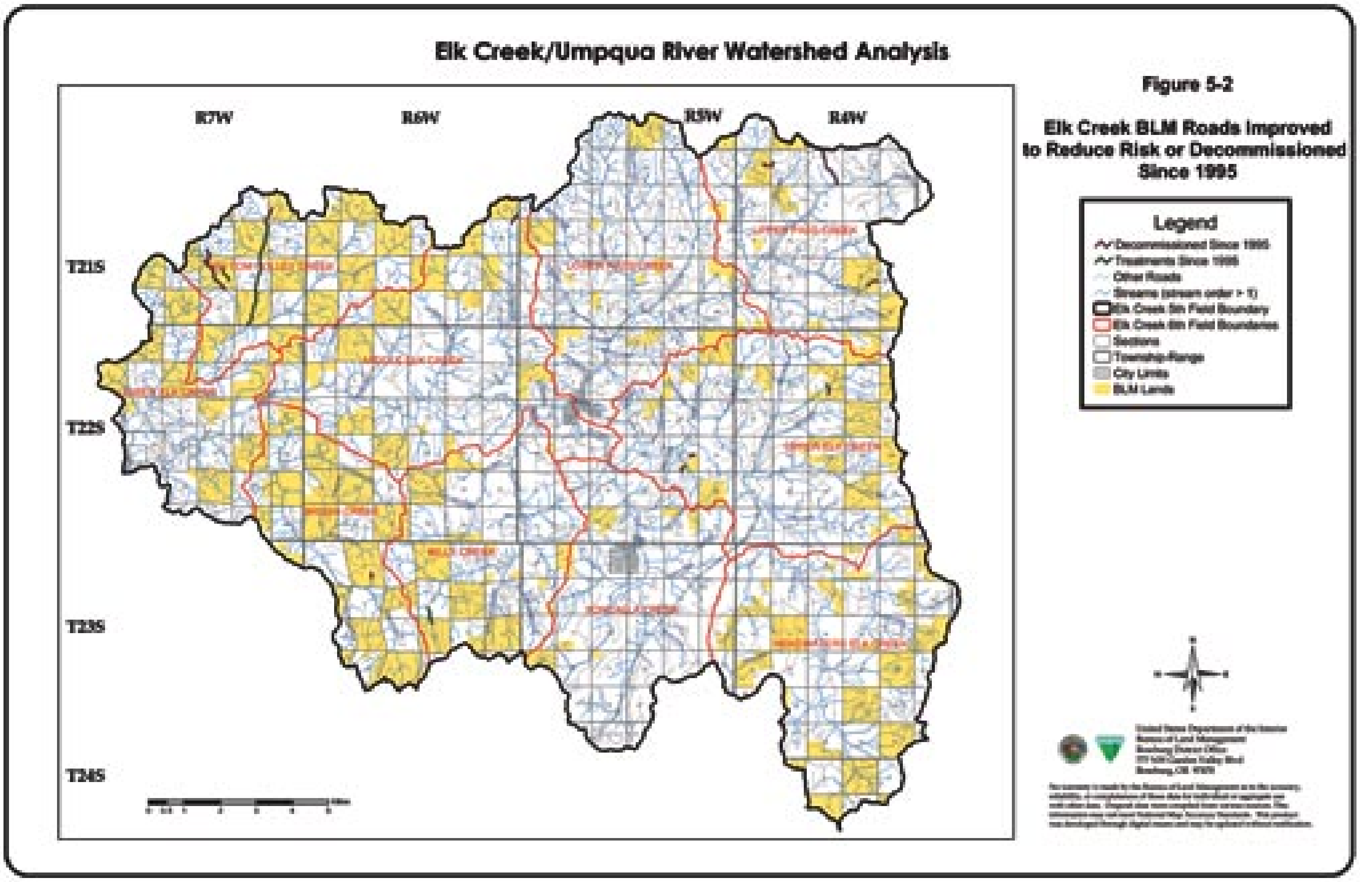


Figure 5-1 Elk Creek Geology



[1] See Limitations of Landslide Inventory in the Geology and Soils Appendix

Figure 5-2 Elk Creek BLM Roads Improved to Reduce Risk or Decommissioned Since 1995



6. Hydrology and Water Quality

A. Elk Creek Hydrologic Characteristics

The Elk Creek watershed drains about 290 square miles of land. The eastern boundary of this watershed extends to the lower Cascades which forms the headwaters of Elk Creek. The western boundary of this watershed is at the confluence of Elk Creek with the Umpqua River near the town of Elkton. As shown in Figure 1-1, most of the floodplain areas are in private ownership and have been converted to agriculture or other uses. BLM has little influence on floodplain conditions or management except within the Big Tom Folley and Brush Creek subwatersheds.

Of the major tributaries within the Elk Creek watershed, Big Tom Folley and Brush Creek are the largest sixth order streams. A break down of stream miles and their location within Elk Creek is shown in Table 7-3 and Figure 1-2.

The Elk Creek Watershed has a Mediterranean type of climate, characterized by cool, wet winters and hot, dry summers. Differences in temperatures and precipitation vary throughout the watershed depending on the topographic position and aspect. The upper elevations of the watershed receive as much as 60 inches of precipitation. The average annual precipitation at Elkton is 53 inches, with approximately 85 percent of the precipitation occurring from October to April. Precipitation occurs mostly as rainfall since little of the watershed is above 2000 feet. As a result, stream flow is characterized by rainfall driven hydrographs.

B. Water Quality

1. 303(d) Listed Parameters

As of 2002, Elk Creek, Brush Creek, Big Tom Folley Creek, and the North Fork of Big Tom Folley Creek have been placed on the Oregon 303(d) list due to documented violations of water quality standards (Figure 6-1). Elk Creek is listed for summer temperature, dissolved oxygen, and fecal coliform bacteria. Brush Creek, Big Tom Folley Creek, and the North Fork of Big Tom Folley are listed only for summer temperature. The affected beneficial uses are resident fish and aquatic life, salmonid fish spawning and rearing, and water contact recreation.

Listing criteria for bacteria require that the geometric mean of fecal coliform bacteria not exceed "200 per 100 milliliters with no more than 10 percent of the samples exceeding 400." This listing is most likely related to failed septic systems, sewage treatment practices, and agricultural grazing practices. BLM has no control over these sources of bacteria. Thus, this parameter is not discussed further.

2. Stream Temperatures – Natural and Management Influences and Future Trends

Stream temperatures vary naturally depending on geographic location and elevation. Temperatures also fluctuate naturally over time with variations in climate and precipitation. A stream temperature study of Elk Creek was conducted in 1998 by the Umpqua Basin Watershed Council. A key part of this study found that at 3-12 miles from the source of Elk Creek, stream temperature increased at a rate of +0.7 degrees Celsius per mile. At 12-45 miles from the source, the maximum stream temperature remained relatively constant at around 28 degrees Celsius. This pattern suggests that there may be a threshold value for the minimum of the seasonal maximum temperatures that is directly related to the distance from the source and limits the amount that the seasonal maximum temperature can be lowered. Stream temperatures are influenced by current practices on private forest, agricultural, and residential properties. Because the majority of the riparian forests within BLM-administered portions of the Riparian Reserves provide adequate shade from mid-to-late seral stage forests, BLM's riparian forest management is not expected to greatly influence changes in future stream temperatures. One of the BLM's objectives for managing Riparian Reserves is to maintain and enhance shade providing vegetation along streams.

3. Flow Modification

Changes in flows can include consumptive withdrawals, flow regulation at storage dams, and the effects of land-use activities on storm water runoff, infiltration, storage and delivery. Commercial and domestic withdrawals are common along Elk Creek.

About 3,000 acres (<2 percent) of Transient Snow Zone (TSZ), areas with elevations greater than 2,000 feet, are located in Elk Creek. Because of the small amount of this area, peak flows should not be affected by changes in canopy conditions due to timber harvest within the Transient Snow Zone.

A GIS and remote sensing analysis for the Elk Creek fifth-field watershed determined that Equivalent Clearcut Area (ECA) for the watershed is approximately twenty percent (Table 2-1). However, the Equivalent Clearcut Area method is inappropriate for use as an indicator of disturbance history for this watershed because it was developed for watersheds where rain-on-snow and snowmelt processes are the predominant processes for water yield. A very low percentage of the Elk Creek watershed is in the elevation bands where rain-on-snow events or snowmelt processes are the predominant processes for water yield. A detailed discussion about why Equivalent Clearcut Area is not a proper method for determining changes in stream flow events is discussed in the HYDROLOGY APPENDIX.

Although seventh-field tributary stream flows have not been gauged, there is evidence that previous management has heavily influenced stream channels throughout the Elk Creek watershed. Most third and fourth-order streams in the watershed show evidence of recent bank scour, widening and degradation (downgrading). This trend may be due in part to elevated peak flows. Increased peak flows can cause changes in physical stream dimensions, geomorphology, and microhabitat characteristics. Mechanisms that may alter flows include: loss of vegetative cover, compaction of soils due to the roads and skid trails, conversion of sub-surface flow to surface flow by road cut-banks, and the extension of the stream network by road ditch lines and culverts (Coffin and Harr 1992, Jones and Grant 1996, King and Tennyson 1971, Megahan, 1971, Wemple, et. al. 1996). BLM forest management in Elk Creek would be designed under the RMP Best Management Practices to reduce or prevent watershed impacts such as altered stream flows.

Many tributaries within Elk Creek have also been cleaned and/or salvage logged. Because the effects of cleaning and salvage logging operations are difficult to separate from the effects of elevated peak flows, it is difficult to quantify the extent to which elevated peak flows have impacted instream or off-channel habitat.

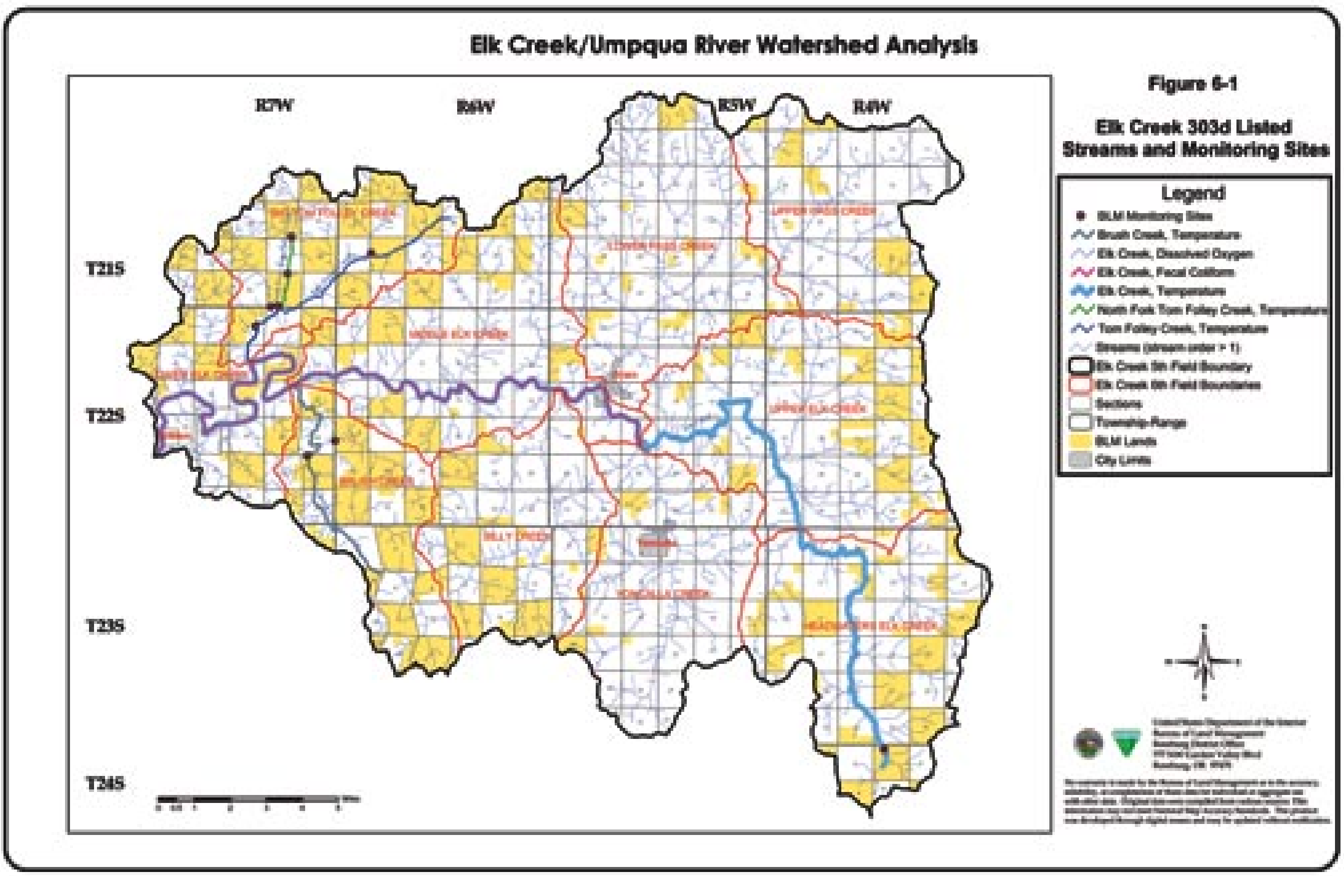
With Best Management Practices to be implemented under the Northwest Forest Plan, future land management actions are likely to have less of an impact on peak flows than historical practices. Relationships between road densities, harvest activities and stream flows are generally complicated and difficult to characterize. A general discussion of stream flow changes as a result of forest management can be found in the HYDROLOGY APPENDIX.

4. BLM Commitments to Monitoring and Water Quality

Figure 6-1 shows where BLM has conducted monitoring in the past. The Roseburg BLM District has developed a district monitoring strategy to guide methods to answer RMP monitoring questions in the future.

The Roseburg District BLM has a Memorandum of Understanding with the City of Drain for the Bear Creek Municipal Watershed. This includes the entire Bear Lake and Bear Creek Drainages, comprising about 2,880 and 1,420 acres respectively. The objective of this agreement is to maintain the best water quality for the City of Drain Water System via Best Management Practices to control non-point sources of pollution. The system provides domestic water for approximately 1,200 users near Drain. The source of water is Bear, Allen, and Lost Cabin Creeks.

Figure 6-1 Elk Creek 303d Listed Streams and Monitoring Sites



7. Aquatic Habitat and Associated Species

A. Aquatic Species, Presence and Distribution

1. Fish Distribution

Figure 7-1 shows fish distribution by stream name within Elk Creek. This map is based on the most current stream surveys as compiled by the Oregon Department of Fish and Wildlife, and on the visual presence/absence surveys conducted by BLM Fisheries Biologists. Fish species present within Elk Creek are shown in Table 15-1. This information is based on fish caught in rotary screw traps operated in Big Tom Folley and by incidental observations by BLM personnel during stream surveys within the watershed.

Elk Creek and its tributaries contain spawning and rearing habitat for low-to-mid water velocity dependant fish species. These include coho salmon, chinook salmon (rearing), steelhead trout, cutthroat trout, pacific lamprey, and resident non-game fish species (dace and sculpin). These tributaries are important in the overall high production rates for these species.

2. Listed Fish Species

NOAA Fisheries (NOAAF) (formerly National Marine Fisheries Service) designated the **Oregon Coast coho salmon** (*Oncorhynchus kisutch*) Evolutionary Significant Unit (ESU) as a threatened species on August 10, 1998 (FR 63 (153). The listed status was set aside by the order of Judge Michael Hogan of the United States District Court for the District of Oregon in September, 2001. In review of Judge Hogan's ruling, the Ninth Circuit Court of Appeals issued a stay in December, 2001. However in February of 2004, the Ninth Circuit Court of Appeals upheld Judge Hogan's ruling. The current listing status of the Oregon Coast coho under the Endangered Species Act (ESA) is unclear. NOAAF has indicated that until conclusion of the Ninth Circuit Court of Appeals review, there is no legal protection for coho salmon under the ESA.

On August 9, 1996, NOAAF listed the **Umpqua River cutthroat trout** (*Oncorhynchus clarki clarki*) as endangered (FR 61:41514) and then delisted the species on April 19, 2000. On April 5, 2000 (FR 64 (64)) NOAAF listed the Umpqua River cutthroat trout as a candidate species under the ESA and transferred jurisdiction on any final listings and responsibilities for consultation to the U.S Fish and Wildlife Service (FR 65 (78)).

NOAAF proposed the **Oregon Coast steelhead** (*Oncorhynchus mykiss*) for listing as a candidate species for threatened species designation under the ESA on March 19, 1998 (FR 63 (53)).

Other Special Status fish species have been listed in the AQUATIC HABITAT APPENDIX.

3. Essential Fish Habitat

The Magnuson-Stevens Fishery Conservation and Management Act (MSA) requires federal action agencies to consult with the Secretary of Commerce via the National Marine Fisheries Service regarding any action or proposed action authorized, funded, or undertaken by the agency that may adversely affect Essential Fish Habitat (EFH) identified under the MSA. The Magnuson-Stevens Act defines adverse effects as any impact, which reduces the quality and/or quantity of essential fish habitat. Adverse effects include direct, indirect, site-specific or habitat-wide impacts, including individual, cumulative or synergistic consequences of actions. Essential Fish Habitat is habitat that is currently available or was historically available to Oregon Coast coho or Chinook salmon. For planning purposes, Figure 7-1 indicates current habitat associated with anadromous salmonids appropriate for initial Essential Fish Habitat determinations.

B. Aquatic Habitat, Current and Historical Perspectives

1. Survey Data Related to Stream Reaches

Oregon Department of Fish and Wildlife (ODFW) habitat surveys have been conducted throughout Elk Creek mostly in the third through sixth-order streams. It is within these larger streams that the habitat is most prevalent for spawning and as nurseries for the larger fish species such as salmon and trout (salmonid) species.

Between 1991 and 1997, the Oregon Department of Fish and Wildlife, through the Umpqua Basin Watershed Council, conducted aquatic habitat surveys for fish-bearing streams within Elk Creek. Table 7-3 compares stream miles in categories important to fish within the Elk Creek by subwatershed with stream miles surveyed by ODFW. Figure 7-1 shows where ODFW-surveyed streams occur within Elk Creek. These surveys capture most of the important fish-rearing and spawning habitat within the Elk Creek watershed tributaries.

Six percent stream gradient was used as a maximum indicator for the presence of salmonid spawning and rearing habitat within the Elk Creek watershed. This was assessed through review of various literature, observations of BLM and ODFW fisheries biologist, and analysis of water velocity as a component of water volume, stream width, depth, sediment, and gradient. The higher proportion of potential fisheries habitat resides within the fourth to sixth-order streams.

The most dominant species of fish within the watershed are the salmonids. The various salmonid life cycles within the Elk Creek are noted in AQUATIC HABITAT APPENDIX, Table 13-4. Due to the diverse habitat requirements of the salmonid life cycle, the presence, absence and diversity of these species within the watershed provides a dynamic indicator of the health of the aquatic habitat.

A typical life cycle of an anadromous salmonid consists of several stages, each with different habitat requirements. Habitat features that affect migrating salmonids are water depths and velocities; water quality; cover from predators; and full or partial barriers. Substrate composition, cover, water quality, and water quantity are important habitat elements for salmonids before and during spawning. Important elements for rearing habitat for newly emerged fry and juvenile salmonids are quantity and quality of suitable habitat (overhanging vegetation, undercut banks, submerged boulders and vegetation, etc.); abundance and composition of food (primarily macro-invertebrates); and water temperature.

2. Historical Stream/Riparian Enhancement Projects

Within Elk Creek, stream and riparian enhancement projects have been especially focused in the Brush Creek subwatershed in the mid-to-late 1990's. Road improvement, culvert replacement and road decommission activities have also been completed over the last several decades. Although these activities provide functional enhancements to the riparian system through reduction in sediment (fines) inputs and improving fish passage and habitat, many of these projects were not previously identified as stream enhancement projects. The following information is a compilation of the known enhancement projects.

Brush and Thistleburn Creeks - Several instream projects inclusive of up-stream V-weirs, log placements, cabled logs, rocks, and root wads were completed in collaboration with ODFW, Lone Rock Timber Co., and BLM 1993 through 2001. In 2001, Lone Rock Timber Co. placed full-length logs in Brush Creek within their lands. From 2000 through 2002, marked salmon fry were released in Brush Creek. In 2002, a record number of salmon spawned in Brush Creek. However, the amount of spawning salmon was lower in 2003 which may be more reflective of ocean conditions. The number of spawners per mile of stream was larger than Big Tom Folley. This may have been the result of instream habitat enhancement in Brush Creek from 1995 through 2000 (see AQUATIC HABITAT APPENDIX). Lone Rock Timber Company is a major landowner in Brush Creek. Since 1995, they have inventoried their roads and identified problem areas. These have been fixed so that they are in compliance with the Oregon Forest Practices Act.

Big Tom Folley Creek - instream projects, boulder and large log placements, are being planned and implemented on about 20 miles of publicly and privately owned streams. Since 2002, these projects have been and are being planned in collaboration with Seneca Jones Timber Co., ODFW, Umpqua Basin Watershed Council and BLM. In the 1970's and 1980's large wood in streams was considered a barrier for anadromous fish. Tractors were used to push out large wood to clean the stream of debris to open fish passage. As a result, much of Big Tom Folley is currently bedrock dominated.

The above projects were accomplished after the completion of ODFW Aquatic Habitat Surveys so that the analysis of the survey data will not include whatever habitat may have been created by the above projects.

3. Culvert Barriers to Aquatic Passage and Roads

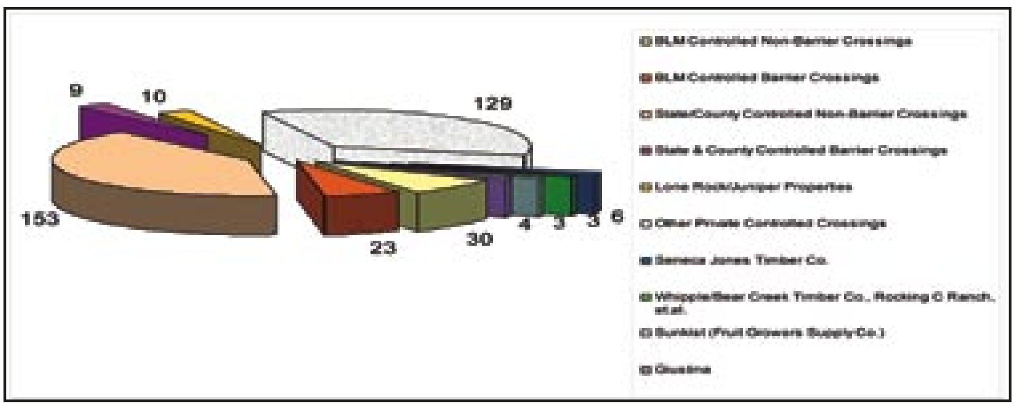
Various culvert conditions that can block fish passage may consist of one or more of the following: water velocity too great; water depth in culvert too shallow; no resting pool below culvert; and/or jump too high (Evans and Johnston 1980). In a joint study by The Oregon Department of Forestry and Oregon Department of Fish and Wildlife, it was determined that single vertical jumps of above 12 inches could be barriers to adult salmon and above 6 inches for juvenile salmonids.

Since 1995, approximately seven (7) BLM culverts have been replaced either because the culvert was old and failing or it was blocking fish passage. Within the BLM and State/County road system of the Elk Creek watershed, approximately 23 culverts for BLM and nine culverts for State/County have been identified as restricting access to anadromous fisheries habitat (Table 7-1). Figure 7-2 shows the location of these culverts and the low gradient (≤ 6 percent) stream reaches upstream from the barriers. Three culverts (Ward Creek and two Cox Creek culverts) have been funded to be replaced in the summer of 2004. These culverts would open about three miles of fish habitat upstream. In total, the fish barrier culverts within the watershed restrict access to approximately 34 miles (Table 7-1) of potential fish habitat (third-order and greater streams). In addition Chart 7-1 shows the number of fish stream/road crossings by major landowner which could be potential barriers. This could be a communication tool for watershed councils and landowners to begin finding important fish barriers.

Table 7-1 Known Culvert Barriers by Subwatershed and Potential Fish Habitat Above

Subwatersheds	# of Known BLM Culvert Barriers	# of Known State & County Culvert Barriers	Miles of Habitat Above BLM Culvert Barriers	Miles of Habitat Above State & County Culvert Barriers	Miles of Habitat Above Culvert Barriers
Big Tom Folley Creek	0	0	0.0	0.0	0.0
Billy Creek	3	0	0.7	0.0	0.7
Brush Creek	0	0	0.0	0.0	0.0
Headwaters Elk Creek	9	1	5.3	0.0	5.3
Lower Elk Creek	0	0	0.0	0.0	0.0
Lower Pass Creek	1	2	0.9	5.7	6.6
Middle Elk Creek	3	1	0.8	1.4	2.2
Upper Elk Creek	6	1	6.5	0.9	7.4
Upper Pass Creek	1	3	0.7	9.6	10.3
Yoncalla Creek	0	1	0.0	1.0	1.0
TOTAL	**23**	**9**	**14.9**	**18.6**	**33.5**

Chart 7-1 Number of Potential Fish Barriers by Major Landowner



The amount of roads within 200 feet of a stream has been used as an indicator of potential impact to stream/riparian health. The following Table 7-2 provides the amount of roads within 200 feet of a stream by major landowner category and by subwatershed. It also provides the amount of BLM road miles within 200 feet of stream by each subwatershed that BLM has identified as needing to be decommissioned or improved. This shows that 30 percent of streams in the watershed have roads within 200 feet of their banks. The decommissioning or improvement of the 31 miles of BLM roads within 200 feet of streams would not significantly change this percentage at the watershed or subwatershed scale.

Table 7-2 Road Miles within 200 Feet of Streams by Subwatershed

Subwatershed	Miles of BLM Roads Proposed for Decommission or Improvement within 200 feet of Streams	Estimated Total Miles of BLM Roads within 200 feet of Streams	Estimated Total Miles of State/ County Roads within 200 feet of Streams	Estimated Total Miles of Private Roads within 200 feet of Streams	Estimated Total Road Miles in Elk Creek Watershed within 200 feet of Streams	Total Miles of Stream
Big Tom Folley Creek	5.2	19	13	7	39	178
Billy Creek	5.8	20	15	26	60	188
Brush Creek	3.8	20	14	9	43	173
Headwaters Elk Creek	2.5	20	12	17	49	176
Lower Elk Creek	6.8	18	16	19	54	162
Lower Pass Creek	0.3	4	17	75	97	249
Middle Elk Creek	4.5	16	27	43	86	284
Upper Elk Creek	1.7	13	22	58	93	258
Upper Pass Creek	0.1	4	19	35	58	240
Yoncalla Creek	0.6	7	24	35	66	174
TOTAL	**31**	**140**	**179**	**324**	**645**	**2,082**

C. Aquatic Habitat Assessment

1. Habitat Analysis Key Components Description

Because many of the riparian plant communities and instream habitat within Elk Creek have been affected by past land-use practices, reference sites consisting of ecologically intact and functional aquatic-riparian systems were identified. Approximately 20 stream reference reaches in the Coast Range of the Umpqua Basin were used to compare against all surveyed streams. These relatively unmanaged reaches represent the variability of conditions within natural stream systems as well as characteristics desirable for a variety of fish species (including salmonid habitat). These stream reaches were selected based on the absence of roads within old-growth riparian areas, as well as lack of any other evidence of human disturbance.

In order to determine the extent of disturbance and/or degradation, the ODFW Aquatic Habitat Survey data was statistically summarized by subwatershed and compared to the relatively unmanaged reaches using the following habitat indicators:
- ➢ percent sand, silt, and organics (fines)
- ➢ percent sand, silt, and organics in riffles (embeddedness)
- ➢ cubic meters of wood volume per 100 meters

2. Subwatershed Instream Habitat Comparisons to Reference Reach Conditions

a) Riparian and Instream Woody Debris and Recruitment Potential

Large woody debris is a key component of aquatic habitat. Large woody debris, especially trees that have fallen into the stream with root wads still anchored to the stream bank, provides physical structure that creates pools and undercut banks, deflects and breaks up stream flow, and stabilizes the stream channel. Although logjams sometimes block spawning migrations of adult salmon, debris usually aids migration by creating pools and cover where salmon can rest and conserve energy for spawning. By forming small dams, woody debris helps to prevent spawning gravels from washing downstream. For juveniles, the slack water around debris offers good opportunities for drift feeding, and debris provides essential cover from predators and from freshets of autumn and winter (Murphy and Meehan 1991). Large conifers are generally more resistant to rot and are preferable to hardwoods. This allows for a longer time frame for the tree to be effective in interacting with the stream channel.

Chart 7-2 compares the average amount of large wood volume within Lower Umpqua reference stream reaches to the amount within each Elk Creek subwatershed. The aquatic habitat survey data indicates that most of the tributaries within Elk Creek are lacking large woody debris. The difference in wood volume for Brush Creek subwatershed from the 1993-94 surveys to 1997 shows a decrease. It is presumed that the large winter storms of 1996-97 flushed out large debris jams in a couple of its stream reaches.

A partial reason for the lack of large wood can be attributed to past logging practices and the fisheries “stream cleaning” ideology of the 1960s, 1970s, and 1980s. In addition, between 1970 and 1980, most timber sales included provisions to clear the streams of all logs in order to benefit fish passage. Many of the Riparian Reserves were harvested before receiving the Reserve designation instituted by the Aquatic Conservation Strategy (1994). Chart 7-3 gives a picture of the amount of riparian vegetation by seral age class within 200 feet of streams on BLM lands. Approximately 55 percent of BLM streamside forest vegetation is younger than 80 years. The trees in these forests are generally of small diameter and deteriorate quickly after they die and fall in the riparian areas or into streams. Because 55 percent of the Elk Creek riparian areas on BLM lack large trees (Chart 7-3), recruitment potential of large wood into the streams to provide habitat structure for fisheries would be deficient over the next 100 years.

b) Instream Sediment

The effects of sediment within the stream system are very difficult to describe because of the dynamics and complexity of these systems and the inadequacy of current science. The Geology and Soils section above describes BLM roads contributing sediment within Elk Creek in the context of other landowners and background sedimentation rates. Because of its dynamic nature, sediment effects to streams can only be described in general terms. The ODFW instream habitat data is a snapshot in time and in this analysis the data is used to compare sixth-field subwatersheds as a system to relatively undisturbed stream reaches as a whole. The following Chart 7-4 compares the estimated average and standard deviation of sand, silt, and organics (a measure of fine sediment) within relatively undisturbed Lower Umpqua reference stream reaches to averages and standard deviations within Elk Creek subwatersheds. Chart 7-5 compares sand, silt, and organics in riffles (a measure of substrate embeddedness) to averages and standard deviations within Elk Creek subwatersheds. Based on this data, except for the Upper Elk Creek, Lower Pass Creek and Upper Pass Creek subwatersheds, it appears that sediment conditions within these Elk Creek subwatersheds, as a whole, are functioning similarly to the relatively undisturbed stream reach conditions in the lower Umpqua Basin. BLM has limited ownership and influence within the Pass Creek subwatersheds. It is unknown at this time what influences have affected sediment conditions in Upper Elk Creek.

Chart 7-2 Comparison of CWD in Reference and Umpqua Basin Coast Streams

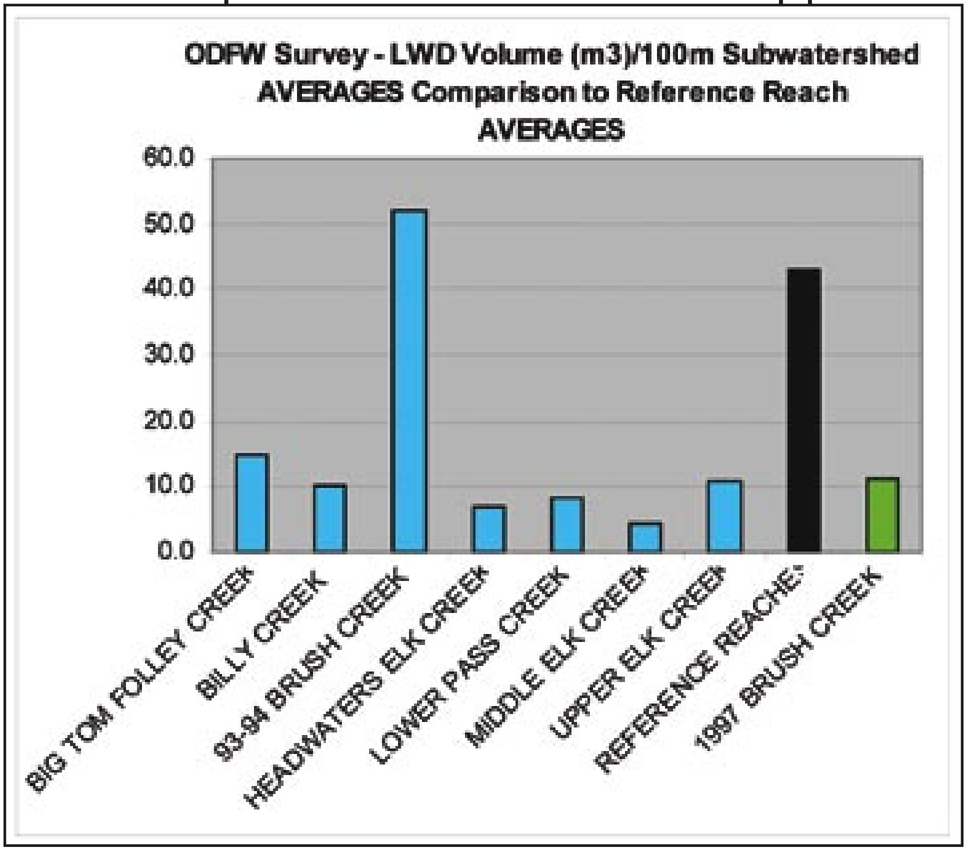


Chart 7-3 Elk Creek BLM Acres and Percent Forest Classes within 200 Feet of Streams

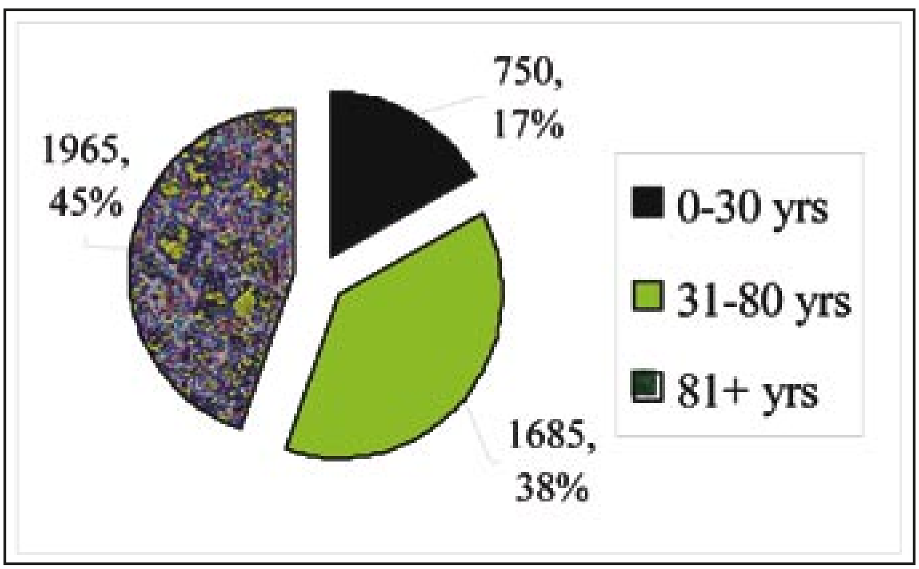


Chart 7-4 Percent Sediment for Elk Creek Subwatersheds Compared to Lower Umpqua Reference Reaches

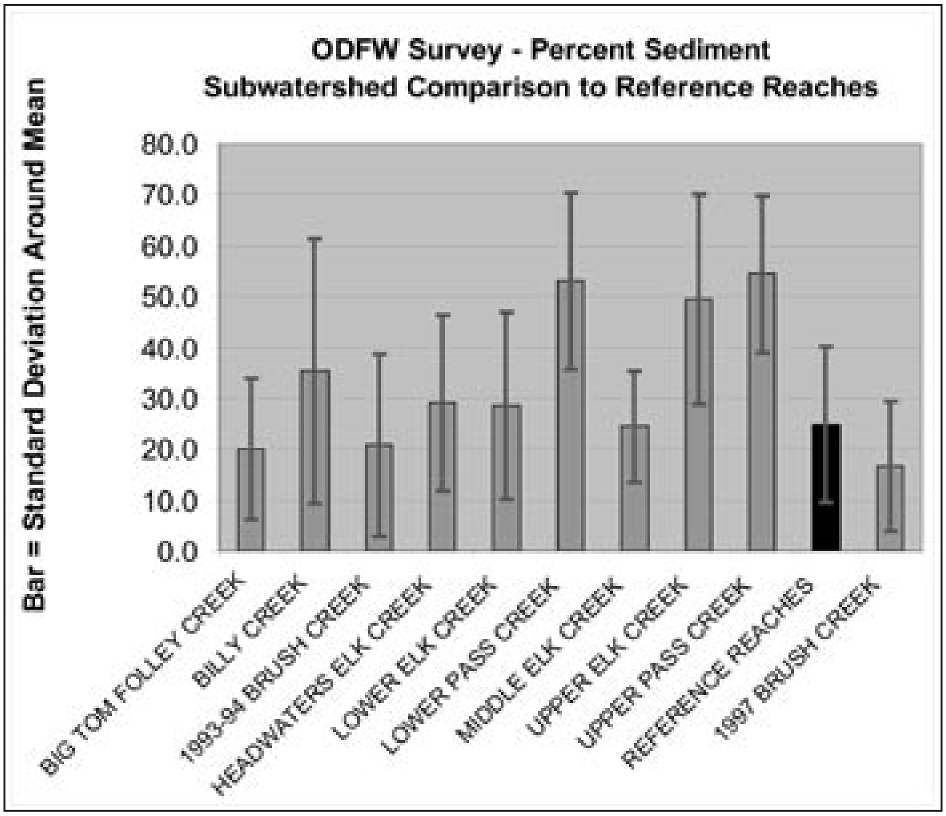


Chart 7-5 Percent Sediment in Riffles for Elk Creek Subwatersheds Compared to Lower Umpqua Reference Reaches

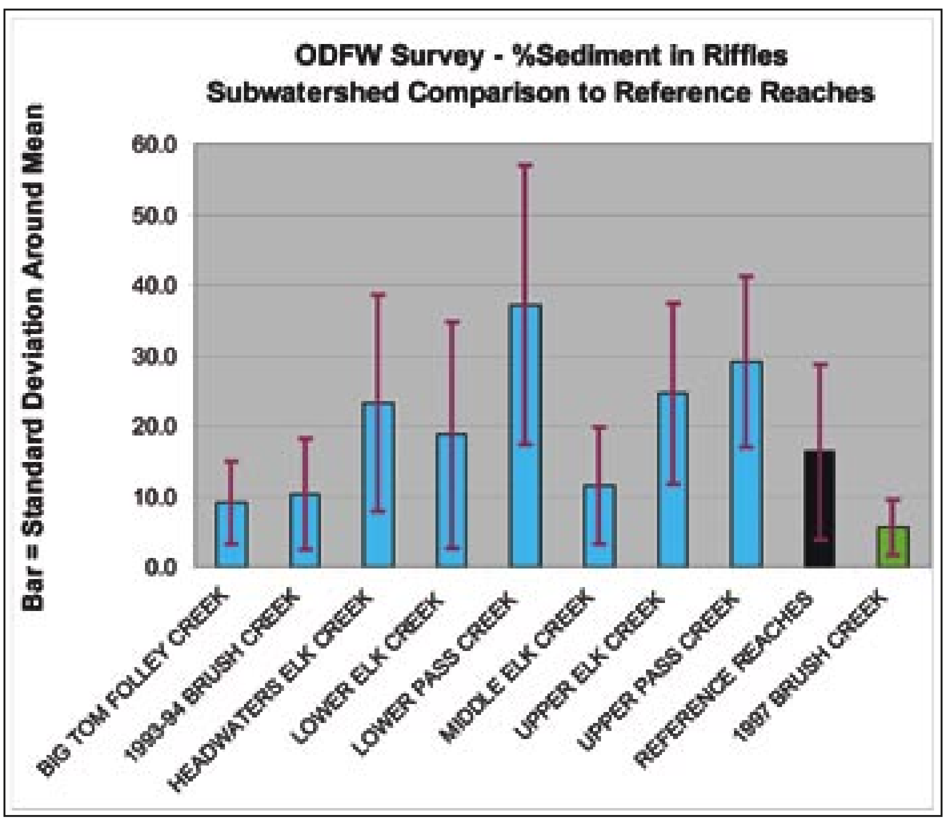


Figure 7-1 Elk Creek Fish Distribution and ODFW Surveyed Streams

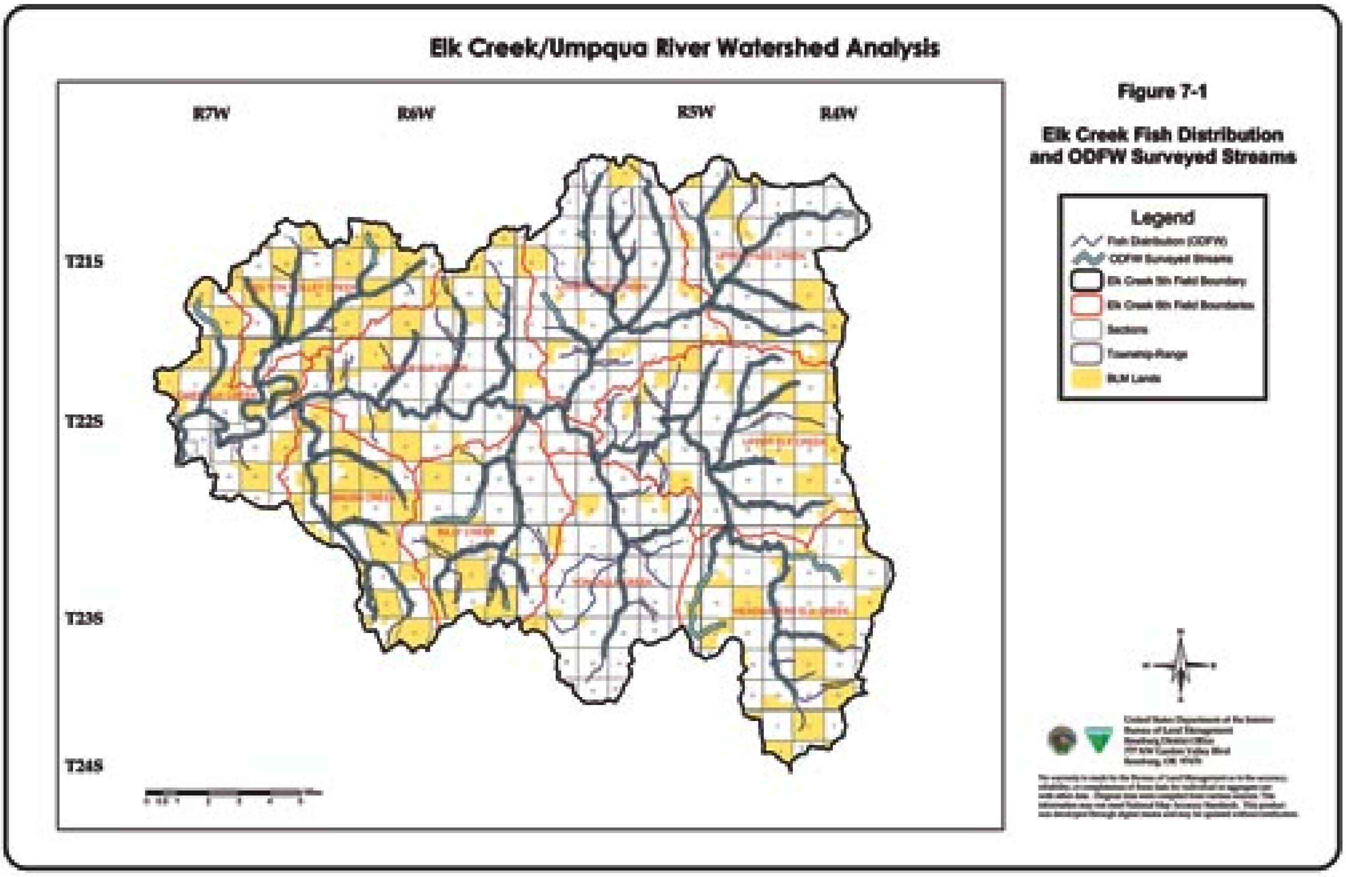
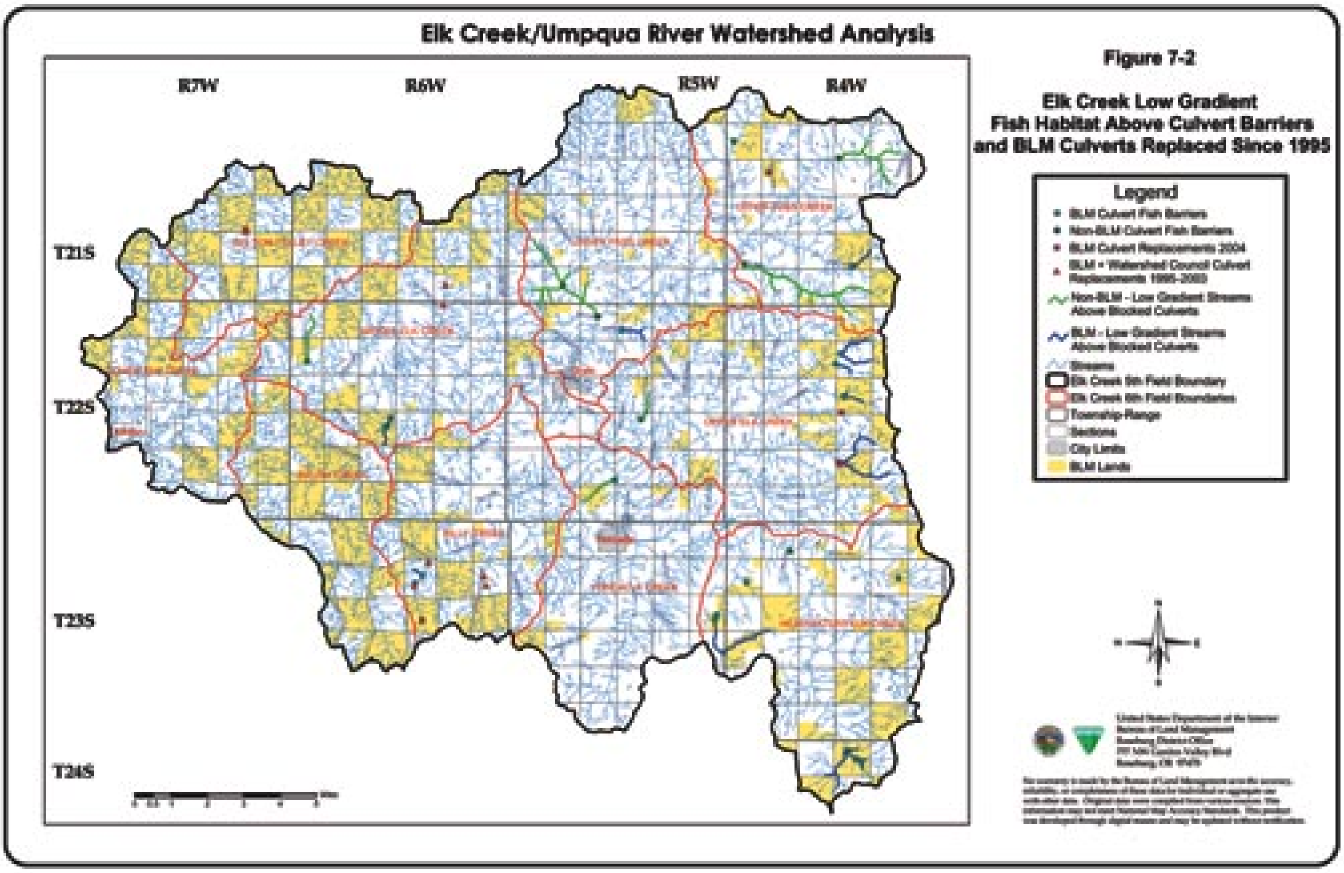


Table 7-3 Elk Creek Stream Categories by Subwatershed

	Big Tom Folley Creek	Billy Creek	Brush Creek	Headwaters Elk Creek	Lower Elk Creek	Lower Pass Creek	Middle Elk Creek	Upper Elk Creek	Upper Pass Creek	Yoncalla Creek	TOTAL
Stream Miles stream order 1	102	112	105	94	90	139	165	143	80	95	**1125**
Stream Miles stream order 2	38	38	34	44	32	52	56	49	30	38	**411**
Total Stream Miles stream order 3	18	18	14	18	17	24	25	29	114	22	**299**
Total Stream Miles stream order 4-6	20	20	20	20	10	34	23	29	16	19	**211**
Total Stream Miles stream order 7	0	0	0	0	13	0	15	8	0	0	**36**
Total Stream Miles	178	188	173	176	162	249	284	258	240	174	**2082**
Total Stream Miles <=6% stream gradient	21	29	18	31	27	43	45	50	25	38	**327**
Total Miles ODFW Habitat Surveys	16	17	27	18	29	27	25	26	17	10	**212**

Figure 7-2 Elk Creek Low Gradient Fish Habitat above Culvert Barriers and BLM Culverts Replaced Since 1995



8. Management Opportunities

The Roseburg District's RMP provides land use allocations with management direction. The following management opportunities are meant to provide further direction that would enhance the allocation's objectives. Environmental Assessments (EA) will address follow-up actions that may be implemented in response to the management opportunities described below.

A. Thinning for Fish And Wildlife Objectives — Late-successional and Riparian Reserves

To improve or maintain the development of late-successional habitat to meet Late-Successional Reserve, wildlife, and botany objectives within this watershed, connectivity between habitats and Late-Successional Reserve units need to be enhanced or maintained. Treatments need to focus on the following habitat objectives to meet long term late-successional wildlife objectives:

- ➢ shaping the overstory by maintaining or speeding up diameter growth rates
- ➢ controlling crown depth and crown closure
- ➢ creating gaps and providing opportunity for understory regeneration
- ➢ recruitment of snags and course woody debris
- ➢ increase the amount of late successional habitat.

The LSRA outlines the treatment guidelines for northern spotted owl home ranges (pp. 70-71). The management objective within the home range radius of any northern spotted owl site in a Late-Successional Reserve is to maintain or enhance the ability of spotted owls to use their home range and to provide their life requirements to survive and reproduce.

Maintaining connectivity within and between Late-Successional Reserves is critical to their functionality. Movement of animals between Late-Successional Reserves is important to maintain genetic and demographic integrity. The LSRA defines connectivity habitat as stands greater than 40 years of age (LSRA, p. 67). One objective of the Riparian and Late-Successional Reserve land-use allocations described in the RMP is to provide connectivity habitat between Late-Successional Reserve units.

Riparian Reserves not only function to provide habitat for riparian-dependent species, but are also expected to function as connectivity and dispersal habitat for late-successional species. The presence of a variety of overstory and understory vegetative layers and downed wood and snags provide habitat for a large number of terrestrial wildlife species. Riparian reserves lacking late-successional components would benefit from density management treatments.

Late-Successional and Riparian Reserves with mid-seral forests need to be thinned to allow greater amounts of light and growing space for large conifers and hardwoods, provide for snags and course woody debris now and in the future, and enhance understory development. In Late-Successional and Riparian Reserves where levels of these components are below those of unmanaged stands, projects to increase the levels may be appropriate. The LSRA identifies average values for snags and CWD abundance in naturally regenerated stands (pp. 28-31, Tables 8 through 11). Table 4-4 summarizes that information. Within the Riparian Reserves the creation and management of course woody debris would follow LSRA guidance (pp. 87 - 91). Variable spacing that is diameter based would create more diversity, especially if a particular species or growth form is selected. Not all of the smaller diameter merchantable trees need to be removed. Very few of the larger diameter trees need to be removed. Retention trees could be clumped, and canopy gaps would be enlarged.

Density management treatments within mid-seral stands in Late-Successional and Riparian Reserves could improve habitat connections between Late-Successional Reserve units and late-successional habitat by providing more dispersal opportunities for late-successional species. Management prescriptions need to be designed to develop long-term habitat connectivity while insuring that some degree of connectivity function is maintained. Quality, quantity, and spatial arrangement of connectivity habitat need to be considered when evaluating treatment sites.

There are currently about 3,000 acres of Late Successional and Riparian Reserves that need density management treatments now, and another 1,000 acres that will need treatment within the next ten years. Treatments would help meet wildlife and botany objectives by creating late-successional characteristics in these stands.

Recommendation: Thin mid-seral forest stands in LSR in the western portion of Elk Creek to accelerate the development of late-successional habitat (Figure 8-1).

Reason: The Late-Successional Reserves in the western portion of Elk Creek provide connectivity habitat between the Late-Successional Reserve units outside of the watershed to the north and southwest. A little over half of these (Table 2-3) are either in early or mid-seral managed forest age classes. About a third of these forest stands are in mid-seral age classes and could be thinned to meet the short and long term late-successional wildlife objectives. Thinning would increase the amount of late-successional habitat structure available for these associated species in the long term.

Recommendation: Thin mid-seral forest stands in Riparian Reserves to accelerate the development of late-successional habitat and recruitment of large woody debris for riparian areas.

Reason: The Riparian Reserves provide important connectivity habitat across the landscape within the matrix lands designated for more intense timber harvest. This is especially true in the eastern portion of Elk Creek, which provides an important north/south connection link for the Cascades. About a third of these lands are in mid-seral age classes and could be thinned to meet the short and long term late-successional wildlife objectives.

B. Commercial Thin Objectives-connectivity/diversity Blocks and GFMA Lands

1. General Harvesting

One of the socioeconomic objectives of the Northwest Forest Plan is sustainable timber harvest. The Record of Decision for the Roseburg BLM District's Resource Management Plan has an annual allowable harvest level based on the principle of sustained yield (i.e., management of the timber resource that results in an even and continuous level of harvest). This is based on harvest within the entire matrix lands and therefore necessitates the regeneration harvest of late-successional stands as well as the commercial thinning harvest of mid-seral stands. Upland Connectivity/Diversity Blocks and GFMA lands were designated for this purpose.

Recommendation: Implement the sold sales and harvesting units planned through 2006 (Figure 2-3) in Connectivity/Diversity Blocks and GFMA.

Reason: This would help meet the harvest commitments that came out of the Northwest Forest Plan for the local and regional economy.

2. Commercial Thinning

The mid-seral (30 to 80 year age) stands in all Land Use Allocations are a priority for commercial thinning. As discussed above, expanding and accelerating the development of late-successional habitat between Late-Successional Reserve units would meet fish and wildlife objectives. Thinning mid-seral stands would also meet silvicultural objectives by maintaining conditions for growth, providing a balance between wood volume production and wood quality.

For Connectivity/Diversity Blocks and GFMA lands, a general prescription for thinning early and mid-seral forest stands would include maintaining the dominant tree species at free-to-grow densities while also protecting the residual old-growth trees, large snags, and course woody debris. Trees would be retained based on species and size with little or no emphasis given to spacing. Uniform spacing as a guide in commercial thinning has the potential for reducing growth and yield, and is usually less beneficial to wildlife. Leaving clumps of dominant trees and creating small openings has the potential for maximizing timber yields, while at the same time, maintaining stand attributes such as hardwoods and shrubs. Clumps of retained dominant trees may be more wind firm, and can be used to surround and protect snags and course woody debris. There would usually be between 50 and 100 dominant trees per acre retained.

Recommendation: Thin mid-seral forest stands in Connectivity/Diversity Blocks and GFMA as shown in Table 8-1 and Figure 8-1.

Reason: Many of the growth rates in mid-seral forest stands within Connectivity/Diversity Blocks and GFMA are slowing while natural tree mortality is increasing. Thinning would bring a financial return on the planting, fertilizing, and pre-commercial thinning investment costs from previous years in the managed stands. Thinning would also provide a valuable product for the local and regional economy. As discussed on page 3, Connectivity/Diversity has been designated into blocks east and west of Interstate-5. Within Connectivity/Diversity Block lands (Chart 2-8) especially in the eastern portion of the watershed, close to fifty percent of uplands are mid-seral forest stands. Connectivity/Diversity Block lands are meant to function as a diverse block across the landscape in a 150-year area control rotation. This means that 1/15th of the entire Land Use Allocation would be regeneration harvested every decade. Thinning some the Connectivity/Diversity Block east of Interstate-5 to low residual densities (Figure 8-1) would help diversify the forest structural habitat across the landscape over the long term.

Table 8-1 Elk Creek BLM Potential Commercial Thinning and Density Management Acres

Harvest Totals	High Priority Ready to Thin within the next 5 years (Acres)	Medium Priority Ready to Thin within the next 5-10 years (Acres)	TOTAL
Commercial Thin Acres (GFMA/ Conn) TOTAL	2600	1150	**3750**
LSR Density Mgt Acres TOTAL	1650	1310	**2960**
Riparian Reserve Density Mgt Acres TOTAL	2655	1005	**3660**
Connectivity/Diversity Block Low Residual Density Harvest Acres TOTAL	315	0	**315**
TOTAL	**7220**	**3465**	**10685**

Recommendation: Consider a much heavier thinning prescription than normal for approximately 1,000 to 1,200 acres of the mid-seral GFMA forest stands.

Reasons: Between 1,000 and 1,200 acres of forest stands from 40 and 60 years of age on GFMA lands were reviewed by the timber planner and silviculturalist. On GFMA lands, commercial thinning normally leaves approximately 100 to 120 square feet basal area per acre so that one or two other future commercial thinnings may be viable prior to final regeneration harvest. The review found that a heavier thinning prescription for these particular stands would be better before final regeneration harvest for the following reasons:

- ➢ The forest stands position and location in relation to existing roads and topography make commercial thinning by conventional means likely to damage the remaining trees.
- ➢ Some of these stands are of a composition and density such that normal commercial thinning is not economically feasible.
- ➢ Some of these stands are at a density where suppression mortality is occurring. If no harvest occurs, then that investment in producing this wood volume is lost.

3. Regeneration Harvest

The selected late-mature and old-growth stands, although controversial, would provide for the long-term rotation of the forests on these lands. The total late-mature and old-growth stands in Connectivity/Diversity Blocks and GFMA represents about seven percent of the BLM lands (Table 2-2, Table 2-3, Table 2-5, and Table 2-6) and about two percent of all lands within this watershed.

Most harvesting on private lands for commercial purposes leave wildlife trees clumped in one area of the unit rather than scattered throughout. With BLM regeneration harvesting, leaving six to eight (GFMA) or 12 to 18 (Connectivity/Diversity Blocks) trees per acre scattered throughout a harvest unit creates a unique early seral habitat on the landscape that does not occur on private lands. This is because the RMP gives guidelines for retained trees to be distributed in variable patterns within harvest units (i.e., single trees, clumps, and stringers). Compared to clearcut harvests on private, the green retained wildlife trees throughout regeneration harvest units on BLM will be the dominant trees and future snags as the understory begins to recover. Existing snags would be retained as well (RMP 1994).

Recommendation: Defer for ten years any regeneration harvest of late-successional forest stands (80 years and older) within the 4,100 acres of the upland Connectivity/ Diversity Block east of Interstate-5 highway.

Reason: As shown in Chart 2-8, approximately 24 percent of this block is in late-successional habitat as defined as 80 years and older. This is below the 25 to 30 percent requirement in the RMP. Possible harvest treatments in late-successional habitat of this Connectivity/Diversity Block would be reevaluated after ten years.

Recommendation: Consider regeneration harvest of late-successional forest stands (80 years and older) within the 1,900 acres of the upland Connectivity/Diversity Block west of Interstate-5 highway. However, limit this to 750 acres at the most during the next decade to maintain at least 25 percent late-successional habitat across the block.

Reason: As shown in Table 2-6 and Chart 2-8, approximately 42 percent of this block is in late-successional habitat as defined as 80 years and older. The 25 percent requirement in the RMP would be maintained if less than 750 acres is regeneration harvested during this decade.

Recommendation: Regeneration harvest the mid-seral 60 to 80 year age forest stands shown in Table 8-2 and Figure 8-2 in GFMA.

Reason: Many of these stands within GFMA are operationally difficult to thin economically. There is value lost to mortality that can't be recovered. These stands are better suited for a shorter rotation regeneration harvest.

Recommendation: Regeneration harvest from the approximate 1,700 acres of late-seral forests in the GFMA uplands shown in Table 8-2 and Figure 8-2.

Reason: Harvesting this timber would help meet the allowable sale quantity of the Roseburg District RMP and contribute to the local and regional economy.

C. Noxious Weed

Recommendation: Continue treatment and monitoring for the eradication of Portuguese broom (*Cytisus striatus*). Use native species for habitat restoration and control of broom populations.

Reason: Portuguese broom eradication projects began in Cox Creek in 2000. To prevent the reestablishment of this high priority weed, treatment, monitoring and restoration will be needed for several more years. Funding for the project is currently obtained on a year-to-year basis. While little information is available, specifically about Portuguese broom, much is known about the closely related Scotch broom (*Cytisus scoparius*). Scotch broom produces copious amounts of long-lived seed with a very high germination rate with few seeds lost through predation. The biological controls that have been established on Scotch broom have not been effective on Portuguese broom. There are currently no biological controls available for Portuguese broom. Portuguese broom competes with timber production, interferes with road safety and disrupts native plant and wildlife communities. The Cox Creek Weed Management Area has been established for eradicating a concentration of Portuguese broom on BLM lands.

D. Geology And Soils - Decreasing Landslide Frequency and Sedimentation

Recommendation: Use Figure 8-3 and Table 8-2 and Table 8-3 as a starting list for fixing sediment problems on BLM roads.

Reason: The Geology and Soils analysis shows that landslide frequencies from the 1950s to the 1980s were at a higher level than naturally occurred because of land management activities. The analysis also suggests that landslide frequencies have been declining because of the changes in management practices. However, the analysis shows that some roads from past decades were built with sidecast on steeper slopes, with inadequate drainage, and in higher landslide risk locations. As a result, these roads still have a high risk of creating landslides in the future. To further decrease the rate of landslides

Table 8-2 Elk Creek BLM Potential Regeneration Harvest Acres

	Forests 80 Years and Older, acres	Mid-Seral 60-80 Year Old Forest Stands, acres	TOTAL ACRES
GFMA Regeneration Harvest Acres TOTAL	1700	100	1800

as well as sedimentation within Elk Creek, BLM roads were evaluated for their relative landslide risk as well as their current contribution as a chronic source of sediment. Figure 8-3 and Table 8-2 and Table 8-3 represent those BLM roads where the highest priority risks or problems exist and need to be corrected. This road list only represents an initial assessment for candidate roads and will be further refined. These roads represent approximately 17 percent of the BLM-controlled road system and approximately four percent of the entire road system within Elk Creek (Chart 5-1).

Engineers and an interdisciplinary team will be able to use the list of roads from Table 8-3 and Table 8-4 to develop more site-specific road fixes. As a further step in this process, the engineers will present the proposed roads for decommissioning to the Douglas Fire Protection Association (DFPA) and Right-of-Way (R/W) permittees for their approval. This process allows DFPA and R/W permittees to give their feedback for roads that they need for current and future access. Because some decommission candidate roads may be needed for private use, it is expected that their risks would be reduced through improvements rather than decommissioning.

E. Instream and Aquatic Habitat Enhancement

Based on BLM land ownership within Elk Creek, the subwatersheds where BLM has the greatest potential to enhance physical instream habitat is in the Big Tom Folley and Brush Creek subwatersheds. BLM ownership in all the other subwatersheds is scattered and any instream enhancement would need to be coordinated with willing landowners in those specific areas. Surveyed stream reaches within Big Tom Folley and Brush Creek represent approximately 45 miles of streams out of the 212 surveyed miles and out of the total 510 miles of third through sixth-order stream reaches within Elk Creek (Table 7-3). Seneca Jones Timber Co. has already initiated instream enhancement in the Big Tom Folley subwatershed in coordination with the Umpqua Basin Watershed Council and ODFW with plans to include BLM as a partner.

Recommendation: Conduct instream enhancements in the Big Tom Folley and Brush Creek subwatersheds and other drainages on BLM lands as opportunities allow (Figure 8-3).

Reason: BLM has the greatest amount of potential effects to stream systems in these areas because of the large amount of federal ownership. There are also opportunities to develop and maintain partnerships for instream enhancement through the ODFW and the Umpqua Basin Watershed Council. Enhancing these streams and with these partnerships would most effectively increase the salmonid habitat in the short term for the Elk Creek watershed.

Recommendation: Replace the fish barrier culverts as shown in Figure 8-3.

Reason: Fish barrier culverts were ranked within the Swiftwater Resource Area through a District-wide anadromous fish barrier inventory. Specific culvert replacement would be based on their ranking and opportunity within road renovation and improvements for management actions.

Figure 8-1 BLM Potential Density Management and Commercial Thinning Areas Beyond 2006

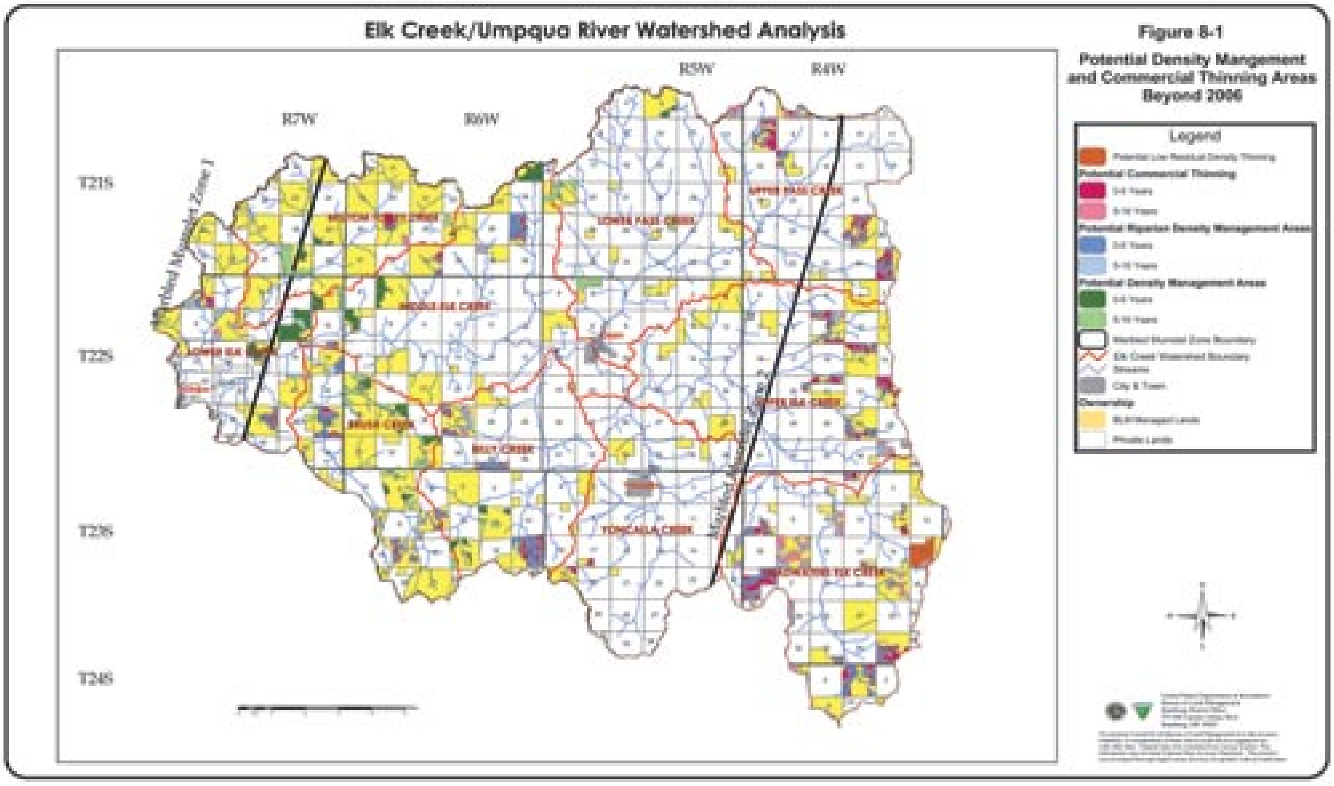


Figure 8-2 BLM Potential Regeneration Harvest Areas

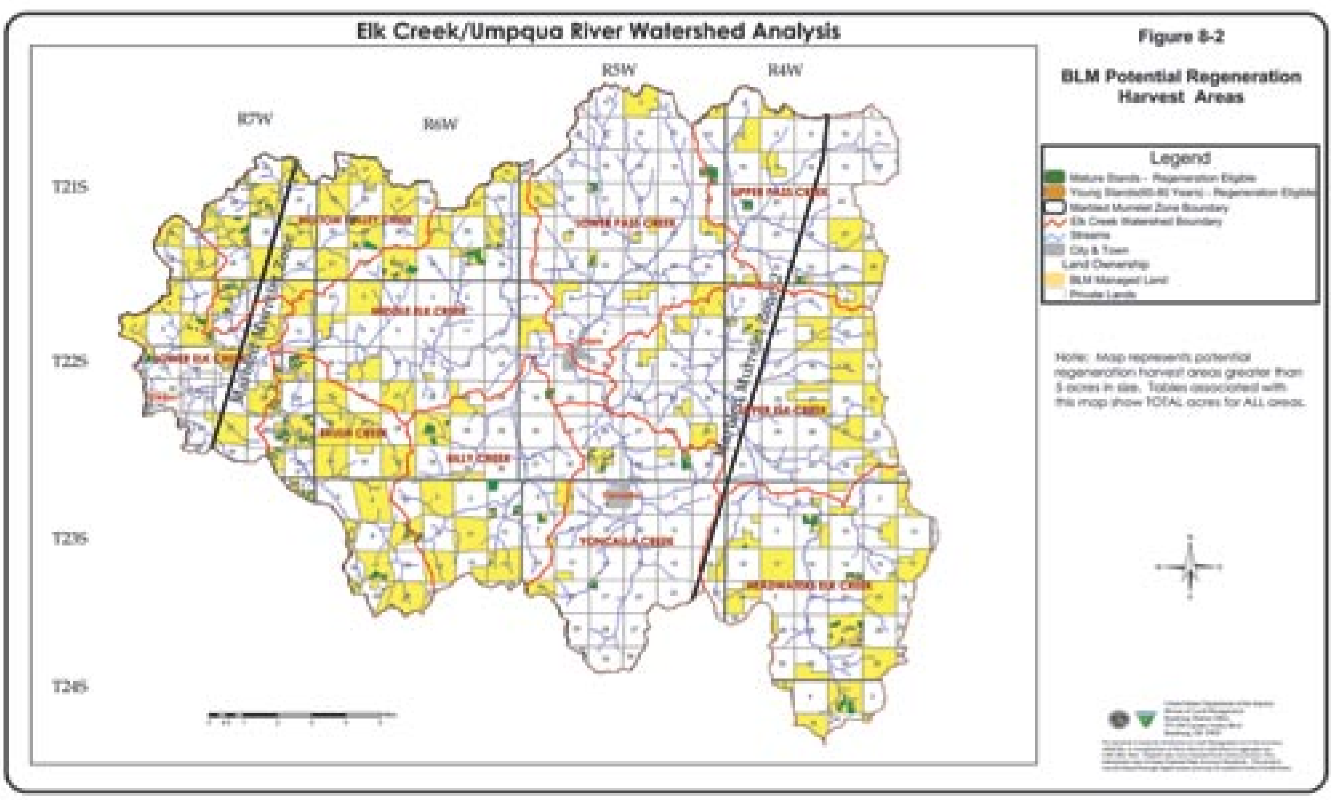
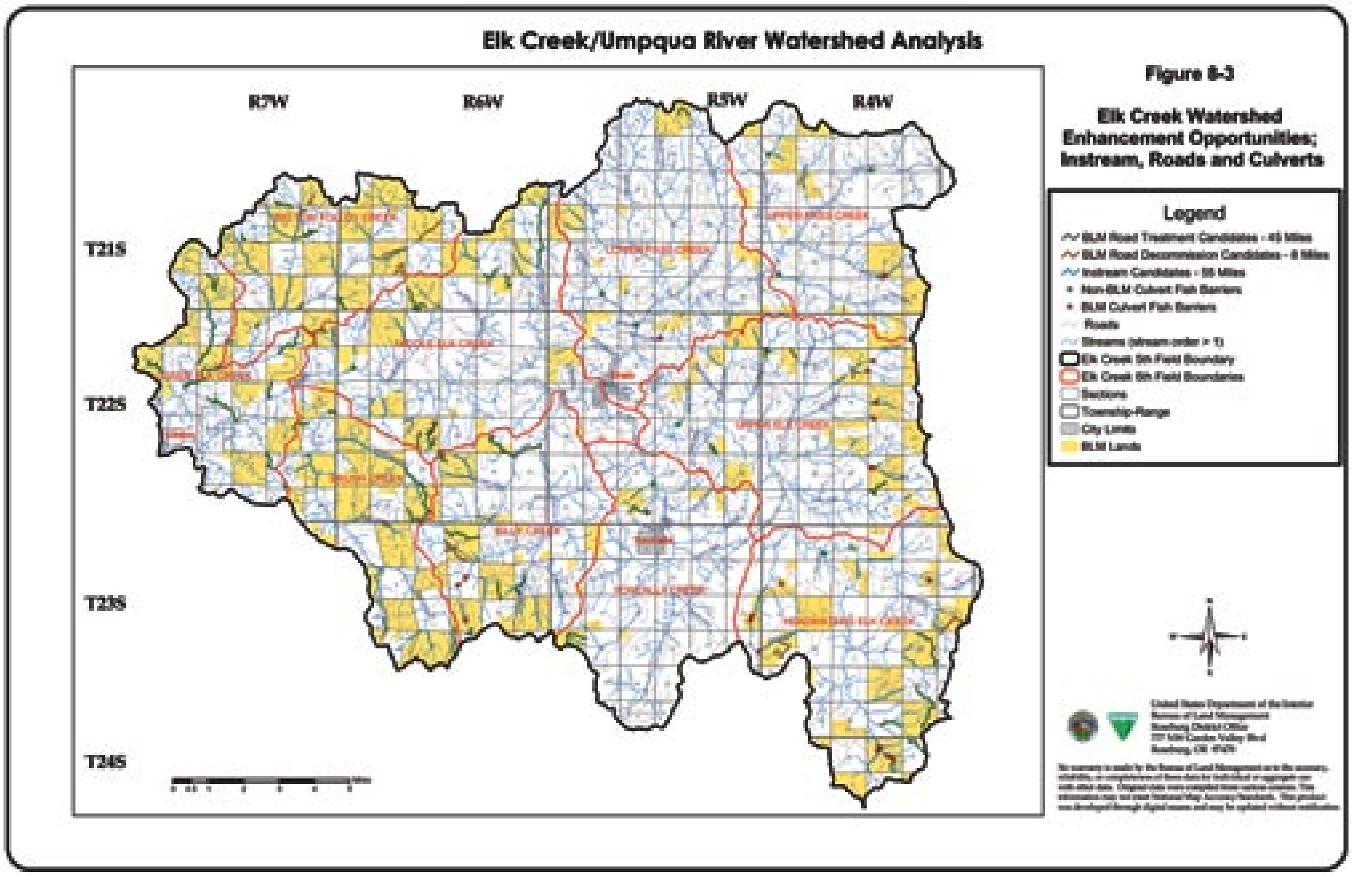


Figure 8-3 Elk Creek Watershed Enhancement Opportunities; Instream, Roads, & Culverts



Definitions for Table 8-3 and Table 8-4

Surface Type
- ABC = Aggregate Base Course
- ASC = Aggregate Surface Course
- PRR = Pit Run Rock
- GRR = Grid Rolled Rock
- NAT = Natural Surface Material or Dirt

Control = Ownership of the road
- BL = BLM Ownership
- PB = Private Ownership of Base Road, BLM Ownership of Improvements
- BP = BLM Ownership of Base Road, Private Ownership of Improvements
- PV = Private Ownership

Table 8-3 Elk Creek Road Decommission Candidates

ROAD ID/SUBWATERSHED	CONTROL	SURFACE TYPE	MILES
21 S 06 W 29.01A0	BLM	NAT	0.9
21 S 07 W 22.00B	BLM	NAT	0.3
21 S 07 W 24.00C0	BLM	NAT	0.4
22 S 07 W 14.00S	BLM	ABC	0.7
22 S 07 W 14.00U	BLM	CSS	0.5
22 S 07 W 14.00V	POA	NAT	0.4
BIG TOM FOLLEY CREEK TOTAL			**3.2**
23 S 06 W 03.00A	BLM	NAT	0.2
23 S 06 W 10.01B	BLM	NAT	0.8
BILLY CREEK TOTAL			**1.0**
23 S 06 W 06.00C	BLM	NAT	0.3
23 S 06 W 06.02C	BLM	NAT	0.2
BRUSH CREEK TOTAL			**0.5**
23 S 04 W 19.01A	BLM	NAT	1.2
23 S 04 W 24.00A0	BLM	NAT	1.2
HEADWATERS ELK CREEK TOTAL			**2.4**
22 S 04 W 09.01B	BLM	NAT	0.3
UPPER ELK CREEK			**0.3**
24 S 04 W 27.02A	BLM	NAT	0.1
UPPER PASS CREEK TOTAL			**0.1**
TOTAL FOR BLM, ELK CREEK WATERSHED			**7.5**

Table 8-4 Elk Creek Road Improvement Candidates

ROAD ID/SUBWATERSHED	CONTROL	SURFACE TYPE	MILES
21 S 07 W 14.07A0	POA	NAT	0.5
21 S 07 W 14.07B0	BLM	NAT	0.1
21 S 07 W 23.01A0	BLM	NAT	0.2
21 S 07 W 23.01C0	POA	NAT	0.9
21 S 07 W 23.03A0	BLM	NAT	0.2
21 S 07 W 35 00D	POA	NAT	0.2
21 S 07 W 36.00B0	BLM	NAT	0.6
22 S 07 W 01.00A	BLM	NAI	0.5
22 S 07 W 01.02A	BLM	NAT	0.2

ROAD ID/SUBWATERSHED	CONTROL	SURFACE TYPE	MILES
22 S 07 W 04.01A0	BLM	NAT	0.3
22 S 07 W 11.00C0	BLM	NAT	0.6
22 S 07 W 14.00F	BLM	ABC	0.2
22 S 07 W 14.00K	BLM	ABC	0.3
22 S 07 W 17.01C0	BLM	NAI	0.3
BIG TOM FOLLEY CREEK TOTAL			**5.1**
22 S 06 W 22.01B0	BLM	NAT	0.3
22 S 06 W 22.01D0	BLM	NAT	0.2
22 S 06 W 23.00A0	BLM	ABC	0.8
22 S 06 W 24.00A0	POA	ABC	1.1
22 S 06 W 24.00B0	BLM	ABC	0.3
22 S 06 W 24.00F0	POA	ABC	0.3
23 S 05 W 19.01A0	BLM	ABC	0.2
23 S 06 W 01.00E	BLM	NAT	1.3
23 S 06 W 11.00A0	BLM	ABC	0.6
23 S 06 W 12.00B0	POA	NAT	1.0
23 S 06 W 12.00Q	POA	PRR	0.4
23 S 06 W 15.00B	POA	NAT	0.4
BILLY CREEK TOTAL			**7.0**
22 S 07 W 13.01B0	BLM	NAT	0.3
22 S 07 W 22.03C	POA	NAT	1.2
22 S 07 W 23.00B0	POA	NAT	0.6
22 S 07 W 24.00C	BLM	ABC	0.4
22 S 07 W 24.00C0	BLM	ABC	0.4
22 S 07 W 24.00D	BLM	ABC	2.1
23 S 06 W 06.02B	POA	ABC	0.4
23 S 06 W 15.01B	POA	ABC	0.9
23 S 06 W 15.01E	BLM	ABC	0.3
BRUSH CREEK TOTAL			**6.7**
23 S 04 W 15.01B	BLM	ABC	1.5
23 S 04 W 28.00F	POA	NAT	0.9
23 S 04 W 28.01C	BP	ABC	1.9
23 S 04 W 34.01A	POA	NAT	0.7
24 S 04 W 03.02A	BLM	NAT	0.5
HEADWATERS ELK CREEK TOTAL			**5.5**
22 S 07 W 11.00A0	BP	NAT	1.2
22 S 07 W 14.00A	BP	ABC	0.6
22 S 07 W 17.00A0	BP	ABC	0.2
22 S 07 W 17.01A	BP	ABC	0.1
22 S 07 W 17.01B0	BLM	ABC	1.4
22 S 07 W 17.02B	BLM	NAT	0.7
22 S 07 W 22.01A1	POA	ABC	1.4
22 S 07 W 22.01C0	BP	ABC	0.7
22 S 07 W 22.01D0	BP	ABC	1.0
22 S 07 W 22.01E0	BLM	ABC	0.1
22 S 07 W 22.01G0	BLM	ABC	0.9
22 S 07 W 22.03B	BLM	NAT	0.1
LOWER ELK CREEK TOTAL			**8.3**
21 S 05 W 03.02A0	BLM	ABC	0.5

ROAD ID/SUBWATERSHED	CONTROL	SURFACE TYPE	MILES
LOWER PASS CREEK TOTAL			**0.5**
21 S 06 W 26.02A0	BLM	NAT	0.5
21 S 06 W 27.00A0	BLM	NAT	0.1
21 S 06 W 33.01A0	BLM	NAT	0.1
21 S 06 W 33.03A0	BLM	NAT	0.5
21 S 06 W 35.00A0	BLM	NAT	0.6
21 S 06 W 36.00B0	POA	ABC	1.2
21 S 06 W 36.00C0	POA	ABC	0.5
21 S 06 W 36.00D	BLM	NAT	0.4
22 S 06 W 04.01C0	BLM	NAT	1.0
22 S 06 W 15.00B0	BLM	ABC	1.3
22 S 06 W 21.01A0	BLM	ABC	0.5
22 S 07 W 01.01A	BLM	NAT	0.2
MIDDLE ELK CREEK TOTAL			**7.0**
22 S 04 W 07.00A	BLM	NAT	0.1
22 S 04 W 07.01A	BLM	NAT	0.2
22 S 04 W 08.01B	BLM	NAT	0.3
22 S 04 W 33.02B	POA	NAT	0.5
22 S 04 W 33.02C	BLM	NAT	0.5
22 S 05 W 13.00H	BLM	NAT	0.3
22 S 05 W 23.00B0	BLM	NAT	0.3
UPPER ELK CREEK TOTAL			**2.2**
21 S 04 W 27.00B	POA	NAT	0.1
UPPER PASS CREEK TOTAL			**0.1**
22 S 05 W 33.00A	BLM	ABC	1.1
23 S 05 W 19.00A0	BLM	ABC	1.2
YONCALLA TOTAL			**2.3**
TOTAL FOR BLM, ELK CREEK WATERSHED			**44.6**

9. Previous Watershed Assessments Appendix

Watershed Assessments in Portions of Elk Creek

-*Tom Folley WAU Watershed Analysis*, April 1995, Roseburg District
This included one subwatershed on the northwest side of the Elk Creek fifth field watershed which is the Tom Folley subwatershed.

-*Brush Hayhurst Yoncalla Watershed Analysis*, April 1996, Roseburg District
This included three subwatersheds on the south central side of the Elk Creek fifth field watershed. The three subwatersheds are Brush Creek, Hayhurst Creek, and Yoncalla Creek.

-*East Elk WAU*, October 1996, Roseburg District
This included seven subwatersheds on the eastern half of the Elk Creek fifth field watershed.

-*Elkton-Umpqua WAU*, June 1998, Roseburg District
This included one subwatershed on the west side of the Elk Creek fifth field watershed which is now the Lower Big Elk Creek subwatershed.

-*Elk Creek fifth field Watershed* (Associated with the cities of Elkton and Drain), 2nd Iteration, July 1998.

This second iteration summarized some specific passive and active restoration information and attempted to tie the above analyses together into one document.

10. Vegetation Appendix

A. Expanded Vegetation Age Class Definitions

Early seral is the time when the available growing space is occupied and shared by many species of plants, sometimes referred to as *pioneers*. In managed forest stands these early plants compete with trees and are often removed as part of management. Conifers become established and eventually expand to exclude many of the early plants so that eventually competition is primarily between trees. In general, for the purposes of this analysis, stand age for early seral is considered to be less than 30 years, and the average diameter of trees is less than 10 inches.

Mid-seral forest stands begin when trees and/or other plants have captured all of the available growing space. They are most often characterized as even aged or *single-cohort* forest stands and are defined as all the trees that have resulted after a single disturbance event (Oliver et al. 1990). The area is fully occupied and new plants will normally not invade unless there is further disturbance. The dominant plants are competing with each other for the available growing space, often forming a continuous closed canopy that allows very little light to reach the soil surface. Shade intolerant trees that are not in a dominant canopy position begin to die out and there are fewer shrubs, herbaceous plants and grasses. Growing space becomes available slowly as trees die from competition, and tree growth rates decline. In general for the purposes of this analysis, mid-seral stands range in age from about 30 to 80 years, and the diameters of trees average from about 10 to over 20 inches.

Stand differentiation often begins in the mid-seral stage of development. In natural stands, differences in the age, size, and genetic potential of trees, micro site, and the abundance and arrangement of plants leads towards stand differentiation. There are nearly always individual or grouped larger and older trees mixed with smaller trees and shrubs. Canopy gaps allow for shrubs, hardwoods and conifer regeneration.

In managed plantations, trees are more uniform in size, age, spacing, and genetic potential. Other plants are often excluded as part of management. It is more likely that the trees in these stands will all grow up together and reach a condition where competition between trees results in substantially reduced growth. It probably takes much more time for stands in this condition to differentiate. These are stands where density management may be needed to meet the objectives of the current Resource Management Plan.

Late-mature seral as defined by the Roseburg Districts' RMP would be very similar to the description above for mid-seral. However, natural unmanaged stands tend to start differentiating into *multi-cohort* forest stands around the age of 80 years. Managed stands that have not been treated (thinned) tend to remain *single-cohort* forest stands up until 100 years of age. For the purposes of this analysis, 'late-mature seral' will refer to stands between 81 and 200 years of age and may contain *some* of the stand characteristics defined below.

Old Growth is mostly *multi-cohort* forest stands where minor disturbance events have created openings in a patch-like nature and younger cohorts exist interspersed with older cohorts. With current managed landscapes, unharvested areas most often characterize these stands. For the purposes of this analysis, 'old growth' will refer to stands greater than 201 years of age and contain *most* of the stand characteristics defined below. The following define their major characteristics:

-*Deep multiple canopy layers*: This characteristic may not often occur in our area because of the nature of Douglas-fir and the frequency of fire. Two or more canopy layers exist when shade tolerant tree species become established and grow in the understory.

-*Diverse tree size, form and condition*: Trees are not evenly spaced and may exist in clumps, and tree size and forms are affected by this variable distribution and density. Trees that are open grown typically have large diameter stems and full crowns. Tall, cylindrical stems with narrow crowns are found when trees grow close together. Large, old conifers are present. Many of the oldest conifers are fire scarred and hollow, have broken tops, and contain heart and butt rots.

-*Canopy gaps and natural openings*: Late-successional forests contain openings. The degree to which a stand is open, and the size and spatial arrangement of openings depend on the processes that create them. Stand age, frequency and intensity of fire, disease, insects, wind, and soil movement all have an effect.

-*Large snags in various stages of decay*: Fire, insects and disease are primarily responsible for the creation of large snags. This is a highly variable characteristic. Some large snags are present in late-successional forests even when fires occur frequently.

-*Coarse woody debris*: The processes that create snags also create coarse woody debris. The amount that exists may depend on the frequency and intensity of fire.

-*Species diversity*: Species diversity is high in late-seral forests, many of which are difficult to inventory and describe. The late-seral stage includes areas of early and mid-seral development interspersed.

B. Vegetation Data Sources

The two data sources as shown on Figure 2-1 and Figure 2-2 include the 1997 Interagency Vegetation Mapping Project (IVMP), and the BLM's Forest Operations Inventory (FOI). The data allows the vegetation to be grouped into the early, mid, and late seral age classes for comparison purposes, however these data sources have differing degrees of detail and resolution.

The 1997 Interagency Vegetation Mapping Project (IVMP) provides a representation of vegetation age classes across all ownerships within the Elk Creek watershed (Figure 2-1, Table 2-1 andTable 2-2). IVMP is a joint Forest Service/BLM project that derives a 25-meter pixel-based vegetation map from 1997 satellite imagery. The vegetation map has been classified into categories according to the Interagency Vegetation Standards that were adopted by the Interagency Advisory Committee.

The Forest Operations Inventory (FOI) gives a more detailed description of age classes on BLM lands (Figure 2-2, Table 2-2 through Table 2-5, and Charts 2-4 through 2-7) because it is based on field data as well as aerial photo inventories. IVMP data is primarily useful for cumulative effects analysis that includes public and private lands.

11. Botany Appendix

Table 11-1 Weeds Known or Suspected to Occur in the Elk Creek Watershed

COMMON NAME	SCIENTIFIC NAME	ODA RATING	OCCURANCE	TREATMENT
Italian thistle	*Carduus phycnocephalus*	B	suspected	treat as needed
Diffuse knapweed	*Centaurea diffusa*	B	historical	no action
Meadow knapweed	*Centaurea pratensis*	B	suspected	biological control
Yellow starthistle	*Centaurea solstitialis*	B,T	known	treat as needed
Rush skeletonweed	*Chondrilla juncea*	B, T	historical	no action
Canada thistle	*Cirsium arvense*	B	suspected	biological control
Bull thistle	*Cirsium vulagre*	B	suspected	biological control
Yellow nutsedge	*Cyperus esulentus*	B	suspected	(native) no action
French broom	*Cytisus monspessulanas*	B	suspected	treat as needed
Scotch broom	*Cytisus scoparius*	B	known	treat as needed
Portuguese broom	*Cytisus striatus*	B,T	known	high priority
Giant horsetail	*Equisetum telmateia*	B	suspected	(native) no action
English ivy	*Hedera helix*	B	known	treat as needed
St.Johnswort	*Hypericum perforatum*	B	suspected	biological control
Purple loosestrife	*Lythrum salicaria*	B,T	suspected	treat as needed
Japanese knotweed	*Polygonum cuspidatum*	B	known	manage all sites
Himalayan blackberry	*Rubus discolor(prcerus)*	B	known	treat as needed
Tansy ragwort	*Senecio jacobaea*	B, T	suspected	biological control
Buffaloburr	*Solanum rostratum*	B	known	manage all sites
Spanish broom	*Spartium junceum*	B	suspected	treat as needed
Medusahead rye	*Taeniatherum canput-medusae*	B	suspected	low priority
Gorse	*Ulex europaeus*	B, T	known	high priority
Spiny cocklebur	*Xanthium spinosum*	B	suspected	(native?) treat as needed

Table 11-2 Elk Creek, Summary of Special Status Botanical Species

SPECIES	STATUS[1]	PRESENCE IN PROJECT AREA?	GENERAL HABITAT REQUIREMENTS
VASCULAR PLANTS			
BUREAU SENSITIVE			
Wayside Aster *Aster vialis*	BS, ST	Expected	Woods, Edge habitat
Tall Bugbane *Cimicifuga elata*	BS	Expected	Woods, Thickets, Edge habitat
False Caraway *Perideridia erythrorhiza*	BS	Expected	Meadows
Thompson's Mistmaiden *Romanzoffia thompsonii*	BS	Expected	Outcrops
Hitchcock's Blue-eyed Grass *Sisyrinchium hitchcockii*	BS	Expected	Woods, Meadows
Hairy Sedge *Carex gynodynama*	AS	Expected	Wet Meadows
Timwort *Cicendia quadrangdularis*	AS	Expected	Meadows
California Globe Mallow *Iliamna latibracteata*	AS	Expected	Thickets
Coffee Fern *Pellea andromedaefolia*	AS	Expected	Outcrops
California Sword Fern *Polystichum californicum*	AS	Expected	Outcrops
Humped Bladderwort *Utricularia gibba*	AS	Expected	Aquatic
Lesser Bladderwort *Utricularia minor*	AS	Expected	Aquatic
Dotted Water-meal *Wolffia borealis*	AS	Expected	Aquatic
Water-meal *Wolffia columbiana*	AS	Expected	Aquatic
BRYOPHYTES			
BUREAU ASSESSMENT			
Crumia latifolia	AS	Expected	Rock outcrops
Funaria muhlenbergii	AS	Expected	Rock outcrops
Shistostega pennata	AS	Expected	Wet meadows
Tripterocladium leucocladulum	AS	Expected	On soil, rocks, and trees

[1]Status abbreviations: FE -- Federal Endangered; FT -- Federal Threatened; SE -- State Endangered; ST -- State Threatened; BS -- Bureau Sensitive in Oregon; AS -- Bureau Assessment Species; S&M(A) -- Survey and Manage, Category A

SPECIES	STATUS[1]	PRESENCE IN PROJECT AREA?	GENERAL HABITAT REQUIREMENTS
LICHENS			
BUREAU SENSITIVE			
Sulcaria badia	BS	Expected	Mesic uplands with conifers and hardwoods
SURVEY & MANAGE			
Lobaria linita	S&M (A), BS	Expected	Moist conifer forests, on trees, shrubs, and rocks.
Bryoria tortuosa	S&M (A)	Expected	Low elevation conifer and hardwood forests
Gomphus bonarii	S&M (B)	Documented	Late-successional conifer forests
Helvella elastica	S&M (B)	Documented	Late-successional conifer forests
Hypogymnia duplicata	S&M (A)	Expected	Late-successional conifer forests
Leptogium cyanescens	S&M (A)	Expected	On bark, rotten logs, and rocks
Nephroma occultum	S&M (A)	Expected	Late-successional conifer forests
Peltigera pacifica	S&M (E)	Documented	Late-successional conifer forests
Platismatia lacunosa	S&M (A)	Expected	Riparian hardwoods
Ramalina thrausta	S&M (A)	Expected	Low elevation moist conifer and riparian forests
Ramaria araiospora	S&M (B)	Documented	Late-successional conifer forests
Pseudocephellaria rainierensis	S&M (A)	Expected	Late-successional conifer forests
Sowerbyella rhenana	S&M (B)	Documented	Late-successional conifer forests
[1]Status abbreviations: FE -- Federal Endangered; FT -- Federal Threatened; SE -- State Endangered; ST -- State Threatened; BS -- Bureau Sensitive in Oregon; AS -- Bureau Assessment Species; S&M(A) -- Survey and Manage, Category A			

12. Wildlife Appendix

Table 12-1 Elk Creek, Terrestrial Wildlife Special Status Species- Status, Occurrence, and Habitat Requirements.

SPECIES	OTHER STATUS[1]			HISTORIC OCCURRENCE IN ELK CREEK WATERSHED	CURRENT OCCURRENCE IN ELK CREEK WATERSHED[2]	HABITAT REQUIREMENTS	MICRO HABITAT
	STATE	ONHP	NWFP				
FEDERAL THREATENED							
Bald Eagle *Haliaeetus leucocephalus*	ST	2	V	Yes	Documented	Late-successional conifer forests	Large diameter trees/snags
Canada Lynx *Lynx Canadensis*				Out of Species Range		Dense boreal forests	Dense understory structure of woody debris; snowshoe hare
Fender's Blue Butterfly *Icariacia icarioides fenderi*				Yes	Unknown	Modified or relic prairie habitat	Kincaid's lupine (*Lupinus sulphurous* ssp. *kincaidii*)
Marbled Murrelet *Brachyramphus marmoratus*	ST	2		Yes	Documented	Late-successional conifer forests	Large diameter trees/limbs, platforms
Northern Spotted Owl *Strix occidentalis caurina*	ST	1		Yes	Documented	Mature and older conifer forests	Large diameter trees/snags, cavities
Vernal Pool Fairy Shrimp *Branchinecta lynchi*				Unknown	Unknown	Temporary pools of water in grass or mud bottomed swales	Algae, bacteria, protozoa, rotifers, and detritus
BUREAU SENSITIVE							
American Peregrine Falcon *Falco peregrinus anatum*	SE	2		Yes	Documented	Cliffs, rock outcrops	Open habitats for hunting avian prey
Arctic Peregrine Falcon *Falco peregrinus tundrius*	SE			Yes	Suspected- Winter/ Migration	Cliffs, rock outcrops	Open habitats for hunting avian prey
Columbian White-tailed Deer *Odocoilus virginianus leucurus*	V	1		Yes	Documented	Bottomlands, oak/hardwood forests	Adequate cover for fawning and shelter
Crater Lake Tightcoil *Pristiloma arcticum crateris*		1	B	Yes	Documented	Perenially wet areas in Late seral forests and riparian areas above elevations of 2000 feet	Mosses and other vegetation near wetlands, springs, seeps, and riparian areas
Green Sideband *Monadenia fidelis beryllica*		1		Unknown	Unknown	Coast Range- Riparian Forests at low elevations	Deciduous trees and shrubs in wet, relatively undisturbed forest
Insular Blue Butterfly *Plebejus saepiolus insulanus*		1		Yes	Suspected	Wet meadows, streamsides, and forest openings	Clover
Lewis' Woodpecker *Melanerpes lewis*	CR	4		Yes	Unknown	Open woodland habitat near water	Open woodland canopy and large-diameter dead or dying trees; Snag cavities
Northern Goshawk *Accipiter gentilis*	CR	2		Yes	Documented	Mature and older conifer forests	Multi-storied canopies and great structural diversity
Northwestern Pond Turtle *Clemmys marmorata*	CR	1		Yes	Documented	Ponds, low gradient rivers	CWD, rocks, riparian

SPECIES	OTHER STATUS[1]			HISTORIC OCCURRENCE IN ELK CREEK WATERSHED	CURRENT OCCURRENCE IN ELK CREEK WATERSHED[2]	HABITAT REQUIREMENTS	MICRO HABITAT
	STATE	ONHP	NWFP				
BUREAU SENSATIVE							
Pacific Fisher *Martes pennanti*	CR	2		Yes	Expected	Late-successional conifer forests	Large course woody debris; snags; live trees with dead tops; riparian zones with continuous canopy
Purple Martin *Progne subis*	CR	2		Yes	Documented	Grasslands, brushlands, open woodlands	Snag cavities
Oregon Giant Earthworm *Driloleirus macelfreshi*		1		Unknown	Unknown	Riparian Forests	Undisturbed soils with accumulated organic material
Oregon Shoulderband *Helminthoglypta hertleini*		1	E	Unknown	Expected	Talus and rocky substrates	Permanent ground cover, fissures, piles of woody debris
Round Lanx *Lanx subrotundata*		1	FA	Unknown	Unknown	Freshwater habitats	Presence of algae and detritus
Scott's Apatanian Caddisfly *Allomyia scotti*		1		Out of Species Range		Cold mountain streams, often at high elevations (> 4000 feet)	Rocks in flowing or turbulent water
Townsend's Big-eared Bat *Corynorhinus townsendii*	CR	2		Yes	Expected	Late-successional conifer forests	Caves/mines, buildings, bridges
Traveling Sideband *Monadenia fidelis celeuthia*		1	FA	Out of Species Range		Late-successional forests and riparian forests at low elevations	Somewhat dry and open forested terrain
BUREAU ASSESSMENT							
Brazilian Free-tailed Bat *Tadarida brasiliensis*		2		Out of Species Range		At low elevations where climatic conditions are warm	Caves/mines, snags, buildings
Cascades Frog *Rana cascadae*	V	2		Out of Species Range		Lakes, ponds, streams in meadows above elevations of 2600 feet	Muddy or silty substrate of shallow waters
Cascade Torrent (Seep) Salamander *Rhyacotriton cascada*)	V	2	FA	Out of Species Range		Rocky streams, lakes, and seeps in Conifer or Alder forests	Flowing water over rocks, splash zone of streams, spray zone of waterfalls
Common Kingsnake *Lampropeltis getulus*	V	2		Yes	Expected	Grassland, mixed oak woodlands	Riparian
Del Norte Salamander *Plethodon elongatus*	V	2	FA-PB	Out of Species Range		Late-successional conifer forests	Rock rubble and talus slopes
Foothill Yellow-legged Frog *Rana boylii*	V	2		Yes	Expected	Low gradient streams/ponds	Gravel/cobbles, riparian
Fringed Myotis *Myotis thysanodes*	V	2	FA-PB	Yes	Documented	Late-successional conifer forests, associated with water	Caves/mines, bridges, rock crevices
Harlequin Duck (breeding population) *Histrionicus histrionicus*	U	2	V	Yes	Expected	Streams associated with forests within the Cascade Mountains	Turbulent streams; macro-invertebrates
Northern Red-legged Frog *Rana aurora aurora*	U	2		Yes	Expected	Low gradient streams/ponds	Aquatic vegetation
Tailed Frog *Ascaphus truei*	V	2	FA	Yes	Expected	High gradient, perennial streams	Cobbles/boulders, riparian

SPECIES	OTHER STATUS[1]			HISTORIC OCCURRENCE IN ELK CREEK WATERSHED	CURRENT OCCURRENCE IN ELK CREEK WATERSHED[2]	HABITAT REQUIREMENTS	MICRO HABITAT
	STATE	ONHP	NWFP				
FEDERAL ASSESSMENT							
Western Least Bittern *Ixobrychus exilis hesperis*	P	2		Out of Species Range		Freshwater marshes	Aquatic vegetation
White-tailed Kite *Elanus leucurus*		2		Yes	Documented	Open grasslands, meadows, emergent wetlands, farmlands, lightly wooded areas	Wooded riparian habitats in close proximity to open hunting habitats; tall trees and shrubs
BUREAU TRACKING							
Acorn Woodpecker *Melanerpes formicivorus*		4		Yes	Expected	Mixed oak woodlands	Snags
American Marten *Martes americana*	V	4	FA	Yes	Expected	Late-successsional forest	Large course woody debris, snag; uneven aged stand with adequate cover
Band-tailed Pigeon *Columa fasciata*		4		Yes	Documented	Coniferous forests	Closed canopy forests; mineral sites
Bank Swallow *Riparia riparia*	U	4		Out of Species Range		Open habitats	Dirt embankments
California Mountain Kingsnake *Lampropeltis zonata*	V	3		Out of Species Range		Pine forests, oak woodlands, chaparral	Rotting logs, loose soil
Cascades Apatanian Caddisfly *Apatania tavala*		4		Out of Species Range		Cool springs and small streams at high elevations (>4000 feet)	Dense coniferous canopy; cobble, moss, and bole-wood substrates
Clouded Salamander *Aneides Ferreus*	U	3	FA	Yes	Documented	Forested habitats	Coarse wood debris/talus
Franklin's Bumblebee *Bombus franklini*		3		Unknown	Suspected	Coastal mountains	Flowers
Great Gray Owl *Strix nebulosa*	V	4	C	No	Documented	Coniferous forests	Meadows and natural openings near nesting habitat
Indian Paintbrush Bug *Polymerus castilleja*		3		Unknown	Expected	Old-growth and late- successional conifer forests, mature riparian woods	Indian paintbrush (*Castilleja sp.*)
Long-eared Myotis *Myotis evotis*	U	4	FA-PB	Yes	Documented	Late-successional conifer forests, associated with water	Caves/mines, bridges, snags
Long-legged Myotis *Myotis volans*	U	4	FA-PB	Yes	Documented	Late-successional conifer forests, associated with water	Caves/mines, bridges, loose bark, rock crevices
Mt. Hood Brachycentrid Caddisfly *Eobrachycentrus gelidae*		4		Out of Species Range		Dense coniferous canopy shaded streams and springs in the subalpine zone of the Cascade Peaks	Aquatic mosses
Olive-sided Flycatcher *Contopus cooperi*	V	4		Yes	Documented	Coniferous forests	Uneven canopy with snags and tall trees
Oregon Megomphix *Megomphix hemphilli*		4	Z	Yes	Documented	Moist conifer/hardwood forests up to 3000 feet	Hardwood leaf litter and decaying nonconiferous plant matter under bigleaf maple trees; sword fern
Oregon Red Tree Vole *Arborimus longicaudus*		3	Z	Yes	Documented	Late-successional and mid seral Douglas Fir forests	Arboreal platform structures

SPECIES	OTHER STATUS[1]			HISTORIC OCCURRENCE IN ELK CREEK WATERSHED	CURRENT OCCURRENCE IN ELK CREEK WATERSHED[2]	HABITAT REQUIREMENTS	MICRO HABITAT
	STATE	ONHP	NWFP				
FBUREAU TRACKING							
Pallid Bat *Antrozous pallidus*	V	4	FA-PB	Yes	Expected	Ponderosa pine, oak woodlands	Buildings, bridges, snags
Pileated Woodpecker *Dryocopus pileatus*	V	4	V	Yes	Documented	Forests 40 years and older	Snags, CWD
Pristine Springsnail *Pristinicola hemphilli*		3		Unknown	Expected	Small, cold, pristine springs	Shallow, slow-flowing water
Ringtail *Bassariscus astutus*	U	4		Yes	Expected	Coniferous forests, mixed woodlands	Vertical structure to habitat, streams and rivers
Sagehen Creek Goeracean Caddisfly *Goeracea oregona*		3		Yes	Expected	Small, cold mountain streams	Rocks
Sharptail Snake *Contia tenuis*	V	4		Yes	Expected	Forested habitats	CWD, talus, riparian
Shiny Tightcoil Pristiloma wascoense		3		Out of Species Range		Coniferous forests	Mosses and other vegetation near wetlands, springs, seeps, and riparian areas
Silver-haired Bat *Lasionycteris noctivagans*	U	4	FA-PB	Yes	Expected	Late-successional conifer forests, associated with water	Caves/mines, bridges, loose bark, rock crevices, snags
Southern Torrent (Seep) Salamander *Rhyacotriton variegatus*	V	4		Yes	Expected	Springs and streams	Riparian/wetland, CWD
Tombstone Prairie Farulan Caddisfly *Farula reapiri*		4		Out of Species Range		Small, cold mountain streams at high elevations (>4000 feet)	Rocks and algae
Western Bluebird *Sialia mexicana*	V	4		Yes	Documented	Open habitats	Tree cavities
Western Gray Squirrel *Sciurus griseus*	U	3		Yes	Documented	Oak/hardwood forests, conifer forests, riparian	Broad-leafed component in habitat
White-footed Vole *Phenacomys albipes*	U	4		Yes	Expected	Riparian habitats within conifer forests	Small clearings supporting growth of forbs
Willow Flycatcher *Empidonax traillii brewsteri*	V	4		Yes	Documented	Riparian, edges of forest clearings	Willows, brushy vegetation
Yuma Myotis *Myotis yumanensis*				Yes	Expected	Late-successional conifer forests, associated with water	Caves/mines, bridges, buildings, snags

[1] **Oregon State Status:** SE= State Endangered; ST= State Threatened; CR= Critical; V= Vulnerable; P= Peripheral/Naturally Rare; U= Undetermined Status
Oregon Natural Heritage Program (ONHP) Status: 1= List 1 (Taxa that are threatened with extinction or presumed to be extinct throughout their entire range); 2= List (Taxa that are threatened with extirpation or presumed to be extirpated from the state of Oregon); 3= List 3 (Species for which more information is needed before status can be determined, but which may be threatened or endangered in Oregon or throughout their range); 4= List 4 (Taxa, which are of concern, but are not currently threatened or endangered).
Northwest Forest Plan (NWFP) Status: V = Viable; FA = Further Analysis; PB = Protection Buffer; A = Rare, Pre-disturbance surveys practical; B = Rare, Pre-disturbance surveys not practical; C = Uncommon, Pre-disturbance surveys practical; D = Uncommon, Pre-disturbance surveys not practical or necessary; E = Rare, Status undetermined; F = Uncommon or concern for persistence unknown, status undetermined; Z = Any combination of Categories A through F.
[2]Documentation of species can be referenced from the following sources: a) Oregon Natural Heritage Program; b) BLM surveys and wildlife observations; c) Breeding Bird Surveys; d) Audubon Christmas Bird Count; e) *Land Mammals of Oregon,* B.J. Verts and L. N. Carraway, 1998; f) *Amphibians of Washington and Oregon*, Leonard et al., 1993; and g) Atlas of Oregon Wildlife, B. Csuti et al., 1997.

Additional Special Status Species and Special Attention Species

A. Federally Threatened and Endangered Species

1. Canada Lynx

The Canada lynx (*Lynx canadensis*) was listed as a Federal Threatened species on March 24, 2000 (FR 65:16051-16086). In the Pacific Northwest, Canada lynx are associated with high elevational localities primarily east of the Cascade crest (Survey Protocol for Lynx, USDI and USDA 1998). A self-sustaining resident lynx population does not exist in Oregon but individual animals are present (Verts and Carraway 1998). The Elk Creek watershed is located outside of the range of the Canada lynx.

2. Fender's Blue Butterfly

The Fender's Blue butterfly (*Icariacia icarioides fenderi*) was listed as a Federal Endangered species on January 25, 2000 (FR 65(16):3875-38901). This butterfly is currently restricted to the WillametteValley (ONHP 1998). The caterpillar of the Fender's Blue butterfly is dependent on a few species of lupine, especially Kincaid's lupine (*Lupinus sulphurous* ssp. *kincaidii*), as a source of food.

Kincaid's lupine is primarily restricted to native upland prairie habitats in the Willamette Valley (FR 65(16):3875-38901). There is potential for Kincaid's lupine to occur in the watershed where conditions are similar to those in the Willamette Valley. Kincaid's lupine has been located, within the Umpqua Valley and South River Resource Area, in modified or relic prairie habitat. The suspected presence of Kincaid's lupine means Fender's blue butterfly could also occur in the watershed. However, it is unknown if the Fender's Blue butterfly is present in the Elk Creek watershed. Kincaid's lupine populations discovered should be monitored to detect the presence of Fender's blue butterfly caterpillars.

3. Vernal Pool Fairy Shrimp

The vernal pool fairy shrimp (*Branchinecta lynchi*) inhabits temporary pools of water in grass or mud bottomed swales (USDI 1994). The known distribution range is restricted to the Central Valley in California. The vernal pool fairy shrimp has been documented occurring on the Medford BLM District. It is unknown if the vernal pool fairy shrimp is present on the Roseburg BLM District. Private lands in the valleys of the watershed may have habitat, temporary water pools, which could be used by this shrimp species. The vernal pool fairy shrimp is not expected to occur on BLM-administered lands in the watershed.

B. Bureau Sensitive Species

1. American Peregrine Falcon

Peregrine falcons (*Falco peregrinus*) utilize cliff systems and rock outcrops for nesting. No known historic peregrine falcon sites occur within the watershed. Individual peregrine falcons have been observed throughout the watershed. The closest known nest site occurs along the Umpqua River, approximately four miles to the southwest of the watershed boundary. There is limited cliff or rocky outcrop habitat scattered throughout the watershed, which may provide nesting opportunities. The American Peregrine Falcon subspecies (*Falco peregrinus anatum*) breeds in Oregon, whereas the Arctic Peregrine Falcon subspecies (*Falco peregrinus tundrius*) is known to winter or migrate through Oregon.

The peregrine falcon has been delisted and is no longer considered a Federal Endangered species under the Endangered Species Act of 1973, as amended (FR 64(164): 46542-46558). The peregrine falcon is now considered to be a Bureau Sensitive species. Its status will be re-evaluated after monitoring, in 2015. Management guides include managing known and potential nesting cliffs to maintain site integrity. Sites occupied in the future will have seasonal disturbance restrictions of one-quarter mile or greater. Projects that require disturbance, such as blasting, within one mile of any high potential habitat discovered in the future, should be surveyed before project initiation. Pesticides that have a negative effect on prey species or their habitat will not be applied within two miles of an active site (RMP 1994).

2. Columbian White-Tailed Deer

The Douglas County distinct population segment of Columbian white-tailed deer was delisted on July 24, 2003 and is no longer considered a Federal Endangered species under the Endangered Species Act of 1973, as amended (FR 68(142): 43647-43659). Its status will be re-evaluated after five years of monitoring. The entire Elk Creek watershed is within the historic Columbian white-tailed deer (*Odocoilus virginianus leucurus*) distribution range (USDI 1983, and USDA and USDI 1994a). The southeast portion of the watershed borders the current distribution range of the Columbian white-tailed deer (ODFW, White-tailed Deer Distribution Map, May 2002). The historic optimum Columbian white-tailed deer habitat in the watershed has been impacted to some extent by human development. Bureau of Land Management administered land in the watershed is not considered to be important for the recovery of the Columbian white-tailed deer.

3. Crater Lake Tightcoil

The known range of the Crater Lake Tightcoil (*Pristiloma arcticum crateris*) occurs in the Cascades, south of Crater Lake, Klamath County, Oregon. It may occur throughout the Oregon Cascades in widely scattered populations. This snail is generally associated with old growth and late seral forests and among mosses and other vegetation within ten meters of perennially wet features, such as wetlands, springs, seeps, and riparian areas at elevations above 2,000 feet. The Crater Lake Tightcoil is expected within the watershed.

4. Green Sideband

The green sideband (*Monadenia fidelis beryllica*) snail is generally associated with deciduous trees and shrubs in wet, relatively undisturbed forest at low elevations. The current distribution is uncertain, but is likely to occur between the Sixes River and Winchuck River along the west side of the Oregon Coast Range (Frest and Johannes 2000). This snail species is not expected to occur within the watershed.

5. Insular Blue Butterfly

The Insular blue butterfly *(Plebejus saepiolus insulanus)* is associated with wet meadows, streamsides, and forest openings where there is enough moisture to support clover. Clover is required as a food source during the larval stage of the butterfly species. The distribution of this subspecies is known to occur from northwestern California to southwestern British Columbia. The current status of the species is unknown, but is expected to occur within the watershed.

6. Lewis' Woodpecker

Lewis' woodpecker (*Melanerpes lewis*) is associated with open woodland habitats near water. At the time of European settlement, this species was "very abundant throughout the more open portions of the timbered region of the northwest coast, preferring oak openings and groves" (Suckley and Cooper 1860 via Altman 2000). The population's drastic decline in Oregon since the mid-1960s is speculated to be due to destruction of lowland oak habitat and competition with the European Starling (*Sturnus vulgaris*) (Gilligan et al. 1994 via Marshall et al. 2003). This species has been documented in the Umpqua Valley, however its occurrence is considered "casual" (Hunter et al. 1998); breeding has not been confirmed in the Umpqua Valley (Altman 2000). The status of this species is unknown within the Elk Creek watershed.

7. Northern Goshawk

Historic literature and current geographic distribution suggests the northern goshawk (*Accipiter gentiles*) would not be expected to occur in most of the Roseburg BLM District. However, the northern goshawk has been documented throughout the watershed.

There is one known northern goshawk territory where nesting has been documented, within the watershed. The nest site was located in a mid seral stand, adjacent to an old-growth stand within Late-Succession Reserve. There are five other sections within the watershed that have had consistent goshawk sightings since 1998; however, follow-up surveys have not documented nesting in these areas. Consider follow-up surveys on goshawk sightings by evaluating habitat and conducting surveys to determine if additional goshawks are nesting within the watershed. Protect known and future nesting territories with 30-acre buffers around active and alternative nest sites (RMP 1994). Restrict human activity and disturbance within 0.25 miles of active sites from March 1 to August 31 or until the young have dispersed. A resource area biologist should determine if seasonal restrictions may be waived.

8. Northwestern Pond Turtle

The Northwestern pond turtle (*Clemmys marmorata marmorata*) is an aquatic freshwater species, living in a variety of habitats including ponds, streams and rivers. Northwestern pond turtles originally ranged from northern Baja California, Mexico, north to the Puget Sound region in Washington. Their current distribution includes the Columbia River Gorge and the inland valleys between the Coast Range and Cascade Mountains. Threats to native turtles include habitat alteration, predation on young turtles by exotic bullfrogs and fishes, drought, local disease outbreaks and fragmentation of remaining populations. Northwestern pond turtles require water to live and eat, and favor habitat with large amounts of emergent logs or boulders for basking. Habitat with sandy or silty substrates surrounding the aquatic habitat is also important for nesting (Brown et al. 1995). The Northwestern pond turtle has been documented during surveys and incidental finds (Oregon Natural Heritage Program, 2003), primarily along Elk Creek and in ponds within the watershed.

9. Pacific Fisher

The Pacific fisher (*Martes pennanti*) is very rare in Oregon. In 2000, a distinct population segment (including portions of California, Washington, and Oregon) of the Pacific fisher was petitioned for listing as "endangered" under the Federal Endangered Species Act of 1973. On April 8, 2004, the Fish and Wildlife Service announced a 12-month finding that the distinct population segment of the fisher is warranted to be proposed for listing, but precluded by pending proposals for other species with higher listing priorities, making the west coast distinct population segment of the fisher a "candidate" species (FR 69 (68): 18770-18792).

Most of the sightings are in the Coast and Cascade mountains. The most recent fisher sighting on the Roseburg District occurred near Drain, OR in 1975. Fishers primarily use mature closed-canopy coniferous forests with some deciduous component and frequently along riparian corridors (Csuti et al. 1998). Fishers also tend to utilize stands with a high degree of structural diversity on the forest floor. Habitat loss and forest fragmentation, as well as overtrapping have nearly extirpated this species from Oregon. The status of fisher is unknown, but expected to occur within the watershed.

10. Purple Martin

The purple martin (*Progne subis*) is an uncommon migrant and local breeding summer resident in Oregon. The western population of the purple martin was once fairly common in western Oregon (USFWS 1985). Purple martins nest in cavities and under natural conditions, nest in woodpecker holes in dead trees. Purple martins will also use nest boxes or gourds for nesting. Forest management practices, such as suppression of fire and clear-cutting without snag retention, significantly reduced natural nesting habitat. The Guidelines for Management of the Purple Martin in the Umpqua Valley (ODFW 1998) was developed to increase the purple martin population in the Umpqua River basin by establishing new colonies with a nest box program centered on local creeks, ponds, and reservoirs. The purple martin is known to occur within the watershed and has been observed in seven areas; nesting was documented within one of these areas on BLM-administered lands in 2002. Management practices creating snags in open areas would benefit this species.

11. Oregon Giant Earthworm

The Oregon giant earthworm (*Driloleirus macelfreshi*) was first discovered in 1937 with very few documented sightings to date. Oregon giant earthworms live in deep, moist, undisturbed soils of riparian forests. The biggest threat has been the destruction of their habitat due to agricultural activity, logging, and urban development. Not much is known about the distribution of this species. Positive sightings have occurred within the Willamette Valley and the Coast Range. The occurrence of the Oregon giant earthworm within the Elk Creek watershed is unknown.

12. Oregon Shoulderband

Oregon Shoulderband (*Helminthoglypta hertleini*) is a snail that is known to occur in southern Oregon and is suspected to occur as far north as Douglas County, Oregon (Burke et al. 1999). This species has been documented on the Roseburg BLM District within the North Bank Habitat Management Area within the Swiftwater Resource Area, as well as within the South River Resource Area. Habitat for this species is generally associated with, though not restricted to, talus and other rocky substrates. Other habitat components may include rock fissures or large woody debris sites. The occurrence of this snail species is unknown within the watershed.

13. Round Lanx

The round lanx (*Lanx subrotundata*) is a freshwater limpet. The status and distribution of the species is poorly understood. The *Lanx* genus occurs only in the west coast states in a variety of freshwater habitats. This species feeds on algae and detritus. The occurrence of the round lanx within the watershed is unknown.

14. Scott's Apatanian Caddisfly

The Scott's Apatanian caddisfly (*Allomyia scotti)* is associated with cold streams, often at high elevations in the mountainous areas of Oregon. Larvae frequently are found on vertical rock faces in a thin layer of flowing water, but also occur on rocks in turbulent water. Larvae scrape the upper surfaces of rocks to build their cylindrical larval case from small rock fragments (Wiggins 1977). The distribution or the status of this species is unknown within the watershed. However, due to this caddisfly species being associated with high elevational (> 4,000 feet) streams, it is not expected to occur within the watershed.

15. Townsend's Big-Eared Bat

Townsend's big-eared bat (*Corynorhinus townsendii*) is a relatively rare species with declining populations in Oregon. The species are known to occur in forested habitats west of the Cascade Mountains. The presence of suitable roost sites is more important than the vegetation type in determining the distribution of this bat (Csuti et al 1998). The species are strongly associated with caves and mines and are extremely sensitive to disturbance. When Townsend's big-eared bats are found occupying caves or mines on federal land, the appropriate state agency should be notified and management prescriptions for that site should include special consideration for potential impacts on this species (ROD/ Standards and Guidelines, pp. 37-38). There are currently no known roost sites within the watershed. The status of Townsend's big-eared bat is unknown within the watershed, but is expected to occur where suitable roost sites are present.

16. Traveling Sideband

The traveling sideband (*Monadenia fidelis celeuthi)* snail is associated with somewhat dry, open forested terrain at relatively low to moderate elevations. As of 1998 it appears to be restricted to a portion of the eastern Rogue River valley of Southern Oregon (Frest and Johannes 2000). Therefore, this species is not expected to occur within the watershed.

C. Bureau Assessment Species

1. Common Kingsnake

The common kingsnake (*Lampropeltis getula*) occurs in inland valleys at elevations below 2,200 feet. This species inhabits many habitat types, but is most closely associated with moist river valleys in southwestern Oregon. It is usually associated with thick vegetation near streams (Brown et al. 1995). The common kingsnake is expected to occur within the Elk Creek watershed.

2. Foothill Yellow-legged Frog

The foothill yellow-legged frog (*Rana boylii*) is associated with low-gradient streams and rivers with rock and gravel substrates or exposed bedrock (Corkran and Thoms 1996). Young frogs live in pools with gravel and cobbles. Adults will live in pool edges, in bedrock at the edge of the main channel, or under cobbles at the bottom of the pool. Species distribution includes the Oregon Coast Range, western interior valleys, and the west slope of the Cascades. Therefore, the foothill yellow-legged frog is expected to occur within the watershed.

3. Fringed Myotis

The fringed myotis (*Myotis thysanodes*) is a bat species that occurs throughout the state of Oregon, though does not appear to be abundant. This species is associated with woodlands at moderate elevations and is adapted to live in areas with diverse vegetative substrates (Verts and Carraway 1998). This is a highly migratory species that roosts in rock crevices, caves, buildings, mines, snags and trees. Fringed myotis are colonial and maternity colonies of several hundred individuals may be common in some areas (Maser 1998). Hibernacula include caves and buildings, but not much is known about their winter habitats (Verts and Carraway 1998). The species has been documented on the Roseburg District and is expected to occur within the Elk Creek watershed.

4. Northern Red-legged Frog

The northern red-legged frog (*Rana aurora aurora*) is associated with moist coniferous or deciduous forests and forested wetlands in the lowlands west of the Cascade Mountains (Corkran and Thoms 1996). They require cool water, usually well-shaded ponds, lake edges, or slow streams, for breeding. During summer, young and adult frogs live along streams, on shaded pond edges, or under logs or debris. They may occur in forests far from water during damp conditions. Leaving shade trees around aquatic habitat and managing runoff from roads will benefit this species (Corkran and Thoms 1996). The northern red-legged frog is known to occur and has been documented with the watershed.

5. Tailed Frog

The tailed frog (*Ascaphus truei*) occurs in fast, small, permanent well-shaded forest streams with clear, cold water, cobble or boulder substrates, and little silt (Corkran and Thoms 1996). Tadpoles are more likely to be found lower in stream than young and adult frogs, which occur in gravel or under large cobbles, often in very shallow water. Adults may be found on streambanks at night and during wet weather. Adults may also be found away from streams during winter rains and occasionally on warm, humid, cloudy days (Corkran and Thoms 1996). The species distribution includes the Oregon Coast Range and Cascades. Therefore, this species is expected to occur within the Elk Creek watershed.

6. White-Tailed Kite

The white-tailed kite (*Elanus leucurus*) is associated with wooded riparian habitats in close proximity to open hunting habitats such as farmlands, grasslands, meadows, emergent wetlands, and lightly wooded areas (Martin 1989 via Bosakowski and Smith 2002). Though nesting has been documented in Douglas County, the white-tailed kite is considered a rare to very rare breeder in the Umpqua Valley (Marshall et al. 2003). Protecting wetlands and maintaining riparian buffer strips would provide nesting and roosting habitat for this species. The white-tailed kite has been documented within the Elk Creek watershed.

D. Special Interest Species

These species are of special interest to the general public or another agency, such as the Oregon Department of Fish and Wildlife.

1. Bat Species

Presence and abundance of bats within this watershed is unknown due to few known site locations and lack of survey information for these species. Five bat species of concern (Appendix 4-2), such as Yuma myotis (*Myotis yumanensis*) and long-legged myotis (*Myotis volans*), are likely to occur in late-seral forest within the watershed. Structural features of older forest stands, including large snags, tree deformities, prominent flaking bark, and thick foliage are known to provide suitable roosting sites for some of these species. These bats may forage over a variety of habitat types, particularly in riparian areas with adjacent late-seral habitat. In riparian habitats, insects associated with nearby water sources can provide good foraging habitat in close proximity to roosting sites. Considering the association of these species with late-seral forests, snags, and riparian areas, it is likely that these species are very sensitive to forest management practices. Management recommendations are provided in the ROD - Appendix 1 (USDA and USDI 2001) to provide additional protection for roost sites for bats including the fringed myotis, silver-haired bat (*Lasionycteris noctivagans*), long-eared myotis (*Myotis evotis*), long-legged myotis, and pallid bat (*Antrozous pallidus*).

2. Neotropical Bird Species

Bird species that migrate and spend the winter south of the North American Continent are considered to be Neotropical bird species. Bird species that live on the North American Continent year round are called resident birds. Widespread concern for Neotropical bird species, related habitat alterations, impacts from pesticide use, and other threats began in the 1970s and 1980s (Peterjohn et al. 1995).

Oregon has over 169 bird species considered to be Neotropical migrants. Population trends of Neotropical migrants in Oregon show declines and increases. Over 25 species have been documented to be declining in numbers (Sharp 1990). Oregon populations of 19 bird species show statistically significant declining trends while nine species show significant increasing trends (Sharp 1990). Including all species showing declines, increases, or almost statistically significant trends, there are 33 species decreasing and 12 species increasing in number in Oregon (Sharp 1990).

The Elk Creek watershed supports populations of Neotropical bird species. The watershed provides suitable habitat for Neotropical species known to nest in the Roseburg BLM District. The hardwoods, shrubs, and conifers function as breeding, feeding, and resting habitat for many Neotropical birds.

Partner's In Flight, a coalition of state and federal agencies, private agencies and organizations, and academia-developed conservation plans to ensure long-term maintenance of healthy populations of native landbirds. *The Conservation Strategy for Landbirds in Coniferous Forests of Oregon and Washington* and *The Conservation Strategy for Landbirds in Lowlands and Valleys of Western Oregon and Washington* provide recommendations intended to guide planning efforts and actions of land managers. In addition, the *Guide for Assessing the Occurrence of Breeding Birds in Western Riparian Systems* (BLM 1999) provides a tool to help construct a standard for western riparian bird communities, and to determine what breeding birds could be, or should be, on a given site.

3. Osprey

The osprey (*Pandion haliaetus*) is a migratory species that breeds in Oregon. Osprey is a bird of prey whose diet consists primarily of fish. As a result, it nests in areas within easy reach of lakes and rivers. It requires suitable nest sites such as large, dead trees or artificial nesting platforms. Potential osprey nesting habitat is present along Elk Creek, as well within the vicinity of ponds and lakes present within the watershed. There are no documented osprey nest sites on BLM-administered lands within the watershed.

4. Raptors

Raptors are birds of prey, which includes eagles, hawks, kites, falcons, and owls. Two eagle species, five hawk species, three falcon species, seven owl species, and the white-tailed kite occur or could potentially occur within the watershed in various habitat types. Known and future raptor nest sites, not protected by other management recommendations, will be protected under the RMP by providing suitable habitat buffers and seasonal disturbance restrictions (RMP 1994).

5. Roosevelt Elk

Historically, the range of Roosevelt elk (*Cervus elaphus*) extended from the summit of the Cascade Mountains to the Oregon coast. In 1938, the elk population in Oregon was estimated to be 7,000 animals (Graf 1943). Elk numbers and distribution changed as people settled in the region. Over time, elk habitat areas shifted from the historical distribution to "concentrated populations centers which occur as islands across forested lands of varying seral stages." Information about the historical distribution and current population estimates of Roosevelt elk in the Elk Creek watershed is not available (pers. comm. ODFW).

Elk forage for food in open areas where the vegetation includes grass-forb, shrub, and open sapling communities. Elk use a range of vegetation age classes for hiding. Cover includes large shrub, open sapling, closed sapling, and mature or old-growth forest habitat (Brown 1985). Logging, thinning, prescribed burning, road management, and other forest management practices can maintain, enhance, or degrade elk habitat. Developments such as roads, trails, and campgrounds, and disturbance from recreational and management activities increasingly influence available forage. Projects designed with elk as an objective can improve the distribution of cover and forage, enhance forage quality and quantity, and maintain cover structure (ODFW 2003). In addition, gating roads to limit motorized access would reduce disturbance and minimize displacement of elk from federal lands to private lands. The portion of the watershed along the Interstate-5 corridor is included in a "deemphasis elk management unit" due to livestock conflicts with private landowners (pers. comm. ODFW).

6. Wild Turkey

The historic distribution range of the wild turkey (*Meleagris gallopavo*) extended from Arizona north and east to New England and southern Canada. Their range also extended to Veracruz, Mexico. The wild turkey has disappeared from its historic range. It has been introduced into California, Nevada, Oregon, Utah, Washington, and Wyoming (Csuti et al. 1997).

Wild turkeys inhabit savannah woodlands, young forest stands less than 10 years old, meadows, and riparian areas (Csuti et al. 1997, Crawford and Keegan 1990). The oak savannahs present in the lower elevations of the watershed are mostly on private land. Bureau of Land Management administered land would not play a major role in maintaining turkey populations in the watershed. However, some turkeys may use BLM-administered lands that are adjacent to the agricultural and hardwood areas on private land.

13. Geology And Soils Appendix

A. Detailed Description of Elk Creek Geology/landslide Relationships

1. Description of Geology and Landslides

Debris avalanches, debris flows, slumps and earth flows are the main types of landslides that occur in the Elk Creek watershed. **Debris avalanches** are rapid, shallow-seated landslides (usually 2 to 10 feet deep) that occur where downslope shear stresses exceed soil shear strength along shallow, planar surfaces. They are composed of earth, rock fragments and vegetative material. The water component is less than that of a debris flow. **Debris flows** are rapid moving water-charged slurries of soil, rock fragments and vegetative debris that move down steep-graded confined stream channels. **Slumps** are consolidated masses of soil or weak bedrock that shear in a rotational manner around a pivot point. The shear surface is usually well below root zones. **Earth flows** are blocks or multiple blocks of earth and weak rock that move in gliding movements that are slow in comparison to debris avalanches and debris flows. These blocks can remain relatively intact as they move and their failure surfaces are usually well below root zones. Some earth flow movements are very slow and not perceptible most of the time. They often occur in combination with slumps. Slumps and earth flows, because of their deeper depths, are less easily influenced by management activity than debris avalanches and debris flows.

Distinct differences in landslide types, frequency, distribution, magnitudes and effects can be attributed to the varied geomorphology in the Elk Creek watershed. The distinct landscapes, drainage patterns and bedrock characteristics that developed because of the differences in geology account for most of the variations in landslides. The **Tyee** is the dominant geological formation, covering 63 percent of the Elk Creek watershed. It consists of rhythmically bedded marine sandstones and siltstones. The topography of the Tyee is commonly a complex of very steep (65 to greater than 100 percent slopes), deeply incised terrain 20 to 1500 acres in size and gentle (3 to 30 percent) to moderately sloping ground (30 to 60 percent) of similar area that is less incised with drainages. The breaks between the two terrain types are usually ridgelines and third order and higher streams. *Note that for the purpose of this appendix, the very steep terminology applies to slopes 65 percent to steeper than 100 percent. In other watershed analysis done by the author of this appendix, this range of slopes covered steep, very steep and extremely steep terminology.*

Over the past 50 years debris avalanches and debris flows have been common in the very steep, deeply incised terrain of the Tyee in the western half of the watershed. Here, there is a relatively high frequency of debris avalanches on slopes generally steeper than 65 percent on concave (moisture converging) positions and 75 percent on convex and planar positions (based on ODF Storm Impacts and Landslide of 1996). Steep-graded low order drainages commonly extend down from very steep, moisture converging headwalls at ridge tops to low gradient third and higher order streams below. It is in these low order drainages with gradients steeper than 35 percent and with channels that are confined and in the very steep headwalls where debris flows of highly variable size and length most often generate. They can be initiated by debris avalanches entering these channels. Debris flows can entrain large volumes of earth, rock and woody debris as they scour stream channels and banks and destroy riparian vegetation. They can travel long distances (some times more than two miles). Upgrade of the deposition zones, stream channels are often scoured to bedrock. Debris flows usually will continue to move downstream until stream gradients become less than six percent or until they enter a fork with another stream at an angle of less than 70 percent or until the stream channel no longer is confined (Benda, 1989). A high percentage of the larger debris avalanches and debris flows (greater than 0.5 acres) identified in the aerial photo landslide inventories reached third order or higher streams. The debris avalanches and flows can create debris jams that back up stream flow. When the jams break, debris is propelled further down the streams in torrents of water called a dam-break flood. There can be a series of dam-break floods that develop, moving debris further down the higher order, low gradient streams. Dam break floods can also destroy riparian vegetation and cause substantial local erosion (Benda, undated).

The majority of this very steep terrain of the Tyee is potentially unstable (can become unstable with changing site conditions). The risk of landslides on these potentially unstable slopes is generally moderate under clear cut conditions and low in thinnings with appropriate project design features. The risk of landslides in regeneration harvests would most often fall between that of clear cuts and commercial thins. Stable ground forms the next largest component on the very steep slopes. It is usually present in bands of very shallow soils (less than ten inches to bedrock) and rock outcrop. A small percentage of the very steep slopes are unstable (actively failing) and are present in some headwalls and stream inner gorges and at slope breaks and seeps.

Much of the very steep areas have soils high in rock fragment content. Stream bank sloughing fed by soil creep, landslides and debris flows has been an important delivery mechanism of rock fragments to streams. Other areas have contributed little rock fragments in proportion to fines. The long term effects of debris flows have been highly variable in the proportions of scour, the removal of stream bank material, and the deposition of earth, rock fragments and woody debris. An attempt was made in the Upper Umpqua Watershed Analysis to correlate debris flows and dam-break floods that occurred within the last 50 years with stream function. About half of the larger ones might have overall enhanced the structural component of fish-bearing streams. The other half might have overall degraded the structural component.

In the moderately sloping terrain, shallow-seated landslides and debris flows have been considerably less than on the steeper ground. They occur along old scarp features and steep inner gorges of streams that have incised these slopes. Widely scattered, deep-seated slumps and earth flows have occurred over the past fifty years on the moderate slopes, usually where surface drainage is poorly developed and deep clayey soils over soft, weak bedrock are present. Earth flows are usually much wider and deeper than debris flows but they have a lot less reach than the larger debris flows and do not always directly impact stream channels. Some fast moving earth flows have exceeded a 1000 feet in length. Also present on these moderate slopes are old, very slow moving earth flows. These earth flows can be part of ancient slump-earth flow systems that are largely dormant. Road construction can reactivate portions of these dormant systems. The **Elkton** Formation has similar terrain and landslide characteristics as the moderately sloping terrain of the Tyee Formation. It consists of massive to thin-bedded marine siltstones with some interbedding of sandstones. The Elkton Formation covers only 0.2 percent of the Elk Creek watershed.

Slopes are overall less steep in the Tyee and the similar **Umpqua** Formations on the east half of the watershed than in the west half. As a consequence, debris avalanche and debris flow concentrations are confined to fewer areas. The Umpqua Formation covers twelve percent of the watershed and consists of marine mudstones, siltstones, sandstones and pebble conglomerates that are associated with the volcanic formations, Siletz River and Colestin. Those sedimentary rocks associated with the Colestin Formation are tuffaceous.

The **Colestin** Formation of the Cascades covers eight percent of the watershed. It consists of volcanic rock that includes andesitic tuff and breccia, waterlaid and airfall silicic ash, and basalt flows. The topography that developed here is quite variable. In some areas are very steep, dissected mountain slopes that have drainages that extend from the upper slopes down to the third order and higher streams. Here, debris avalanches and debris flows are almost as common as in the Tyee and Umpqua Formation. The risk of landslides on the very steep potentially unstable slopes is generally moderate under clearcut conditions and low in thinnings with appropriate project design features. Stable ground forms the next largest component on the very steep slopes. It is usually present in patches of very shallow soils (less than ten inches to bedrock) and rock outcrop. A small percentage of the very steep slopes are unstable (actively failing) and are present in some headwalls and stream inner gorges and at slope breaks and seeps.–

More common in the Colestin Formation is a stair stepping topography where the drainage gradient is broken up by a series of steep scarps, gently sloped benches and moderately sloping ground extending down from ridge tops and buttes. Many drainage systems are young and not highly developed due to disruptions created by earth flow activity. Large, deep-seated, slump-earth flows occasionally initiate on the moderate slopes, usually where surface drainage is poorly developed and deep clayey soils over soft, weak bedrock are present. Shallow-seated debris avalanches occur on the scarps. These slumps and earth flows can be part of larger ancient slump-earth flow systems of variable stability and activeness. Road construction, if incorrectly placed, can reactivate portions of these dormant systems. The **Siletz River** Formation has similar terrain and landslide characteristics as the moderately sloping terrain of the Colestin Formation. It is volcanic basement rock that consists of marine basalts. The Siletz River Formation covers twelve percent of the Elk Creek watershed.

The Swiftwater landslide inventories show a strong correlation between large spikes in landslide activity, both natural and man-caused, with intense storm events and above normal precipitation. This is especially so for large rain-on-snow events. In contrast, there is little landslide activity during the driest years. In the Upper Umpqua watershed, the overall dry 1984-1994 period had 2.5 to 7 times less landslide activity than wetter periods (Chart 5-2 and Chart 5-3). In six representative sixth-field subwatersheds in the Elk Creek watershed, landslide activity increased ten fold from the droughty 1989-1994 period to the wet 1994-1999 period (Chart 5-4).

Management activities had the greatest impact from the 1950's through the early 1980's. Many roads were built in high landslide risk locations with inadequate drainage and with the sidecasting of excavated material on steep slopes. Road-drainage directed water onto unstable and potentially unstable slopes triggering many landslides. Slopes loaded with sidecast and the fills of stream crossings would often fail. Some of these roads still have segments where corrective measures for drainage are needed and where slopes loaded with sidecast are unstable. As a result, these roads still have a high risk of creating landslides in the future. Landslide levels dropped dramatically from 1984 to 1994 during drier weather patterns. During this decade, sidecasting of roadcut material ended, new roads were moved more to stable, ridge top positions and uphill cable yarding was more often utilized on steep slopes as opposed to the more impacting tractor, hi-leading and downhill cable yarding. Landslide levels took a big jump during the wet years of 1995 to 1999 that included the November 1996 and January 1997 large storm events. However, those levels were still lower than the wet 1979 to 1983 period.

2. Limitations of Landslide Inventory

There are many limitations to aerial photo inventories. Undercounting, especially where there are forest canopies, is one major limitation. Another limitation is large holes in coverage for certain photo flights. Slumps with limited displacements are most often missed (fresh slump scarps must be large enough or the body of the slump broken up enough for detection). Because of all the limitations, the inventories do not accurately portray absolute numbers of landslides. They also do not give an accurate comparison between the frequency of the forest-related and management-related landslides. Even comparing the frequencies of road and harvest-related landslides is difficult because of the different sets of limitations in identifying these management-related landslides. Aerial photo landslide inventories have their greatest value in giving a sense of relative magnitude and impacts of the rapidly moving landslides (primarily debris avalanches, torrents/debris flows and rapid earth flows) have from period to period and from area to area. In interpreting Charts 5-2, 5-3 and 5-4, for example, trends in road-related landslides can be seen but there are problems in identifying road-related landslides including recognizing failures in fresh sidecast. Because of this, the total amount of road failures can not be accurately stated and a comparison with the amount of harvest-related landslides can not easily be made. A more comprehensive accounting of the limitations is in the Upper Umpqua Watershed Analysis Geology and Soil Appendix (pp. 156-158).

B. SEDMODL Description and Detailed Results

1. Introduction

Boise Cascade Corporation has developed a GIS-based road erosion/delivery model to assist land managers in identifying road segments with a high potential for delivering sediment to streams in a watershed. The model uses information from an elevation grid, along with road and stream layers to determine which segments of the road system drain to streams. The relative amount of sediment produced from these road segments is then calculated based on road erosion factors from the Washington Department of Natural Resources Standard Method for Conducting Watershed Analysis, surface erosion module (WDNR 1995), with several modifications.

The purpose of this model is to identify road segments that have a high potential for delivering sediment to streams. Although SEDMODL is capable of producing results of sufficient accuracy to support reasonable analytical conclusions, **the model is conservative on the side of aquatic resources; it generally identifies more delivering road segments than actually exist on the ground.**

2. Limitations of the SEDMODL Program

There are a number of limitations of the SEDMODL program that the user should keep in mind when interpreting model results. These limitations relate primarily to the quality of input data (the garbage in, garbage out scenario) and situations that the program is not designed to model.

If stream (or road) layer is off spatially then the amount of road/stream intersections has the potential to increase, which in turn increases the amount of direct delivery segments and potentially the amount of sediment delivered

If road layer attributes are incomplete; treat the sediment produced number in a relative sense (i.e. this segment of road has more sediment delivered than that one).

Current model assumes all roads are in-sloped with a ditch. This can skew sediment amounts. Current model assumes all roads are over two years old.

3. SEDMODL Data Requirements

- ➢ Topography (10m DEM Elevation Grid)
- ➢ Streams (Location)
- ➢ Roads (Surface Type, Traffic Level)
- ➢ Basin Boundary

➢ Precipitation (Included in the Model)
➢ Geology (Included in the Model)

4. Road Segment Delivery

One of the goals of the model is to identify which portions of the road network in a basin are delivering sediment to streams. That way, land managers can pinpoint where to direct road improvements to reduce sediment input to streams. The model divides the road network into three categories: segments that deliver directly to streams (i.e. at stream crossings); segments that deliver sediment indirectly to streams (i.e. roads closely parallel streams, within 100 feet and within 200 feet); and segments that do not deliver to streams (i.e. runoff is directed onto the forest floor and infiltrates). Segments in the latter category are dropped from further computation because sediment produced from these portions of the road network generally does not reach the stream system.

Stream crossings are defined first, using a series of intersections of the road and stream layer. These intersections are then input into the elevation grid to be used as starting points for calculating the delivery length to each crossing. Each grid cell on either side of this point is evaluated to determine if it is higher, lower or the same elevation as the stream crossing. If the new cell is higher in elevation, it becomes the new starting point. This process continues until the next elevation is lower than the previous cells' elevation. The road segments that match with these newly defined areas of direct delivery are extracted from the road layer. The model then buffers the stream layer to 100 and 200 feet and extracts the roads with indirect delivery.

Road segments that deliver directly to streams are assigned a delivery factor of 1, meaning that 100 percent of water and sediment produced from these segments is delivered to the stream network. Road segments that do not deliver to streams are assigned a delivery factor of 0. Road segments that deliver sediment within 200 feet and 100 feet of a stream, but not directly to a stream, are assigned a delivery factor of 10 percent and 35 percent, respectively (WDNR 1995).

5. Erosion from Delivering Segments

Erosion from roads in the basin was estimated using formulas based on empirical relationships between road use, parent material, road surfacing, road surface slope, cutslope and fillslope vegetative cover, and delivery of eroded sediment to the stream network (WDNR 1995, Beschta 1978, Bilby et al. 1989, Megahan et al. 1986, Reid and Dunne 1984, Sullivan and Duncan 1980, Swift 1984).

Sediment is produced from four components of a standard forest road prism: the cutslope, ditch, tread, and fillslope. Since the intended use of this model is a screening tool, actual dimensions and conditions of each of these components throughout the road network are not known. The model uses several simplifying assumptions to allow calculation of relative sediment yield based on measurements of road prisms on over 800 road segments in watersheds in Washington, Oregon, and Idaho. These measurements were made on private, state and federal lands as part of road erosion surveys during watershed analyses.

The **first simplifying assumption** is that roads in the watershed have been in place for several years, and cutslopes and fillslopes have revegetated and stabilized. While there are likely several miles of new roads (less than two years old) in a watershed at any given time, it is assumed that land managers know where these new roads are and have or could take appropriate erosion control measures at stream crossings to reduce sediment input from these segments until the roads have stabilized. The majority of erosion from new roads comes during the first two years from fillslopes, cutslopes, and ditches until these areas revegetate and/or armor. Erosion control on portions of these surfaces that drain to streams and/or sediment detention measures where ditches enter streams has been shown to effectively reduce sediment input from fresh roads. Sediment control measures would be used on new road construction.

The **second assumption** is that most roads in the watershed are insloped with a ditch. This directs water away from fillslopes, and results in only short lengths (average 50 feet) of fillslopes that deliver sediment to streams at road crossings. Field observations and calculations indicate that erosion from the short, vegetated/armored sections of fillslope that occurs at most stream crossings is much smaller than from other portions of the road prism. Therefore, the model assumes that fillslope erosion is negligible. There may be a few locations in your watershed, such as where a road closely parallels a stream for a long distance, or, as mentioned previously, some new road crossings where this assumption is not valid.

The model also groups erosion from the tread and ditch together, so assigned road widths include both the running surface and ditch widths. The result of this assumption is to apply surfacing and traffic factors to the ditch as well as the tread. These two factors will tend to even each other out since most heavily used roads (high traffic factor) have gravel surfacing (lower surfacing factor). Very heavily used gravel roads (main haul roads) will have a very high traffic factor, but applying this to the ditch is probably appropriate since these roads and ditches are likely regraded frequently, disturbing the ditch's armor layer and increasing sediment production.

The average annual volume of sediment delivered to a stream from each road segment is calculated based on the following formulas:

Total Sediment Delivered from each Road Segment (in tons/year) = Tread + Cutslope

Tread = Geologic Erosion Rate x Tread Surfacing Factor x Traffic Factor x Segment Length x Road Width x Road Slope Factor x Precipitation Factor x Delivery Factor

Cutslope = Geologic Erosion Rate x Cutslope Cover Factor x Segment Length x Cutslope Height x Delivery Factor

Values for each factor in the equations are obtained from either model-supplied or user input values or from lookup tables associated with road class, surfacing, slope, or hillside slope obtained from the GIS database.

6. SEDMODL Use in Elk Creek Watershed Analysis

All of the BLM roads rated as higher risk within Elk Creek were evaluated using the SEDMODL. The parameters that most affect changes in sedimentation rates as predicted by the model include: Road conditions (Surface Types) and traffic levels (Administrative vs. Logging Traffic) within 200 feet of streams. In this analysis the value for the current chronic sedimentation rates are based on light haul traffic on these higher risk roads. Total sediment estimated from BLM roads within 200 feet of streams is approximately 560 tons per year. This equates to approximately 4.2 tons per mile of road per year. Applying this rate to state/county and private roads, approximately 750 tons of sediment is estimated from state/county roads and approximately 1,360 tons of sediment is estimated from private roads. The model also calculates a background sediment rate from natural sources. SEDMODL calculated approximately 13,000 tons/year in background sediment for the Elk Creek Watershed. The SEDMODL helps define the context of sedimentation within the watershed. Road improvements should result in a long-term reduction in chronic sediment delivery to stream systems and may result in improved aquatic habitat conditions from reduced fine sediment inputs.

14. Hydrology Appendix

Table 14-1 Elk Creek Tributary Stream Temperature Summary

SITE NAME	7-DAY AVERAGES (DATE)	MAXIMUM TEMPERATURE (° CELCIUS)	TEMPERATURE CHANGE (° CELCIUS)	Days > 17.8 ° CELCIUS
North Fork Tom Folley Upper	07/16/94	13.5	1.4	0
	08/05/00	18.8	3.9	12
	08/01/03	17.2	2.1	2
North Fork Tom Folley Middle	07/23/94	15.0	0.9	0
	08/03/00	18.9	3.3	15
North Fork Tom Folley Lower	07/21/94	18.4	3.6	8
	08/03/95	18.1	3.6	7
	08/03/00	18.9	3.3	15
	09/03/03	19.7	5.7	46
North Fork Tom Folley at Mouth	08/01/00	18.7	3.6	15
Big Tom Folley Upper	07/31/03	17.6	2.8	5
Big Tom Folley Lower	08/26/99	17.8	2.1	11
	08/01/00	20.0	3.6	31
	08/14/02	19.7	4.1	43
	07/30/03	20.4	3.6	51
Saddle Butte	07/21/03	18.2	2.7	10
Brush Creek	07/29/03	25.4	8.0	51
Thistleburn	07/30/03	19.7	3.9	28
Elk Upper	07/26/02	18.9	3.3	18
	07/25/03	19.1	3.1	21

A. Equivalent Clearcut Acre Methodology Discussion

Equivalent Clearcut Acre (ECA) values have not been demonstrated to have meaningful correlation to runoff response or changes to stream channel morphology. This is because the ECA index does not address the underlying causal geomorphological and hydrological mechanisms. A more direct approach to assess the potential hydrological effects implied by an ECA analysis is to perform a peak flow analysis. A general discussion on changes to stream flow can be found in section B of this appendix.

The ECA method (Galbraith 1975) was originally developed to predict potential increases in annual water yield. The type of ECA analysis commonly used accounts for acres of created forest openings and uses partial recovery coefficients for regrowth of young forest stands. The ECA indicator as used in fisheries Endangered Species Act (ESA) consultations (NMFS 1996 and NOAAF et al. 2003) is expressed as a percentage. A 15 percent ECA value can represent 15 percent of the actual acres in a watershed if those acres had the forest canopy entirely removed in one year and the remainder of the acres in that watershed was at full recovery (defined as some percentage of canopy closure). The 15 percent value may represent greater actual acreages in a watershed in various states of hydrologic recovery. It was originally developed for forested lands in Montana and Idaho where snowmelt processes are the dominant hydrographic events. The ECA indicator used in ESA consultation does not predict an actual increase in water yield, nor does it model individual stream flow events (Belt 1980).

There is little or no calibration of vegetative treatments with flow response such as originally was the case by the developer (Galbraith 1975). Furthermore, the ECA method was never intended for precipitation-dominated areas, such as the Elk Creek Watershed, but rather for permanent snow accumulation elevations. In the winter, snow as water equivalent is stored differentially on the forest floor and in openings and spring melt rates may vary depending on forest canopy structure above snow packs (including the effects of litterfall) compared to snow pack in the openings. In contrast, the Elk Creek Watershed is low elevation, rain-dominated, and snow storage seldom occurs, is transitory, and confined to a very limited portion of the watershed.

The ECA procedure was meant to track changes in annual water yield, and this was assumed to be proportional to the increase in area logged. Increased water yield was assumed to be proportional to an increase in spring snowmelt runoff that may influence peak flows. Although regeneration harvest generally does increase water yields, the assumed correlation between an increase in water yield and an increase in peak flow has not been established.

There is no agreed upon ECA procedure in use and many derivatives are being applied. NOAAF (1996) does not provide guidance on which derivative to use. ECA calculations have been undertaken for all precipitation-runoff processes for all watershed elevations (beyond intended uses) including permanent snow pack accumulation areas, rain-on-snow intermediate elevations, and lowland precipitation dominated areas. Furthermore, many users have coupled ECA with an Aggregate Recovery Percentage (ARP) procedure, which was developed to index potential increased peak flows in rain-on-snow elevations (Christner 1981). The result is a hybrid procedure, being called ECA that is really an acres accounting system. Vegetative age classes are determined, starting from a regeneration harvest or open condition, including roads and meadow open area, and then adding in various young stand ages up to a stand condition that is assumed to represent hydrologic maturity in terms of some combination of age, height, canopy cover, or diameter. Coefficients are applied for partial recovery.

This procedure is assumed to indicate increased annual yield with types and patterns of forest tree removal, and this increase is assumed to cause increased peak flows, or be problematic when an indicated ECA threshold is surpassed. However, an ECA procedure, used without reservation across the landscape, leaves the user with difficulty assimilating the differences in rain and snow processes leading to varying runoff regimes. Forest stand characteristics, necessary to modify snow accumulation or melt rates leading to differences in stream flow, may have no effect in rain only watersheds. Coefficients for partial recovery without extensive calibration are suspect in describing water yield or runoff processes. Therefore, the ECA procedure is not a sufficiently precise tool to be relied upon for process based decisions. In common practice by the BLM and Forest Service, ECA and similar indices are used as a coarse screen to indicate when further field evaluation is needed, or as a means to compare alternatives during project analysis.

For the following reasons, the use of the ECA indicator is not appropriate for the Elk Creek Watershed. The scientific uncertainties and assumptions about relationships between ECA values, annual water yield, peak flows, and the point at which harm occurs to listed fish species or adverse effects to critical habitat raise questions about the utility of ECA as an ESA effect determinant tool in general. An incremental increase in an ECA index value does not predict an effect to fish or their habitat.

1) The ECA model was designed for areas where snow pack snowmelt is the dominant water yield process. It has not been calibrated to rain dominated watersheds.

2) ECA analysis as practiced in the current analytical procedures for ESA consultation results in a percentage value. An increasing percentage value indicates a risk of increased annual water yield. There is scientific uncertainty at what point an increase in annual water yield is detectable when forest canopy is removed. NOOAF staff have indicated that the 15 percent threshold value identified in NOAAF (1996) and the current ESA analytical procedure for the Properly Functioning Condition category for the Disturbance History indicator is NOOAF's opinion on what constitutes a low risk of hydrological effects, based upon literature reviews and an expert panel evaluating logging effects in the Snake River Basin in Idaho. Other sources suggest that there is considerable uncertainty on a threshold for detecting increased water yield. Based upon 94 watershed experiments reviewed, Bosch and Hewlett (1982) concluded that water yield increases are usually only detectable when at least 20 percent of the forest cover has been removed. Stednick (1996) made a similar conclusion that in the U.S., changes in annual water yield from forest cover reduction (or catchment area harvested) of less than 20 percent could not be determined, based on plotting paired catchment results. Stednick (1996) does acknowledge that measurable increases in water yield for harvested areas less than 20 percent have been observed. Stednick (1996) also describes for the Pacific Coast region that a simple linear regression between water yield increase and percent harvested suggests a 25 percent minimum harvest to obtain a measurable annual water yield increase.

3) A presumed risk of adverse affects to ESA-listed fish species or their critical habitat would be reached at some ECA percentage. Assumptions must be made between the change in the ECA percentage value attributed to the action, its corresponding increase in annual water yield, and a corresponding increase in flow for any particular recurrence interval event to begin to assess for potential adverse affects. These relationships have not been established and would be speculative without calibration by monitoring examples. They may also be relatively unique to specific watersheds or basins due to differences in vegetation types, geology, elevation, and precipitation regime.

4) Flows for a particular recurrence interval effect would have to be sufficiently increased to harm fish species or damage stream channels, substrate, and banks. The relationships between increments of increased peak flows for specific recurrence interval events and harm to fish or habitat damage have not been established. As described in item 3) above,

the percent ECA value in the NOOAF fish process does not correspond to a value for an increase in annual flow. Changes in annual water yield do not necessarily correspond with changes in peak flows that are responsible for showing an effect; i.e. altering the beds and banks of streams channels.

5) Some annual yield increases may be beneficial to fish; elevating summer flows for example.

6) The relationship between ECA values and the use of wide riparian buffers have not been established. Harvests under the NFP normally include a wide area (may exceed 400 feet where fish are present) of Riparian Reserve forest left adjacent to streams, that may absorb a theoretical flow increase through evapotranspiration processes. For example, a watershed in the Alsea Watershed Study that had 26 percent of its area in patch cuts with stream buffers 50-100 feet in width showed no statistical difference for peak flow effects for fall or winter events between the buffered watershed and a control watershed (Reiter and Beschta 1995).

7) The rainy season in the action area that generates highest peak stream flows (those that may result in changes to the banks and streambed) occurs in the winter, when the differences in evapotranspiration demand from the forest to the openings are the lowest and soils are already saturated, resulting in no significant difference between water yield from forest areas and water yield from areas with canopy removed.

8) There is essentially no snow to differentially accumulate and melt in the action area watersheds that can augment runoff from rainfall.

B. General Disscussion on Stream Flow Changes as a Result of BLM Forest Management

Annual Yield:
Water yield studies indicate that clearcut harvesting of relatively small watersheds in western Oregon can substantially increase annual water yields. These increased yields are generally due to a combination of high annual precipitation (50-100 inches) and reduced annual evapotranspiration (as a result of harvest) in coniferous forests. Annual evapotranspiration losses in western Oregon can exceed 25 inches (Reiter and Beschta 1995).

After examining 94 watershed experiments conducted worldwide, Bosch and Hewlett (1982) concluded that water yield increases are usually only detectable when at least 20 percent of the forest cover has been removed. Also, year to year variation in annual water yield increases following harvest appear to be influenced by annual precipitation amounts. The largest annual yield increases typically occur during the wettest years (Bosch and Hewlett 1982, Harr 1983).

The relationships described above are based on the results of study designs in which a large percentage of small watersheds were clearcut logged with minimal stream buffers. To date, no research has been published that describes the effect Northwest Forest Plan designed timber sales, with full Riparian Reserve buffers, has on changes in stream flow.

The Alsea Watershed Study (AWS) documents the affects of forest management activities on stream flows in the Coast Range of Oregon. One objective of the AWS was to compare the impact of two patterns of clearcutting on water yield. In 1965, ridge-line roads were constructed into Deer Creek (750 acres) and Needle Branch (175 acres). In 1966, Deer Creek was patch-cut in three units covering about 25 percent (187 acres) of the watershed. The units were separated from streams by buffer strips from 50-100 feet wide. Needle Branch was 82 percent clearcut. Average increase in water yield for Needle Branch was 27 percent. Deer Creek exhibited smaller yield increases. The average increase in annual yield for the patch-cut with stream buffer watershed was only 5 percent (Harr 1976).

The results from Deer Creek in the AWS study indicate partial cutting within a watershed combined with riparian buffers of 50-100 feet can reduce increases in water yield. BLM forest management within Elk Creek will incorporate Riparian Reserve Buffers of 200-400 feet. Thinning projects are expected to have even less of an influence on changes in water yield. Therefore, given the design criteria for BLM timber sales, resulting increases in water yield are expected to be much less than 5 percent, and probably undetectable.

While the yield increase from recently clearcut small headwater basins can be relatively large, their influence on the yield of the larger parent watershed can be overshadowed by the water yields from uncut or reforested areas. Water yield increases from subwatersheds become increasingly difficult to detect downstream because of fluctuations in flows from groundwater sources and tributaries, and the varying patters and types of precipitation across the basin (Reiter and Beschta 1995). Water yield changes of 5 percent and less are indistinguishable from natural variation in large watersheds (Huff, et al. 2000).

Peak Flows:
In much of the western Cascades and elsewhere in western Oregon and northern California, the largest post-harvest water yield increases have occurred during the fall months when maximum differences in soil water content exist between cut and uncut areas. In the fall, a smaller proportion of rain is required for soil moisture recharge in cut areas, so a larger proportion can go to stream flow (Harr 1976). By winter, when soil moisture levels are similar in cut and uncut areas, relative increases in peak flows from harvest units are considerably less than those produced by storm events. In the spring, reduced transpiration in harvested areas contributes to peak flow increases, because again a smaller proportion of rain is required to recharge soil moisture in cut areas. The largest increases in peak flows documented for the AWS occurred in the watersheds that were clearcut most extensively.

Several studies have shown that the first storms of the fall have the most increase in peak flow from pre-logging conditions (Rothacher 1973, Harr el al. 1975, Harr, et al. 1979, Ziemer 1981). These fall storms are small and geomorphically inconsequential (Harr 1976). Studies on increased peak flows are varied in their findings on how much increase in flow would result from a given amount of timber harvest. Most studies agree that the effects of harvest treatment decreases as the flow event size increases (Rothacher 1971, Rothacher 1973, Write et al. 1990) and is not detectable for flows with a two year return interval or greater (Harr et al 1975, Ziemer 1981, Thomas and Megahan 1998, Thomas and Megahan 2001).

Stormflow response of small basins is affected primarily by hillslope processes, which are sensitive to management activities. Stormflow response of larger basins is governed primarily by the geomorphology of the channel network, which is less likely to be affected by management activities (Robinson et al 1995). Also, runoff response time is generally shorter for small watersheds when compared to larger watersheds, and runoff per unit area is higher. As small streams form increasingly larger drainage networks, the ability of individual small watersheds to affect flow decreases (Garbrecht 1991). As a result, peak flow increases following harvesting or other forest practices at the drainage level are likely to be undetectable farther downstream.

Based on the relationships described above, the only possible increases in peak flows as a result of BLM forest management would occur during small storm events (less than 2 year return interval) in the smallest non-fish bearing streams (those streams with >20 percent of their catchment area cleared by timber harvest). Any possible increase in peak flow, as a result of timber harvest, would also likely be reduced by the influence of the Riparian Reserve as indicated by the results from Deer Creek in the AWS study. If increases in peak flow develop in these small stream channels, they would likely be small (<5 percent) and probably undetectable.

Low Flows (Base Flows):
Timber harvesting in western Oregon is generally expected to cause an initial increase in summer low flow (Harr 1983). Low flow increases following harvesting generally last only a few years (Ziemer and Lisle 1998), and the additional quantities of stream flow represent a small component of a watershed's annual yield (Harr 1976, Reiter and Beschta 1995). Decreases in low flow, as a result of BLM timber harvest, is not expected because regeneration harvest activities would occur outside of Riparian Reserves, so conversion of stream-side vegetation to hardwood dominated species which transpire more water would not occur. Increases in low flow are also not expected because extra available moisture, if any, would likely be consumed by the adjacent riparian vegetation. However, even small, short lived increases in low flows may be beneficial to aquatic species during the summer if more water is available in the stream.

Extreme Flows:
Extreme flood flows (greater than a 20-year return frequency) are the result of natural weather patterns and flashy watershed response. Large peak flows occur mid-winter after soil moisture deficits are satisfied in both logged and unlogged watersheds (Ziemer and Lisle, 1998). Extreme floods in the lower reaches of a large watershed that cause property damage or other problems normally occur when an extended period of heavy rain adds too much water for soils and streams to absorb, regardless of land use (Adams and Ringer 1994). Forest management has little to do with increasing the size of these events (Harr, et al. 1975).

15. Aquatic Habitat Appendix

A. Fish Presence

Table 15-1 Fish Species Present in Elk Creek

Native species	
Common name	***Scientific name***
Steelhead / rainbow trout	*Oncorhynchus mykiss*
Coho salmon	*Oncorhynchus kisutch*
Chinook salmon	*Oncorhynchus tshawytscha*
Coastal cutthroat trout	*Oncorhynchus clarki clarki*
Pacific lamprey	*Lampetra tridentata*
River lamprey	*Lampetra ayresi*
Western brook lamprey[1]	*Lampetra richardsoni*
American shad	*Alusa sapidissima*
Umpqua chub	*Oregonichthuys kalawatseti*
Sculpin[2]	*Cottus sp.*
Redside shiner	*Richardsonius balteatus*
Umpqua dace	*Rhinicthys cataractae*
Speckled dace	*Rhinicthys osculus*
Long nose dace	*Rhinicthys cataracatae*
Umpqua pikeminnow	*Ptychocheilus umpquae*
Largescale sucker	*Catostomus macrocheilus*
Brown bullhead	*Ameiurus nebulosus*
Small mouth bass	*Micropterus dolomieu*
Mosquitofish	*Gambusia affinis*
Fathead minnow	*Pimephales promelas*
Bluegill	*Lepomis macrochirus*

[1]The habitat in this watershed is capable of supporting this lamprey species. There have not been any confirmed sightings, but it is very probable that they occur within the Elk Creek watershed.
[2]There are numerous members of the sculpin family suspected to be found within this watershed.

Table 15-2 Special Status Fish Species

ELK CREEK WATERSHED		Oregon Coast Coho Salmon *Oncorhynchus kisutch*	Oregon Coast Steelhead *Oncorhynchus mykiss*	Coastal Cutthroat trout *Oncorhynchus clarki clarki*	Pacific Lamprey *Lampetra tridentata*	Umpqua Chub *Oregonichthys kalawatseti*
STATUS	**FEDERAL**	(see WA, p. 64)	Candidate (NOAA Fisheries)	Candidate (USFWS)	Petition for Listing	Bureau Sensitive[3]
	STATE	Critical[1]	Vulnerable[2]	Vulnerable[2]	Vulnerable[2]	Vulnerable[2]
LIFE HISTORY AND HABITAT REQUIREMENTS	**BUREAU**				Bureau Assessment Species[4]	
	ONHP	1	1	4	2	1
		See Coho Salmon species summary p107-114 (life history) and p114-125 (habitat requirements) of the North Umpqua Cooperative Watershed Analysis. While this WA is limited to Canton Creek, Rock Creek, and Middle North Umpqua, this general information can be applied to Elk Creek and Calapooya Watersheds.	See Steelhead species summary p162-169 (life history) and p169-178 (habitat requirements) of the North Umpqua Cooperative Watershed Analysis. While this WA is limited to Canton Creek, Rock Creek, and Middle North Umpqua, this general information can be applied to Calapooya and Elk Creek Watersheds.	See Coastal Cutthroat trout species summary p204-211 (life history) and p211-219 (habitat requirements) of the North Umpqua Cooperative Watershed Analysis. While this WA is limited to Canton Creek, Rock Creek, and Middle North Umpqua, this general information can be applied to Calapooya and Elk Creek Watersheds.	See Pacific Lamprey species summary p45-49 (life history) and p49-55 (habitat requirements) of the North Umpqua Cooperative Watershed Analysis. While this WA is limited to Canton Creek, Rock Creek, and Middle North Umpqua, this general information can be applied to Calapooya and Elk Creek Watershed.	This species is endemic to the mainstem Umpqua River and South Umpqua River. It was previously considered to be a disjunct group of Oregon Chub, but was described by Markle et al. (1991) as a separate species. It occupies habitats of higher current velocity than Oregon Chub. It is believed to be vulnerable to predation by introduced smallmouth bass May through October.

[1]Species for which listing as threatened or endangered is pending; or those for which listing as threatened or endangered may be appropriate if immediate conservation actions are not taken. Also considered critical are some peripheral species which are at risk throughout their range, and some disjunct populations.
[2]Species for which listing as threatened or endangered is not believed to be imminent and can be avoided through continued or expanded use of adequate protective measures and monitoring. In some cases the population is sustainable and protective measures are being implemented; in others, the population may be declining and improved protective measures are needed to maintain sustainable populations over time.
[3]Species that could easily become endangered or extinct in a state.
[4]Species not presently eligible for federal or state status but are of concern.
[5]Species is not present in project area, nearest location is unknown.
ONHP 1: Taxa that are threatened with extinction or presumed to be extinct throughout their entire range.
ONHP 2: Taxa that are threatened with extirpation or presumed to be extirpated from the state of Oregon.
ONHP 4: Taxa which are of concern, but are not currently threatened or endangered.

B. ODFW Surveyed Streams Used as Reference for Elk Creek

Figure 15-1 Physical Locations of Reference Reach Streams

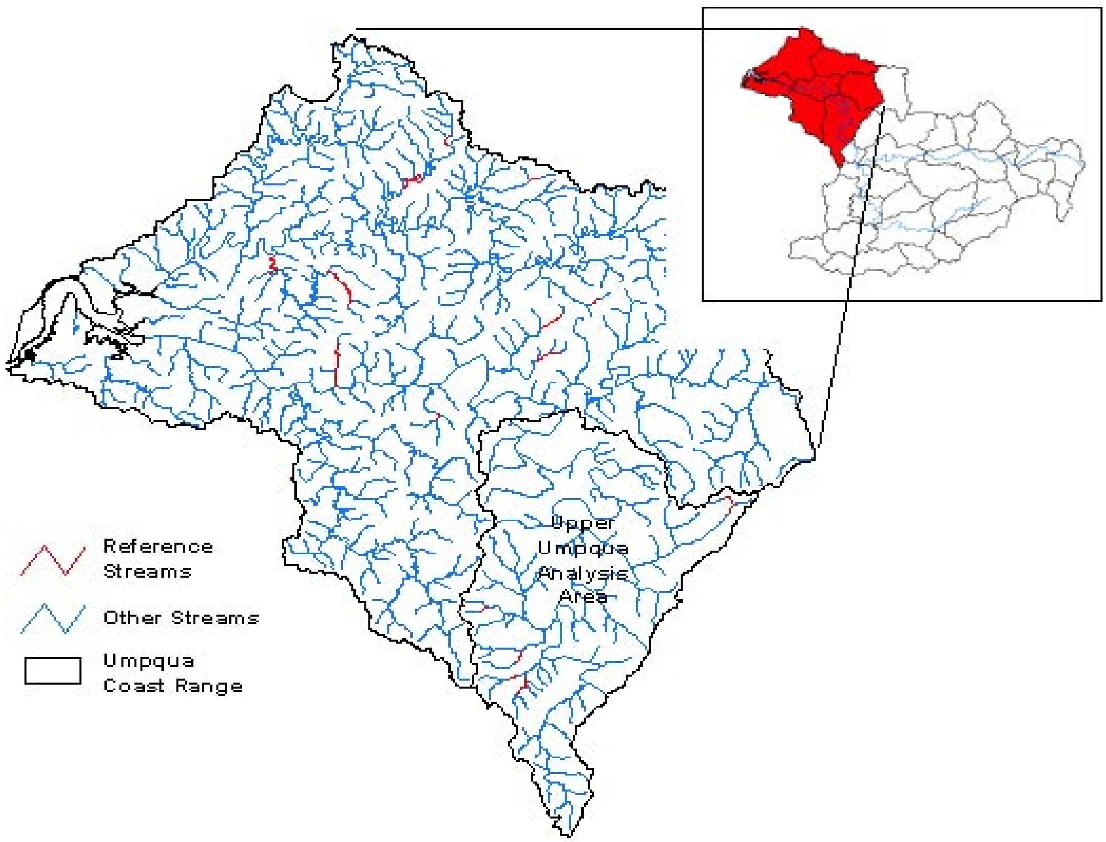


Table 15-3 Reference Stream Reach Selection Criteria

Parameter	Selection Criteria
Percent Harvest (within 200 feet of stream)	< 30%
Riparian Road Density	< 0.3 mi/mi
Width:?Depth Ratio	< 40
Percent Pools	> 10% and < 70%
Percent Fines	< 70%
Percent Gravel	> 20%
Total Pieces CWD	> 5 per 100 m
Percent Bank Erosion	< 30%

Table 15-4 Reference Stream Reaches

Stream Name	Reach ID
Cougar Creek	3
Cougar Creek Trib. #1	2
Halfway Creek	5
Little Mill Creek	1
Little Paradise Creek	3
Little Wolf Creek Trib #1	1
Lutsinger Creek	4
Miner Creek	3
North Sister Creek	4
Paradise Creek	5
Paradise Creek	6
Wasson Creek	8
Wasson Creek Trib #2	1
Wasson Creek Trib #2	2
Wasson Creek Trib #2	3
West Fork of Smith River	3
West Fork of Smith River	6
Yellow Lake Creek	5
Yellow Creek	5

Most Reference Reaches Summary Description

Cougar Creek, Reach 3, consists of approximately 1.5 miles of low gradient stream with 37 percent pools and 3% riffles. Riffles contain 40% fines and 34% gravel. The substrate within the reach consists of 9% silts and organics (SO), 36% gravel, 16% cobble and 14% bedrock. Instream wood was noted at 25.9 pieces and 83.8m^3 of wood per 100m. The adjacent riparian consisted mostly of conifers at a density of 0.50 per 100m^2.
Cougar Creek Tributary 1, Reach 2, consists of approximately 0.7 mile of low gradient stream with 41% pools and 29% rapids (no riffles). The substrate within the reach consisted of 3% SO, 29% gravel, 16% cobble and 35% bedrock. Instream wood was noted at 12.1 pieces and 27.4m^3 of wood per 100m. The adjacent riparian consisted of mostly conifers at a density of 0.77 per 100m^2.
Yellow Creek, Reach 5, consists of approximately 2.3 miles of low gradient stream with 23% pools and 2% riffles. Riffles contain 2.5 % fines and 75% gravel. The substrate within the reach consists of 3% SO, 51% gravel, 26% cobble and 11% bedrock. Instream wood was noted at 14.9 pieces and 44.1m^3 of wood per 100m. The adjacent riparian consisted of a mixture of conifers and hardwoods. Conifer density was indicated at 4.6 per 100m^2.
Little Wolf Creek Tributary #1, Reach 1*, consists of approximately 1.1 miles of low gradient stream with 20.7 % pools and 37.1% riffles. The substrate within the reach consisted of 21% SO, 25% gravel, 16% cobble and 15% bedrock. Instream wood was noted at 11.4 pieces and 43.2m^3 of wood per 100m. The adjacent riparian consisted of a mixture of conifers and hardwoods.
Miner Creek, Reach 3*, consists of approximately 0.6 mile of low gradient stream with 13.1% pools and 26.1 riffles. The substrate within the reach consisted of 22% SO, 31% gravel, 12% cobble and 11% bedrock. Instream wood was noted at 12.4 pieces and

65.2m^3 of wood per 100m. The adjacent riparian consisted of a mixture of conifers and hardwoods.

Halfway Creek, Reach 5, consists of approximately 1.3 miles of low gradient stream with 37% pools and 31% riffles. Riffles contain 20% fines and 54% gravel. The substrate within the reach consisted of 4% SO, 41% gravel, 20% cobble and 4% bedrock. Instream wood was noted at 14.6 pieces and 104.5m^3 of wood per 100m. The adjacent riparian consisted of mostly conifers at a density of 1.2 per 100m^2.

Wassen Creek, Reach 8, consists of approximately 2.0 miles of low gradient stream with 16% pools and 15% riffles. Riffles contain 42% fines and 25% gravel. The substrate within the reach consisted of 10% SO, 34% gravel, 27% cobble and 2% bedrock. Instream wood was noted at 33.0 pieces and 51.1m^3 wood per 100m. The adjacent riparian consisted mostly of hardwoods, conifer density was indicated at 0.5 per 100m^2.

Wassen Creek Tributary #2, Reach 1, consists of approximately 1.6 miles of low gradient stream with 32% pools and 34% riffles. Riffles contain 12% fines and 44% gravel. The substrate within the reach consisted of 7% SO, 17% gravel, 19% cobble and 45% bedrock. Instream wood was noted at 18.0 pieces and 24.7 m^3 of wood per 100m. The adjacent riparian consisted of mostly hardwoods, conifer density was indicated at 0.1 per 100m^2.

Wassen Creek Tributary #2, Reach 2, consists of approximately 0.4 mile of low gradient stream with 52% pools and 34% riffles. Riffles contain 14% fines and 46% gravel. The substrate within the reach consisted of 5% SO, 34% gravel, 34% cobble and 15% bedrock. Instream wood was noted at 26.8 pieces and 25.1m^3 of wood per 100m. The adjacent riparian consisted of mostly hardwoods, conifer density was indicated at 0.67 per 100m^2.

Wassen Creek Tributary #2, Reach 3, consists of approximately 1.1 miles of low gradient stream with 24% pools and 39% riffles. Riffles contain 14% fines and 26% gravel. The substrate within the reach consisted of 6% SO, 31% gravel, 35% cobble and 11% bedrock. Instream wood was noted at 31.5 pieces and 58.8m^3 of wood per 100m. The adjacent riparian consisted of mostly hardwoods, conifer density was indicated at 0.2 per 100m^2.

West Fork Smith River, Reach 3, consists of approximately 3.1 miles of low gradient stream with 21% pools and 31% riffles. Riffles contain 1% fines and 26% gravel. The substrate within the reach consisted of 1% SO, 28% gravel, 9% cobble and 58% bedrock. Instream wood was noted at 9.2 pieces and 13.2m^3 of wood per 100m. The adjacent riparian consisted of mostly hardwoods, conifer density was indicated at 0.4 per 100m^2.

West Fork Smith River, Reach 6, consists of approximately 0.7 mile of low gradient stream with 50% pools and 16% riffles. Riffles contain 3% fines and 74% gravel. The substrate within the reach consisted of 4% SO, 51% gravel, 10% cobble and 25% bedrock. Instream wood was noted at 20.3 pieces and 25.5 m^3 of wood per 100m. The adjacent riparian consisted of only hardwoods.

North Sister Creek, Reach 4, consists of approximately 0.8 mile of low gradient stream with 34% pools and 23% riffles. Riffles contain 11% fines and 35% gravel. The substrate within the reach consisted of 0% SO, 30% gravel, 26% cobble and 13% bedrock. Instream wood was noted at 13.7 pieces and 54.7m^3 of wood per 100m. The adjacent riparian consisted of only hardwoods.

Yellow Lake Creek, Reach 1, consists of approximately 0.6 mile of low gradient stream with 50% pools and 2% riffles. Riffles contain 28% fines and 39% gravel. The substrate within the reach consisted of 7% SO, 26% gravel, 30% cobble and 3% bedrock. Instream wood was noted at 10.2 pieces and 20.6m^3 of wood per 100m. The adjacent riparian consisted mostly of hardwoods, conifer density was indicated at 0.2 per 100m^2.

C. Salmonid Life Cycle Description

The major life stages of most salmonid species are associated with different uses of fluvial systems: migration of maturing fish from the ocean (anadromous fishes), lakes or rivers to streams; spawning by adults; incubation of embryos; rearing of juveniles; and downstream migration of juveniles to large-river, lacustrine, or oceanic rearing areas (Bjornn and Reiser 1991).

Six percent stream gradient was used as a maximum indicator for the presence of salmonid spawning and rearing habitat within the Elk Creek watershed. This was assessed through review of various literature, observations of BLM and ODFW fisheries biologist, and analysis of water velocity as a component of water volume, stream width, depth, sediment, and gradient.

1. Spawning and Incubation

Substrate composition, cover, water quality, and water quantity are important habitat elements for salmonids before and during spawning. The number of spawners that can be accommodated in a stream is a function of the area suitable for spawning (suitable substrate, water depth, and velocity), area required for each redd, suitability of cover for the fish, and behavior of the spawners. Cover is important for species that spend several weeks maturing near spawning areas (Bjornn and Resier 1991). Cover for salmonids waiting to spawn or in the process of spawning can be provided by overhanging vegetation, undercut banks, submerged vegetation, submerged objects such as logs and rocks, floating debris, deep water, turbulence, and turbidity (Giger 1973 as cited in Bjornn and Resier 1991). If fine sediment (silt, organics and sand) are being transported in a stream either as bedload or in suspension, some of the fines are likely to be deposited in the redd. The fine particles impede the movement of water and alevins oxygen during decomposition; if the oxygen is consumed faster than the reduced interagravel water flow can replace it, the embryos or alevins will asphyxiate (Bjornn and Resier, 1991).

2. Rearing

The abundance of juvenile salmon and trout in streams is a function of many factors, including abundance of newly emerged fry, quantity and quality of suitable habitat, abundance and composition of food, and interactions with other fish, birds, and mammals (Bjornn and Resier 1991). Abundant food and cover can increase carrying capacity because more fish can occupy a given area and fewer emigrate (Mason and Chapman 1965). After they emerge in the spring, young fish spread into the available rearing space, some moving upstream but most moving downstream. Juvenile salmon in streams and rivers tend to consume mostly aquatic and terrestrial invertebrates carried along by the flowing water (Mundie 1969), but they also eat small fish, salmon eggs, and occasionally the carcasses of adult salmon (Kline et al. 1990). In small watersheds with dense forest canopies, much of the organic matter in streams originates in the surrounding forest, and the invertebrate communities are dominated by organisms specialized for processing wood and leaves (Gregory 1983). In fall, as stream temperatures decline, young coho salmon become more security conscious, change their behavior, and seek areas with more cover than the areas they used in summer. They may move into side channels sloughs, and beaver ponds for the winter, and they are usually found close to various forms of woody debris, roots, and overhanging brush that provide cover in water of low velocity (Hartman 1965; Bustrard and Narver 1975a as cited Meehan and Bjornn, 1991). Salmonids in interior streams change behavior, from mostly feeding in the summer to hiding and conserving energy during winter. Fish that had been territorial in summer may congregate in large pools in winter, move into areas with woody debris and brush, or move into the interstitial spaces in the substrate (Chapman and Bjornn 1969; Bustrard and Narvar 1975a). The number of fish that can or will stay in a stream over winter can vary with quality of the winter habitat (Bjornn 1978) and the severity of the winter weather (Seelbach 1987). If the habitats in small streams are not suitable and the weather is severe, the fish move to larger rivers in the fall and early winter (Bjorn and Mallet 1964; Bjornn 1978). A reverse behavior pattern has been observed in coastal streams (Cederholm and Scarlett 1982): young coho salmon, cutthroat, and steelhead move upstream into small tributaries from main-stem rivers in fall patterns; coastal rivers are warmer than inland rivers and carry freshets during winter, whereas flows are relatively stable in inland rivers (Meehan and Bjornn, 1991).

Table 15-5 Salmon Life Cycle

WHERE ARE THE SALMON, WHEN?
GENERALIZED LIFE HISTORY PATTERNS OF SALMON, STEELHEAD, AND TROUT IN THE PACIFIC NORTHWEST[1]

	Adult Return	Spawning Location	Eggs in Gravel[2]	Young in Stream	Freshwater Habitat	Young Migrate Downstream	Time in Estuary	Time in Ocean	Adult Weight (Avg.)
COHO	Oct-Jan	coastal streams, shallow tribs.	Oct-May	1+yrs	tributaries, mainstem, slack water	Mar-Jul (2nd yr.)	few days	2 yrs	5-20 lb (8)
CHINOOK		main stem large and small rivers			main stem-large and small rivers		days-months	2-5 yrs	
spring	Jan-Jul		Jul-Jan	1+yrs		Mar-Jul (2nd yr.)			10-20 lb (15)
summer	Jun-Aug		Sep-Nov	1+yrs		Spring (2nd yr.)			10-30 lb (14)
fall	Aug-Mar		Sep-Mar	3-7 months		Apr-Jun (2nd yr.)			10-40 lb
CUTTHROAT (Coastal-Sea Run)	Jul-Dec	tiny tributaries of coastal streams	Dec-Jul	1-3 yrs (2 Avg.)	tributaries	Mar-Jun (2nd-4th yr.)	less than one month	0.5-1 yrs	0.5-4 lb (1)
STEELHEAD[3]		tributaries, streams & rivers			tributaries		less than one month	1-4 yrs	
winter	Nov-Jun	Nov-Jun	Feb-Jul	1-3 yrs		Mar-Jun (2nd-5th yr.)			5-28 l b(8)
spring	Feb-Jun	Feb-Jun	Dec-May	1-2 yrs		Spr & Sum (3rd-4th yr.)			5-20 lb
summer(Col. R)	Jun-Oct	Jun-Oct	Feb-Jun	1-3 yrs		Mar-Jun (of 3rd-5th yr.)			5-30 lb (8)
summer(coastal)	Apr-Nov	Apr-Nov	Feb-Jul	1-2 yrs		Mar-Jun (of 2nd-5th yr.)			5-30 lb (8)

[1]There is much variation in life history patterns--each stream system having fish with their own unique timing and patterns of spawning, growth, and migration. Ask a local biologist about the specific patterns of the fish in your streams and update this chart for your area.
[2]The eggs of most salmonids take 3-5 months to hatch at the preferred water temperature of 50-55 degrees F; Steelhead eggs can hatch in 2 months.
[3]Steelhead, unlike salmon and cutthroat trout, may not die after spawning. They can migrate back out to sea and return in later years to spawn again.
Adapted by Pacific States Marine Fisheries Commission. Sources: Ocean Ecology of North Pacific Salmonids, Bill Pearcy, University of Washington Press, 1992 Fisheries Handbook of Engineering Requirements and Biological Criteria, Milo Bell, U.S. Army Corps of Engineers, 1986; Adopting A Stream; A Northwest Handbook, Steve Yates, Adopt-A Stream Foundation, 1988.

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Roseburg District Office
777 N.W. Garden Valley Blvd.
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