



United States
Department
Of Agriculture



Forest
Service

July 2004

Final Environmental Impact Statement

Eyerly Fire Salvage Project

Sisters Ranger District, Deschutes National Forest
Jefferson County, Oregon

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, gender, religion, age, disability, political beliefs, sexual orientation, or marital or family status. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write USDA, Director, Office of Civil Rights, Room 326-W, Whitten Building, 14th and Independence Avenue, SW, Washington, DC 20250-9410 or call (202) 720-5964 (voice and TDD). USDA is an equal opportunity provider and employer.

EYERLY FIRE SALVAGE PROJECT
And Proposed Non-significant Forest Plan Amendment
Final Environmental Impact Statement
Jefferson County, Oregon

Lead Agency: USDA Forest Service

Responsible Official:

Leslie Weldon, Forest Supervisor
Deschutes National Forest
1645 Highway 20 East
Bend, OR 97701

For Information Contact:

Dave Owens, IDT Lead
Ochoco National Forest
P.O. Box 490
Prineville, OR 97754

Abstract: This Final Environmental Impact Statement (FEIS) describes the effects of implementing three alternatives for salvage, fuels treatment, and reforestation of National Forest System Land and forest that burned in 2002 on the Deschutes National Forest. The project is south of the Metolius River, and north of the town of Sisters, in Central Oregon. The preferred alternative (Alternative 2) would: 1) salvage the economic value of dead and dying trees and reduce fuels available to future wildland fires on approximately 4,846 acres, 2) plant conifers on upland forest lands on about 3,918 acres, 3) remove hazard trees along major roads and within Perry South and Monty campgrounds, and 4) designate substitute areas for two old growth areas burned in the fire. The project is designed to retain dead trees and down woody debris for soil protection and wildlife habitat. About 2.1 miles of temporary road would be constructed, about 33.4 miles of existing road would be reconstructed, and 3.8 miles of existing roads would be decommissioned. A Forest Plan amendment is proposed to designate suitable old growth habitat for two old growth areas damaged in the Eyerly Fire. Alternative 2 would capture greater economic value by harvesting dead/dying trees and accomplish more fuel reduction across the landscape. Alternative 3 would accomplish less salvage of the economic value and fuels reduction, and provides a different strategy to retain snags for wildlife habitat.

Key issues identified during scoping included: detrimental soil impacts, water quality, fish habitat, and effects on bald eagle perch trees and wildlife snags and down wood habitat.

Emergency Situation Determination: The Forest Supervisor is in the process of seeking a determination from the Regional Forester that an emergency situation exists in the Eyerly Fire Salvage Project pursuant to 36 CFR 215.10(b). This emergency situation exists because substantial loss of economic value to the Federal Government would occur if implementation of the decision were delayed through another summer of checking. The final determination by the Regional Forester will be published in the Record of Decision, 36 CFR 215.10(d).

SUMMARY

❖ Eyerly Fire Salvage Project Final Environmental Impact Statement _____

❖ Introduction

On the afternoon of July 9th, 2002 a wildfire was ignited by lightning on the north side of the Metolius arm of Lake Billy Chinook within the Warm Springs Reservation. Despite fire crew line construction and helicopter water suppression, the fire grew rapidly in steep, rugged terrain. The fire was fueled by cheatgrass, juniper, bitterbrush, ponderosa pine and Douglas-fir. On July 11th, the fire spotted across the Metolius River burning onto the Sisters Ranger District and grew from 212 acres to approximately 2000 acres. Extreme fire behavior was observed, and on July 13th the fire made a run toward Perry South campground expanding the burned area to approximately 10,000 acres.

Another extensive burning period began on July 14th. The fire was then estimated at 16,000 acres in size. For the next few days the fire grew steadily. As inversions lifted, the fire spread up the Street, Spring, and Bean Creek drainages. On July 23rd, the fire breached the crest of Green Ridge and burned approximately 50 acres on the west side.

At time of containment, the fire was estimated at 23,134 acres. Total National Forest land consumed is estimated at 17,786 acres. Within the fires perimeter, 12,821 acres suffered from stand replacement severity.

The Eyerly Fire Salvage Project area refers to the about 17,786 acres of the Eyerly Fire within the Sisters Ranger District, Deschutes National Forest.

A Draft Environmental Impact Statement (DEIS) was released for public review in December 2003. The DEIS was mailed to over 150 individuals, organizations, and agencies for a 45-day public review and comment period. The Deschutes National Forest received 30 timely comments on the DEIS. Following review of the comments, the Forest prepared a Final Environmental Impact Statement (FEIS). The following is a summary of the FEIS.

❖ Purpose and Need for Action

Purpose and need actions for the Eyerly Fire Salvage Project are:

- Recovery, through salvage harvest, of the economic value of the burned timber and to provide timber products to the economy.
- Establish fuel conditions that will reduce the potential for future high-severity fires and restore fire as an ecosystem component.
- Accelerate reforestation of the desired species in areas where no seed source remains and to provide habitat to species associated with late and old structured forests.
- Reduce hazards associated with danger trees along major roads and developed campgrounds.
- Designate substitute old growth areas that were burned in the Eyerly Fire.

This action is needed in order to comply with the goals and objectives described in the 1990 Deschutes National Forest Land and Resource Management (LRMP or Forest Plan), as amended, which guides natural resource management activities and establishes management standards for lands administered by the Deschutes National Forest.

Needs for the proposed action are derived from the differences between the current and desired conditions. Desired conditions are based on Forest Plan direction and management objectives. The proposed action is designed to move resource conditions closer to desired conditions and address management direction provided by the Deschutes Forest Plan as amended.

Each of the existing and desired conditions can be linked to the purpose for the proposed action.

❖ Proposed Action (Alternative 2)

Salvage Harvest

The salvage treatment addresses the need to recover economic value of a portion of the fire-killed trees and trees expected to die, and to reduce fuel levels.

Salvage was considered in all stand replacement stands and mixed severity stands. This alternative would salvage most of the most economically feasible dead stands outside of the roadless area and riparian reserves, and treat dead small diameter stands to meet desired future conditions for fuels and fire management.

Salvage would remove dead trees or trees expected to die on approximately 4,846 acres. Minimum diameter of salvage trees would generally be 12 inches for all species. Utilization of small diameter products --such as posts, rails, house logs, chips, or firewood-- would occur on 552 of the 4,846 acres proposed. An estimated total volume of 23.3 million board feet (MMBF) from dead and damaged trees would be harvested under this alternative.

Within the Metolius LSR only dead trees (trees with no green needles) would be salvaged.

No salvage would occur in the Metolius Roadless Area.

No salvage or small diameter utilization activity would occur within Riparian Reserves or Riparian Habitat Conservation Areas (RHCA). Salvage activity would be prohibited in association with stream courses as shown below:

- Fish-bearing streams: 320 feet slope distance each side of stream channel
- Permanently flowing nonfish-bearing stream: 160 feet slope distance each side of stream channel.
- Seasonally flowing or intermittent streams: 160 feet slope distance each side of stream channel.

Access to designated units for harvest and hauling of logs would primarily be on existing forest roads. An estimated 2.1 miles of temporary road construction would be required to access harvest units not readily accessible from existing forest roads. Existing fireline comprises one of the three miles of temporary road construction. Temporary roads would require minimal excavation, would be native surface, and would be sub-soiled after logging operations were complete.

A total of 33.4 miles of road reconstruction are included in this alternative. The reconstruction activities on existing forest system roads would include the reconditioning of the existing travel way, surface and/or resurfacing with crushed aggregate, spot surfacing, and drainage restoration.

About 3.8 miles of road decommissioning would be done under Alternative 2. The road decommissioning (road obliteration) would entail activities to return these roads to a productive condition by a combination of sub-soiling, ripping, re-contouring, and restoring drainage. The road decommissioning is included as a mitigation measure to reduce the potential for sediment delivery and to restore the function of riparian areas. Roads identified for decommissioning are: 1170800, 1170890, 1170810, 1170820, and 1170860.

Snags are provided consistent with levels described in the Metolius Late Successional Reserve Assessment (LSRA). These snag levels would apply to areas within and outside of the Metolius LSR. Within the Metolius LSR down wood is provided at levels consistent with direction in the LSRA. For all units not in the Metolius LSR a minimum of 120 linear feet of logs is provided.

Fuels Reduction

Approximately 4,846 acres of National Forest land within salvage harvest units would receive fuels treatment. The salvage and fuels treatments, together reduce fuels within treated areas to levels within management guidelines. Slash generated during the harvest of merchantable trees, as well as fuels from small trees would be treated. Fuels treatment includes: lop and scatter, grapple piling and burning, underburning, jackpot burning, and hand piling and burning.

Accelerate Reforestation of Desired Species

About 3,918 acres are proposed for conifer planting primarily where stand replacement burn severity occurred.

The objectives of conifer planting are to more quickly establish tree cover for species needing it, i.e. goshawks, spotted owls, and deer and elk. It is expected that planting would result in about 100-150 trees per acre averaging around 14 inches in diameter at age 80.

About 1,426 acres of reforestation treatments are proposed within the Metolius LSR with a diversity of species including ponderosa pine, Douglas-fir, western larch, and sugar pine.

Reduce Hazard Along Major Roads and Campgrounds

Trees determined to be a hazard to human life or property would be felled and utilized in this alternative. Hazard trees are included in salvage operations within Perry South Campground, Monty Campground, Road 64, Road 1170, and along haul routes for the salvage operations.

Designation of Substitute Old Growth

The Deschutes Forest Plan requires the relocation of designated old growth areas when existing old growth is impacted by wildfire. There are two old growth areas affected within the Eyerly Fire Area. These old growth areas were burned at sufficient intensity so that the areas no longer provide old growth habitat for the species intended. This alternative would relocate these old growth areas to areas that currently provide old growth habitat, bringing the area into compliance with the Forest Plan. The relocation of the designated old growth areas would be a non-significant forest amendment to the Deschutes National Forest Land and Resource Management Plan.

There are two existing areas allocated to the old growth management area located within the Eyerly Fire area. The first old growth area is predominantly ponderosa pine (Dry) plant association group and estimated at 208 acres in size. The proposed replacement area is also dominated by the ponderosa pine (Dry) plant association group and is about 238 acres.

The second existing old growth area is comprised primarily of the mixed conifer (Wet and Dry) plant association group and is about 145 acres in size. The proposed replacement area is mixed conifer plant association group (Wet and Dry) and is about 183 acres.

Forest Plan Amendments

A non-significant Forest plan amendment would be required to implement Alternative 2 to designate substitute old growth areas for those burned in the Eyerly Fire as described above. This would change Management Area 15 (Old Growth) to either Management Area 7 (Deer Habitat) or Management Area 20 (Metolius Wildlife-Primitive).

❖ KEY ISSUES

Comments received from the public generated issues and are discussed in this document. The interdisciplinary Team (IDT) reviewed and evaluated comments received from the scoping process and are incorporated as key issues. In the NEPA process, key issues are defined as resource or other values that drive the development of an alternative, may be adversely affected by the proposed action, or involve unresolved conflicts regarding alternative uses of available resources. Key issues provide focus for the analysis and are used directly in formulation of the alternatives. Listed with each key issue are indicators to show a measurement of how each key issue is affected by proposed activities for each alternative.

Soils

There is concern for the effects on soils considering the proposed use of ground-based yarding systems for salvage (tractor yarding) and fuel treatment (grapple piling). Ground-based yarding systems and grapple piling may increase soils erosion, and may affect soils productivity by increasing soil compaction and displacement.

The following measures will be evaluated for each of the alternatives:

- Acres of ground-based (tractor) salvage harvest and fuels treatment (grapple piling).
- Percent of detrimental soil conditions (compaction, displacement, and severely burned areas) by activity unit.

Water

Some comments suggest that any ground disturbing activity following a fire like Eyerly should be avoided. Others suggest that some level of activity can be conducted, such as salvage harvest, without interrupting the processes of long-term ecosystem recovery. This issue centers on the concern that salvage harvest following a major wildfire could increase erosion and sediment delivery to streamcourses.

The following measures will be evaluated for each of the alternatives:

- Number of potentially hydrologically connected road ditches.
- Acres of proposed harvest within the sediment delivery zone.
- Proposed miles of road for timber haul within Riparian Reserves or Riparian Habitat Conservation Areas.

Fish Habitat

Bull Trout are listed as a threatened and endangered species. Fish surveys have found bull trout to inhabit Street Creek within the Eyerly Project Area.

The effects of the proposed activities on fish habitat are of concern expressed by several comments. This key issue is strongly associated with the issues described above for soils and water.

- The effects of the alternatives on bull trout are measured by an estimate of percent increase of sediment to the Street Creek system.

Wildlife Habitat

There are two active bald eagle nests within the Eyerly Project Area. Hazard tree removal within Bald Eagle habitat is a concern. Dead trees greater than 21 inches in diameter provide potential perch sites.

- The effects of the alternatives will be measured by:
- An estimate of the number of potential perch trees removed within essential bald eagle habitat.

The current and future levels of snags and down wood habitat are a concern expressed by several comments. There is a direct connection between the number of trees removed for salvage and those left to provide snag and down log habitat.

The following measures will be evaluated for each of the alternatives:

Number of snags retained per acre within harvest areas.

Level of snags provided within the entire Eyerly Fire area.

Down wood provided within harvest areas.

❖ ALTERNATIVES

Alternatives Considered but Eliminated from Detailed Study

An alternative was considered that included broader application of salvage and fuel treatment activities. In the case of fuels treatments, much of the increased area that would have been treated under this alternative would not have resulted in any timber material produced, and as such would not have met the purpose and need to salvage timber and provide products to the economy, nor would it provide for accelerated development of LSR late and old structure conditions.

The interdisciplinary team also considered an alternative that would have included salvage of burnt timber within the Metolius Roadless Area. This would have provided an estimated additional volume of 5 million board feet (MMBF). Due to steep slopes and erodible soils, salvage within this area would have required helicopter logging. This area could not have been harvested economically; helicopter logging would result in a net loss to the government, and hence was dropped from detailed analysis.

Some comments were received that expressed a desire for a “restoration only” alternative to be considered. A restoration only alternative would not have met the purpose and need to recover economic value of fire-killed and damaged trees. Additionally, the salvage activities proposed in this FEIS are part of a larger effort aimed at restoration of the resource conditions and economic recovery within the Eyerly Fire Salvage area. Several restoration projects are being considered, reference Chapter 1. These restoration projects are not connected to the salvage proposal, and will be documented in separate environmental analyses. The selection of the No Action alternative would result in no salvage or connected actions being implemented, while the separate environmental analyses for other restoration projects could proceed unaffected.

Alternatives Considered in Detail

Alternative comparison charts (*Tables S-1 through S-4*) are provided at the end of this section, beginning on *page S-10*.

Alternative 1 (No Action)

The No Action Alternative is defined as no change from management activities as they now exist.

Alternative 2 – Proposed Action

Alternative 2 will meet the purpose and need by: 1. salvage harvesting dead and dying trees, and thereby recovering the economic value, 2. reducing levels of standing and dead and down fuels, 3. planting trees of desirable species to accelerate establishment of forest vegetation, 4. removing hazard trees along major roads and campgrounds, and 5. designating substitute old growth areas to provide habitat for associated indicator species.

The activities for Alternative 2 were described in the previous section of this summary (*page S-2*) under the proposed action.

Alternative 3

Alternative 3 was developed in response to public concerns related to salvage harvest effects on soils, water, fish and wildlife habitat.

Proposed activities emphasize reduced area of disturbance from post-fire activities within subwatersheds to limit effects on watershed health, while also promoting vegetative recovery within the fire perimeter to intercept rainfall and reduce overland flow magnitudes. The emphasis on reducing post-fire disturbance to resources would result in fewer units receiving salvage harvest and fuels treatment.

Salvage Harvest

Salvage would remove dead trees or trees expected to die with the implementation of this alternative, but on a more limited scale, 10.9 million board feet (MMBF) on approximately 2,893 acres. Utilization of small diameter products -- such as posts, rails, house logs, chips, or firewood -- would occur on 361 of the proposed 2,893 acres. All of the small diameter products units would be designated for ground based logging systems. No salvage or fuels treatment would occur in mixed severity stands under this alternative. No salvage would occur in the Metolius Roadless Area. Only dead trees would be salvaged within the Metolius LSR.

No salvage or small diameter utilization activity would occur within Riparian Reserves or Riparian Habitat Conservation Areas. Riparian Reserves and Riparian Habitat Conservation Areas would be avoided as follows:

- Fish-bearing streams: 320 feet slope distance each side of stream channel
- Permanently flowing nonfish-bearing stream: 320 feet slope distance each side of stream channel (including all mainstems of Spring Creek and Street Creek).
- Seasonally flowing or intermittent streams: 200 feet slope distance each side of stream channel.

The design of this alternative relating to salvage activity and riparian areas as noted above is not a change in the interim riparian reserve or RHCA widths. This relates to the design of this project only.

Access to designated units for harvest and hauling of logs would primarily be on existing forest roads. An estimated 1 mile of temporary road construction would be required to access harvest units not readily accessible from existing forest roads. Temporary roads would require minimal excavation, would be native surface, and would be sub-soiled after logging operations were complete.

A total of 33.4 miles of road reconstruction are included in this alternative. The reconstruction activities on existing forest system roads would include the reconditioning of the existing travel way, surface and/or resurfacing with crushed aggregate, spot surfacing, and drainage restoration.

About 3.8 miles of road decommissioning would be done under Alternative 3. The road decommissioning (road obliteration) would entail activities to return these roads to a productive condition by a combination of sub-soiling, ripping, re-contouring, and restoring drainage. The road decommissioning is included as a mitigation measure to reduce the potential for sediment delivery and to restore the function of riparian areas. Roads identified for decommissioning are: 1170800, 1170810, 1170820, 1170860, and 1170890.

Alternative 3 includes design elements to leave snags at a higher level than that described in the Forest Plan, and higher than Alternative 2. Snags are provided at levels that exceed the levels described in the Metolius Late Successional Reserve Assessment (LSRA). These snag levels would apply to areas within and outside of the Metolius LSR. Within the Metolius LSR down wood is provided at levels consistent with direction in the LSRA. For all units not in the Metolius LSR a minimum of 120 linear feet of logs is provided.

Fuel Reduction

Approximately 2,893 acres of National Forest land within salvage harvest units would receive fuels treatment. The salvage and fuels treatments together reduce fuels within treated areas to levels within management guidelines. Slash generated during the harvest of merchantable trees, as well as fuels from small trees would be treated. Fuels treatment includes: lop and scatter, grapple piling and burning, underburning, jackpot burning, and hand piling and burning.

Accelerate Reforestation of Desired Species

About 2,532 acres are proposed for conifer planting primarily where stand replacement burn severity occurred.

The objectives of conifer planting are to more quickly establish tree cover for species needing it, i.e. goshawks, spotted owls, and deer and elk. It is expected that planting would result in about 100-150 trees per acre averaging around 14 inches in diameter at age 80.

About 1,049 acres of reforestation treatments are proposed within the Metolius LSR with a diversity of species including ponderosa pine, Douglas-fir, western larch, and sugar pine.

Reduce Hazard Along Major Roads and Campgrounds

Trees determined to be a hazard to human life or property would be felled and utilized in this alternative. Hazard trees are included in salvage operations within Perry South Campground, Monty Campground, Road 64, Road 1170, and along haul routes for the salvage operations.

Designation of Substitute Old Growth

The Deschutes Forest Plan requires the relocation of designated old growth areas when existing old growth is impacted by wildfire. There are two old growth areas affected within the Eyerly Fire Area. These old growth areas were burned at sufficient intensity so that the areas no longer provide old growth habitat for the species intended. This alternative would relocate these old growth areas to areas that currently provide old growth habitat, bringing the area into compliance with the Forest Plan. The relocation of the designated old growth areas would be a non-significant forest amendment to the Deschutes National Forest Land and Resource Management Plan.

There are two existing areas allocated to the old growth management area located within the Eyerly Fire area. The first old growth area is predominantly ponderosa pine (Dry) plant association group and estimated at 208 acres in size. The proposed replacement area is also dominated by the ponderosa pine (Dry) plant association group and is about 238 acres.

The second existing old growth area is comprised primarily of the mixed conifer (Wet and Dry) plant association group and is about 145 acres in size. The proposed replacement area is mixed conifer plant association group (Wet and Dry) and is about 183 acres.

Forest Plan Amendments

Alternatives 2 and 3 would require an amendment to the Forest Plan if selected. All action alternatives were designed to designate substitute Old Growth that no longer provides suitable indicator species habitat due to the Eyerly Fire. A non-significant Forest Plan amendment would be required to designate substitute Old Growth.

Selection of the action alternatives would be consistent with the Forest Plan, as amended (36 CFR 219.10(c)).

❖ Comparison of Alternatives

Table S-1. Description of Eyerly Fire Salvage Alternative Elements

Element of Alternative	Alternative		
	1	2	3
Acres of Salvage Harvest	0	4846	2893
Volume of Salvage (million BF)	0	23.3	10.9
Context of Salvage Activity			
Percent of Eyerly Fire Area proposed for Salvage	0	27%	16%
Percent of Stand Replacement Acres Treated (does not include plantation or unsuitable areas)	0	53%	35%
Percentage Removal of Dead Trees 21 in. and Greater from Total Fire Area	0	19%	11%
Logging Systems Based on Acres-acres (%)			
Ground-Based Logging Systems	0	3,583 (74%)	2,129 (74%)
Cable/Skyline Logging Systems	0	858 (18%)	501 (17%)
Helicopter	0	406 (8%)	262 (9%)
Logging Systems Based on Volume–mmbf (%)			
Ground-Based Logging Systems	0	14,836 (64%)	7,007 (64%)
Cable/Skyline Logging Systems	0	5,421 (23%)	2,659 (24%)
Helicopter Logging Systems	0	3,068 (13%)	1,262 (12%)
Fuel Treatment			
Acres of Post-Harvest Fuels Treatment	0	4,846	2,893
Grapple Piling (acres)	0	2,051	1,524
Lop and Scatter (acres)	0	1,877	785
Underburn/Jackpot Burn (acres)	0	608	405
Handpile (acres)	0	310	179
Reforestation			
Planting (acres)	0	3,918	2,532
Road Management			
Temporary Road Construction (miles)	0	2.1	1.4
Road Reconstruction (miles)	0	33.4	33.4
Road Decommissioning (miles)	0	3.8	3.8
Road Maintenance (miles)	0	107.6	89.6
Soil			
Subsoiling (acres)	0	116	47

Table S-2. Comparison of Eyerly Fire Salvage Alternatives – Response to Purpose and Need

Purpose and Need	Alternative 1 – No Action	Alternative 2 – Proposed Action	Alternative 3
Recovery of Economic Value of Fire-killed and Severely Damaged Trees Expected to Die			
Total Volume (Million BF)	0	23.3 MMBF	10.9 MMBF
Net Sale Value (Million \$)	0	\$ 2.3 M	\$.9 M
Jobs	0	130.4	60.5
Employee Income (Million \$)	0	\$ 2.28 M	\$ 1.06 M
Reduce Future Fuel Loadings			
Acres by PAG meeting desired Fuel Loading (estimated for year 2032)			
PP PAG (desired range 5 – 20 tons/acre)	1,518 ac	5,058 ac	1,518 ac
MC PAG (desired range 12 – 35 tons/acre)	1,345 ac	2,339 ac	1,345 ac
Accelerate reforestation			
Acres Planted	0	3,918 ac	2,532 ac
Estimated average diameter of conifers at 80 years (dbh inches)	10 dbh	14 dbh	14 dbh
Reduce hazards along Major Roads			
Areas proposed for hazard tree removal	Forest Roads 64 & 1170 Perry South and Monty Campgrounds	Forest Roads 64 & 1170 Perry South and Monty Campgrounds and along haul routes.	Forest Roads 64 & 1170 Perry South and Monty Campgrounds and along haul routes.
Designation of Substitute Old Growth			
Substitute Old Growth designated	No	Yes	Yes

Table S-3. Comparison of Eyerly Fire Salvage Alternatives – By Key Issue and Measurement

Key Issue		Alternative 1 – No Action	Alternative 2 – Proposed Action	Alternative 3
Soils				
Acres of ground based salvage		0	3,583 ac	2,129 ac
Ground based fuel treatment (grapple piling)		0	2,051 ac	1,524 ac
Average % Detrimental Soils Condition within Units		8%	15%	14%
Water				
Number of potentially hydrologically connected road ditches		0	90	80
Acres of proposed harvest within sediment delivery zone		0	1,206 ac	433 ac
Proposed miles of road for timber haul within Riparian Reserves or Riparian Habitat Conservation Areas		0	8.8 mi	5.5 mi
Fish				
Estimated percent increase in sedimentation		0	4.1%	1.5%
Wildlife				
Number of potential perch trees removed within essential bald eagle habitat, by diameter class.	<21 inches dbh	850	850	850
	>21 inches dbh	120	120	120
Hazard trees along Roads 64 and 1170, and within Perry South and Monty Campgrounds. These trees are felled in all alternatives. They would be removed for salvage in Alternatives 2 and 3. Minimum number of snags retained per acre within harvest units, by PAG.	Mixed Conifer Wet	No Harvest	12.92	12.9
	Mixed Conifer Dry	"	6.51	9.5
	Ponderosa Pine Wet	"	4.37	9.5
	Ponderosa Pine Dry	"	2.48	9.5
Level of snags provided within the entire Eyerly Fire Area. For this measure the DecAID tool is used, and tolerance levels (TL*) are shown.	Acres with snags (>9 inches dbh) at <TL 30	3,906 ac	5,758 ac	3,927 ac
	Acres with snags (>9 inches dbh) at TL 30	4,567 ac	7,175 ac	5,501 ac
	Acres with snags (>9 inches dbh) at TL 50	2,507 ac	2,752 ac	2,955 ac
	Acres with snags (>9 inches dbh) at TL 80	14,461 ac	9,756 ac	13,058 ac
	Acres with snags (>21 inches dbh) at TL <30	12,867 ac	12,502 ac	12,636 ac

Key Issue		Alternative 1 – No Action	Alternative 2 – Proposed Action	Alternative 3
entire Eyerly Fire Area. For this measure the DecAID tool is used, and tolerance levels (TL*) are shown.	Acres with snags (>21 inches dbh) at TL 30	506 ac	437 ac	450 ac
	Acres with snags (>21 inches dbh) at TL 50	7,221 ac	9,185 ac	8,389 ac
	Acres with snags (>21 inches dbh) at TL 80	4,847 ac	3,319 ac	3,970 ac
Down Wood Provided	Within Metolius LSR (tons per acre)	No Harvest	25 t/ac 12 t/ac 10 t/ac 8 t/ac	25 t/ac 12 t/ac 10 t/ac 8 t/ac
	Mixed Conifer Wet Mixed Conifer Dry Ponderosa Pine Wet Ponderosa Pine Dry			
	Outside Metolius LSR	No Harvest	120 linear feet, ≥ 16 inches diameter and 16 feet long	120 linear feet, ≥ 16 inches diameter and 16 feet long

Table S-4. Numbers of Snags by DecAID Tolerance Level

Tolerance Level	30%		50%		80%	
DBH (inches)	≥9	≥21	≥9	≥21	≥9	≥21
Ponderosa Pine PAGS (snags/acre)	1.3	1.1	2.7	1.1	7.2	2.5
Mixed Conifer PAGS (snags/acre)	6.7	2.7	12.6	4.3	25.3	8.6

❖ Preferred Alternative

Alternative 2 is the preferred alternative. The Deschutes National Forest Supervisor will select an alternative in the Record of Decision (ROD). Any of the alternatives considered in detail will be available for selection at the time of that decision.

❖ Affected Environment

The Eyerly Fire Salvage Project area is located east of Green Ridge, south of the Metolius River and Lake Billy Chinook, west of County Road 64, and north of Prairie Farm Creek.

Total National Forest land consumed in the fire is estimated at 17,786 acres. Within the fire's perimeter, 12,821 acres suffered from stand replacement severity where all trees were killed and all except a small percentage of ground fuels were consumed.

About 86% of the Eyerly Fire area may be characterized as short-interval fire adapted ecosystem, or Fire Regime I. Based on a comparison of the fire intensity and scale of the Eyerly Fire to characteristic fire disturbance events that occurred in this area historically, the Eyerly Fire was an uncharacteristic fire event.

The impacted forest vegetation is largely characterized as Dry and Wet Ponderosa Pine and Dry and Wet Mixed Conifer plant association groups. Ponderosa pine is a dominant component of these forest types, with mixtures of Douglas-fir, white fir, western larch, sugar pine, and incense cedar.

Soil types within the fire perimeter are primarily composed of moderately deep surface ash-fall over basaltic colluvial and residual soils.

The Eyerly Fire area lies within the Upper Deschutes River Sub-Basin. It is in the Lower Metolius watershed, which includes the subwatersheds: Lower Fly Creek, Spring Creek, Street, Metolius Horn, Metolius, and Lower LBC Metolius. Lake Billy Chinook reservoir is the only water body listed in the Eyerly Fire Salvage Project area listed on Oregon's 2002 303(d) list. It is listed for pH and chlorophyll a exceedances.

Occasional bull trout have been observed using Street Creek and could potentially use Spring Creek.

About 5,096 acres of the Eyerly Fire burned within the Metolius LSR. The total area of the Metolius LSR is about 75,000 acres. Since the completion of LSR assessment in 1996, about 9 wildfires, greater than 10 acres have occurred impacting approximately 43% of the Metolius LSR.

❖ Environmental Effects

Alternative 1 (No Action)

The alternative would not provide any economic benefits to the economy or communities. Fuel loading will remain low for about the first 10 years, and reach a maximum level that exceeds management objectives within 30 years and remains relatively high for 60 years or more. The buildup of surface fuels would lead to the potential for high severity fire and long burning duration in the event of a landscape scale wildfire. Reforestation of upland conifer sites would take several decades, and would likely provide a natural structure once it is established. Sediment production from existing conditions and from existing roads would continue. Commercial utilization of hazard trees would not occur. The best achievable conditions for cavity-nesting species would be provided.

Alternative 2

The alternative would provide a moderate level of economic benefits related to salvaging merchantable timber. Long-term, potential fire severity would be reduced due to salvage harvesting and fuel treatment. Reforestation would be accelerated throughout the project area. There would be short-term adverse impacts to cavity nesting species habitat, since fewer snags would be available, however long-term habitat suitability of the standing dead trees would rapidly diminish as they decay and fall. There would be a low risk of increased sediment delivered to streams.

Alternative 3

This alternative would provide a low level of economic benefits related to salvaging merchantable timber. Long-term, potential fire severity would be somewhat reduced due to salvage harvesting and fuel treatments. Reforestation would be accelerated on fewer acres than Alternative 2. An increased level of snag habitat would be provided compared to Alternative 2. Habitat suitability of the standing dead trees would rapidly diminish as they fall. There would be a low risk of increased sediment delivered to streams.

❖ Changes from Draft to Final Environmental Impact Statement

The following changes were made between the DEIS and FEIS. Minor corrections to grammar, spelling, explanations, and paragraph formatting have also been made. Some of the changes resulted from comments made to the EIS.

Chapter 1

1. The purpose and need rationale for salvage and fuel treatments has been clarified, with particular attention to the need for these treatments within the Metolius Late Successional Reserve (LSR).
2. A more complete list of fire restoration projects is included to help place the salvage, fuel treatments and other actions proposed in this document in context with the overall Eyerly Fire restoration efforts.

Chapter 2

1. Only dead trees would be salvage harvested within the Metolius LSR.
2. Two units were dropped from Alternative 2. Units number 66 and 125, identified in the Draft EIS, totaling 31 acres have been dropped from Alternative 2.
3. The amount of temporary road needed to access salvage areas has been reduced from 3 miles to 2.1 miles for Alternative 2.
4. Reforestation acres have been revised for both Alternatives 2 and 3 based on field verification. Revised acres for tree planting are shown in the alternative descriptions.
5. The amount of helicopter logging has been increased in Alternative 2 based on field review.
6. In response to public comment and additional field review 3.8 miles of road decommissioning is included in Alternatives 2 and 3. Five roads are proposed and are listed in the alternative description section. These roads are located within the sediment transport zone of adjacent streamcourses. Decommissioning of these roads is included to mitigate the potential for sediment delivery and to foster recovery of riparian vegetation.

Chapter 3

1. A list of past, present and reasonably foreseeable actions is provided.
2. Cumulative effects analysis includes wildfires, which occurred in the summer of 2003, which were not included in the Draft EIS.
3. Several resource sections have been revised with additional analysis to address comments received on the Draft EIS.
4. The discussion of the aquatic conservation strategy is moved from the Appendix to Chapter 3, under Fish Habitat.

Chapter 4

Preparers and Contributors list was updated to include information about contributors to the documents since the Draft EIS was published.

Appendices

1. ACS Objectives, Appendix C in the DEIS, was incorporated into Chapter 3, Fish Habitat. Subsequent Appendix sections moved forward in the FEIS document.
2. Appendix G, cited references updated to support additional data in the FEIS.
3. Appendix H, agencies and individuals contacted has been updated to include new individuals, organizations, and agencies added to the Eyerly mailing list since the publication of the DEIS.
4. One new appendix has been added, Appendix I – Response to Comments. Public comments and agency letters received in response to the publication of the DEIS are listed here.

Index

Alphabetical index of commonly referenced subjects added.

Text Contents

1.0 PURPOSE AND NEED FOR ACTION	1
1.1 INTRODUCTION.....	1
1.2 CHANGES BETWEEN THE DRAFT AND FINAL EIS	2
1.3 BACKGROUND.....	2
1.4 OTHER RESOURCE RECOVERY PROJECTS	6
1.5 PROPOSED ACTION.....	8
1.6 PURPOSE OF AND NEED FOR ACTION.....	9
1.7 PLANNING FRAMEWORK	13
1.8 SCOPING AND PUBLIC INVOLVEMENT	24
1.8.1 Scoping.....	24
1.8.2 Individuals and Agencies Contacted.....	24
1.8.3 Public Notices.....	25
1.8.4 Consultation with Affected Tribes and Agencies	25
1.9 DEIS COMMENTS/RESPONSES	25
1.10 ISSUES	25
1.10.1 Key Issues.....	26
1.10.2 Analysis Issues	27
1.10.3 Issues Not Addressed in Detail.....	30
1.11 DECISION FRAMEWORK.....	30
1.12 PROJECT RECORD.....	31
2.0 ALTERNATIVES, INCLUDING THE PROPOSED ACTION	32
2.1 INTRODUCTION.....	32
2.2 CHANGES BETWEEN DRAFT AND FINAL EIS	32
2.3 DEVELOPMENT OF ALTERNATIVES.....	33
2.4 ALTERNATIVES CONSIDERED BUT ELIMINATED FROM DETAILED STUDY	34
2.5 ALTERNATIVES CONSIDERED IN DETAIL	35
2.6 ALTERNATIVE 1 – NO ACTION	35
2.7 ALTERNATIVE 2 – PROPOSED ACTION	36
2.8 ALTERNATIVE 3	42
2.9 PROJECT DESIGN ELEMENTS	47
2.9.1 Project Design Elements for Soils	48
2.9.2 Project Design Elements for the Protection of Fish Habitat.....	50
2.9.3 Project Design Elements for the Protection of Wildlife Habitat.....	52
2.9.4 Project Design Elements for Temporary Roads and Landings	54
2.9.5 Logging Systems to be utilized in Action Alternatives	55
2.9.6 Guidelines for the Assessment of Tree Survival.....	56
2.9.7 Protection of Healthy Green Trees	58
2.9.8 Fuels Treatment Practices.....	59
2.9.9 Project Design Elements for Noxious Weed Treatment.....	60
2.9.10 Project Design Elements for Air Quality.....	64
2.9.11 Project Design Elements for Heritage Resources	64
2.10 MONITORING.....	64
2.11 COMPARISON OF ALTERNATIVES.....	66
2.12 IDENTIFICATION OF THE PREFERRED ALTERNATIVE.....	69
2.13 MAPS DISPLAYING PROPOSED ALTERNATIVES	70
Map1. Alternative 2 Salvage Harvest.....	70
Map1a. Alternative 2 Temporary Roads and Helicopter Landings	70
Map 2. Alternative 2 Fuels Treatment.....	70
Map 3. Alternative 3 Salvage Harvest.....	70
Map3a. Alternative 3 Temporary Roads and Helicopter Landings	70
Map 4. Alternative 3 Fuels Treatment.....	70
Map 5. Old-Growth MA15 Existing and Replacement Areas	70
Map 6. Proposed Salvage Units.....	70
Map 7. Alternatives 2 & 3 Road Decommissioning	70
Map 8. Alternatives 2 & 3 Hazard Tree Utilization.....	70
Map 9. Recent Activities Within Metolius Watershed (2002-2004)	70
Map 10. Metolius Late Successional Reserves with Recent Large Fires (1996-2003).....	70

3.0 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES.....	71
3.1 CHANGES BETWEEN DRAFT AND FINAL EIS	72
3.2 PAST, PRESENT, AND FORESEEABLE ACTIONS	72
3.2.1 Eyerly Fire History	74
3.3 SOIL QUALITY (KEY ISSUE 1).....	74
3.3.1 Introduction	74
3.3.2 Existing Condition.....	75
3.3.3 Soil Quality Environmental Consequences	90
Exchangeable bases (potassium, sodium, calcium and magnesium).....	109
3.4 WATER QUALITY (KEY ISSUE 2)	119
3.4.1 Introduction	119
3.4.2 Existing Condition.....	119
3.4.3 Water - Environmental Consequences.....	134
3.5 FISH HABITAT (ISSUE 3).....	158
3.5.1 Introduction	158
3.5.2 Existing Condition.....	158
3.5.3 Fish Habitat Environmental Consequences	170
3.5.4 Aquatic Conservation Strategy	180
3.6 WILDLIFE HABITAT (ISSUE 4)	188
3.6.1 Introduction	188
3.6.2 Existing Condition.....	189
3.6.3 Wildlife Environmental Consequences	218
3.7 AIR QUALITY	295
3.7.1 Air Quality Introduction	295
3.7.2 Air Quality Existing Condition.....	295
3.7.3 Air Quality Environmental Consequences	296
3.8 BOTANICAL RESOURCES	299
3.8.1 Introduction	299
3.8.2 Existing Condition.....	299
3.8.3 Botanical Resource Environmental Consequences.....	303
3.9 CULTURAL RESOURCES.....	305
3.9.1 Introduction	305
3.9.2 Existing Condition.....	305
3.9.3 Cultural Resources Environmental Consequences	306
3.10 ECONOMIC AND SOCIAL ANALYSIS	308
3.10.1 Introduction	308
3.10.2 Existing Condition.....	308
3.10.3 Economic and Social Analysis Environmental Consequences	313
3.11 FIRE AND FUELS ACCUMULATION.....	321
3.11.1 Introduction	321
3.11.2 Fire and Fuels Accumulation Affected Environment.....	322
3.11.3 Fire and Fuels Accumulation Environmental Consequences	330
3.12 FOREST VEGETATION AND TIMBER MANAGEMENT	347
3.12.1 Introduction	347
3.12.2 Existing Condition.....	347
3.12.3 Forest Vegetation Environmental Consequences	355
3.13 INSECTS AND DECAY.....	364
3.13.1 Introduction	364
3.13.2 Insects and Decay Existing Condition.....	365
3.13.3 Insects and Decay Environmental Consequences.....	367
3.14 RECREATION RESOURCES	369
3.14.1 Introduction	369
3.14.2 Recreation Resources Existing Condition	369
3.14.3 Recreation Resources Environmental Consequences	372
3.15 ROADS AND TRANSPORTATION	375
3.15.1 Introduction	375
3.15.2 Transportation System Existing Condition.....	376
3.15.3 Roads and Transportation Environmental Consequences.....	377
3.16 SCENIC QUALITY.....	380
3.16.1 Introduction	380
3.16.2 Existing Condition of Scenic Quality	380

3.16.3 Scenic Quality Environmental Consequences	382
3.17 OTHER DISCLOSURES	384
3.17.1 Short-term Uses and Long-term Productivity.....	384
3.17.2 Unavoidable Adverse Effects	384
3.17.3 Irreversible and Irretrievable Commitment of Resources	385
3.17.4 Forest Plan Amendment	386
3.17.5 Northwest Forest Plan Standards and Guidelines Associated with Late Successional Reserves.....	387
4.0 PREPARERS AND CONTRIBUTORS.....	393
APPENDIX A: GLOSSARY OF ABBREVIATIONS AND TERMS	397
ABBREVIATIONS	397
TERMS.....	399
APPENDIX B: PROPOSED ACTIVITY BY UNIT	413
TIMBER SALVAGE	413
FUELS TREATMENT	416
SOIL CONDITION	419
APPENDIX C: EYERLY FUELS TREATMENT AND FUEL LOADINGS GUIDANCE.....	423
APPENDIX D: BEST MANAGEMENT PRACTICES.....	428
APPENDIX E: DETERMINATION OF EFFECTS SUMMARY.....	436
APPENDIX F: RESPONDING TO RECOMMENDATIONS OF BESCHTA ET AL. (1995) AND OTHER VIEWPOINTS ON POST-FIRE SALVAGE	438
RECOMMENDATIONS ON POST-FIRE PRACTICES	445
RECOMMENDATIONS CONCERNING FIRE MANAGEMENT	450
JERRY FRANKLIN’S COMMENTS ON THE BISCUIT FIRE DEIS	451
APPENDIX G: REFERENCES CITED	453
APPENDIX H: AGENCIES AND INDIVIDUALS CONTACTED	480
APPENDIX I: RESPONSE TO COMMENTS AND AGENCY LETTERS	485
INTRODUCTION	485
COMMENT ANALYSIS PROCESS	485
COMMENT RESPONSE.....	486
COMMENTS RECEIVED ON THE DRAFT ENVIRONMENTAL IMPACT STATEMENT AND RESPONSES.....	487
AGENCY LETTERS.....	594

Table 2.11-3. Numbers of Snags by DecAID Tolerance Level.....	69

1.0 PURPOSE AND NEED FOR ACTION

❖ 1.1 Introduction

The Forest Service has prepared this Final Environmental Impact Statement (FEIS) in compliance with the National Environmental Policy Act (NEPA) and other relevant federal and state laws and regulations. This Environmental Impact Statement discloses the direct, indirect, and cumulative environmental impacts that would result from the proposed action and alternatives. The document is organized into five chapters:

- Chapter 1. Purpose and Need for Action: *This chapter includes information on the history of the project proposal, the purpose of and need for the project, and the agency's proposal for achieving that purpose and need. This section also details how the Forest Service informed the public of the proposal and how the public responded.*
- Chapter 2. Alternatives, including the Proposed Action: *This chapter provides a more detailed description of the agency's proposed action as well as alternative methods for achieving the stated purpose. These alternatives were developed based on significant issues raised by the public and other agencies. This discussion also includes mitigation measures. Finally, this section provides a summary table of the environmental consequences associated with each alternative.*
- Chapter 3. Affected Environment and Environmental Consequences: *This chapter describes the relevant natural and social environment, and the environmental effects of implementing the proposed action and other alternatives. The chapter is organized by resources, with those resources that are "key" to the analysis identified.*
- Chapter 4. Consultation and Coordination: *This chapter provides a list of preparers and agencies consulted during the development of the Environmental Impact Statement.*
- Appendices: *The appendices provide more detailed information to support the analyses presented in the Environmental Impact Statement.*
- Index: *The index provides page numbers by document topic.*

Additional documentation, including more detailed analyses of project-area resources, may be found in the project planning record located at the Sisters Ranger District, Sisters, Oregon.

All of the numbers included in the description and analysis of site conditions and the proposed action are approximate, as they have been generated from several sources. Some were generated from electronic sources, i.e. queries of GIS spatial data while others were generated from field surveys. Importantly, they do provide accurate display of effects or trends.

❖ 1.2 Changes Between the Draft and Final EIS _____

The following changes were made between the Draft and Final EIS. This listing does not include correction, explanations, or edits to grammar and spelling. Some of the changes resulted from comments made to the DEIS.

1. The purpose and need rationale for salvage and fuel treatments has been clarified, with particular attention to the need for these treatments within the Metolius Late Successional Reserve (LSR).
2. A more complete list of fire restoration projects is included to help place the salvage, fuel treatments and other actions proposed in this document in context with the overall Eyerly Fire restoration efforts.

❖ 1.3 Background _____

Project Location

The Eyerly Fire area (*Figure 1.3-1*) is located east of Green Ridge, south of the Metolius River and Lake Billy Chinook, west of County Road 64, and north of Prairie Farm Creek. The legal description is:

Township 11 South, Range 10 East, Sections 4, 5, 8 – 10, 14 – 17, 20 – 23, and 32 – 36
Township 12 South, Range 10 East, Sections 1 – 5
Township 11 South, Range 11 East, Sections 30 – 32
Township 12 South, Range 11 East, Sections 5 - 7

On the afternoon of July 9th, 2002 a wildfire was ignited by lightning on the north side of the Metolius arm of Lake Billy Chinook within the Warm Springs Reservation. Despite fire crew line construction and helicopter water suppression, the fire grew rapidly in steep, rugged terrain. The fire was fueled by cheatgrass, juniper, bitterbrush, ponderosa pine and Douglas-fir. On July 11th, the fire spotted across the Metolius River burning onto the Sisters Ranger District and grew from 212 acres to approximately 2000 acres. Extreme fire behavior was observed, and on July 13th the fire made a run toward Perry South campground expanding the burned area to approximately 10,000 acres.

Another extensive burning period began on July 14th. The fire was then estimated at 16,000 acres in size. For the next few days the fire grew steadily. As inversions lifted, the fire spread up the Street, Spring, and Bean Creek drainages. On July 23rd, the fire breached the crest of Green Ridge and burned approximately 50 acres on the west side.

At time of containment, the fire was estimated at 23,134 acres. Total National Forest land consumed is estimated at 17,786 acres. Within the fire's perimeter, 12,821 acres suffered from stand replacement severity. Land ownership within the Eyerly Fire perimeter and project vicinity is displayed in the map (*Figure 1.3-3*), and broken down by acres and percent of the project area in *Table 1.3-1*.

Figure 1.3-1. Eyerly Project Location

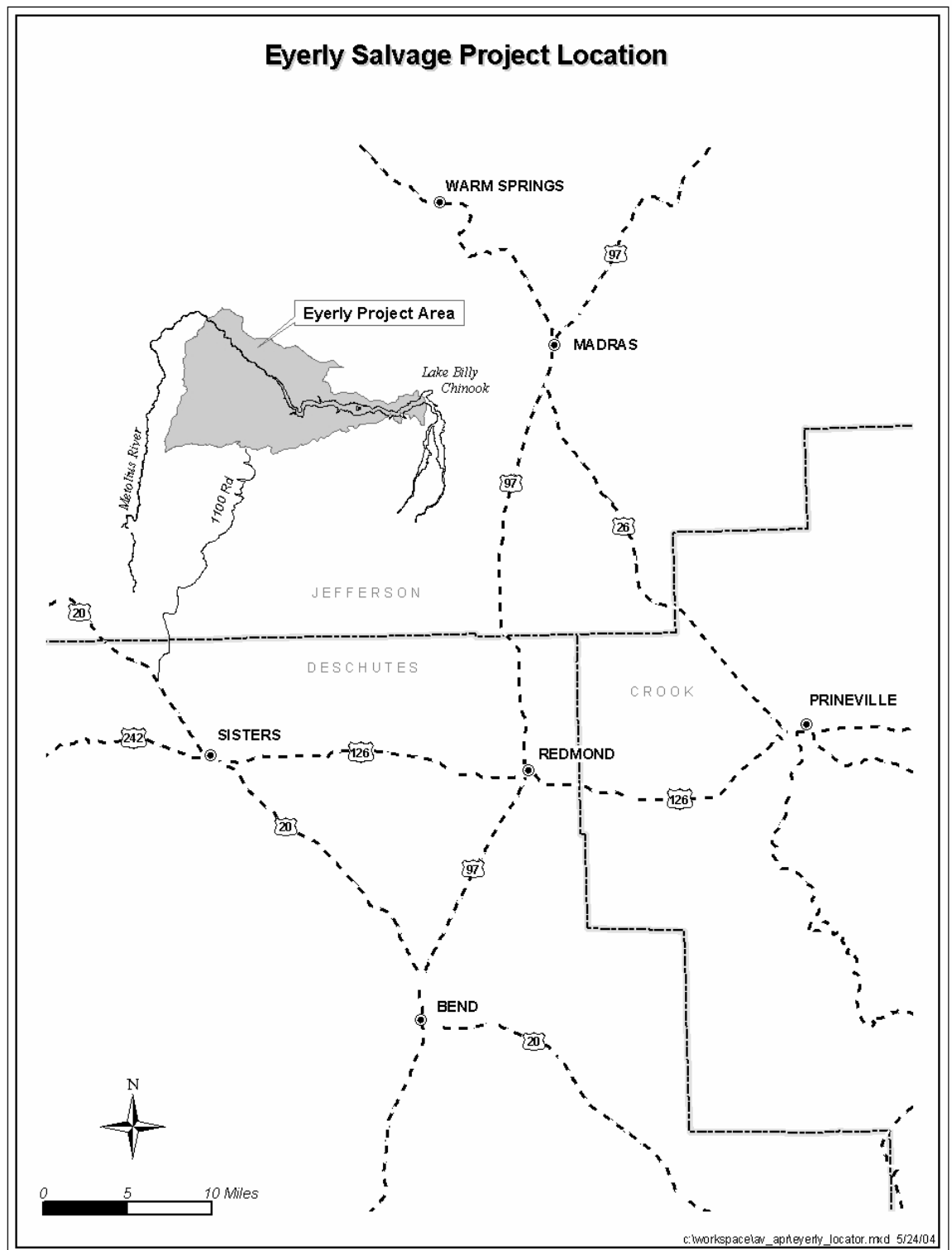


Figure 1.3-2. Road 1190-100 Overlook.

A member of the Burned Area Emergency Rehab (BAER) team surveys the landscape consumed by the Eyerly Fire.

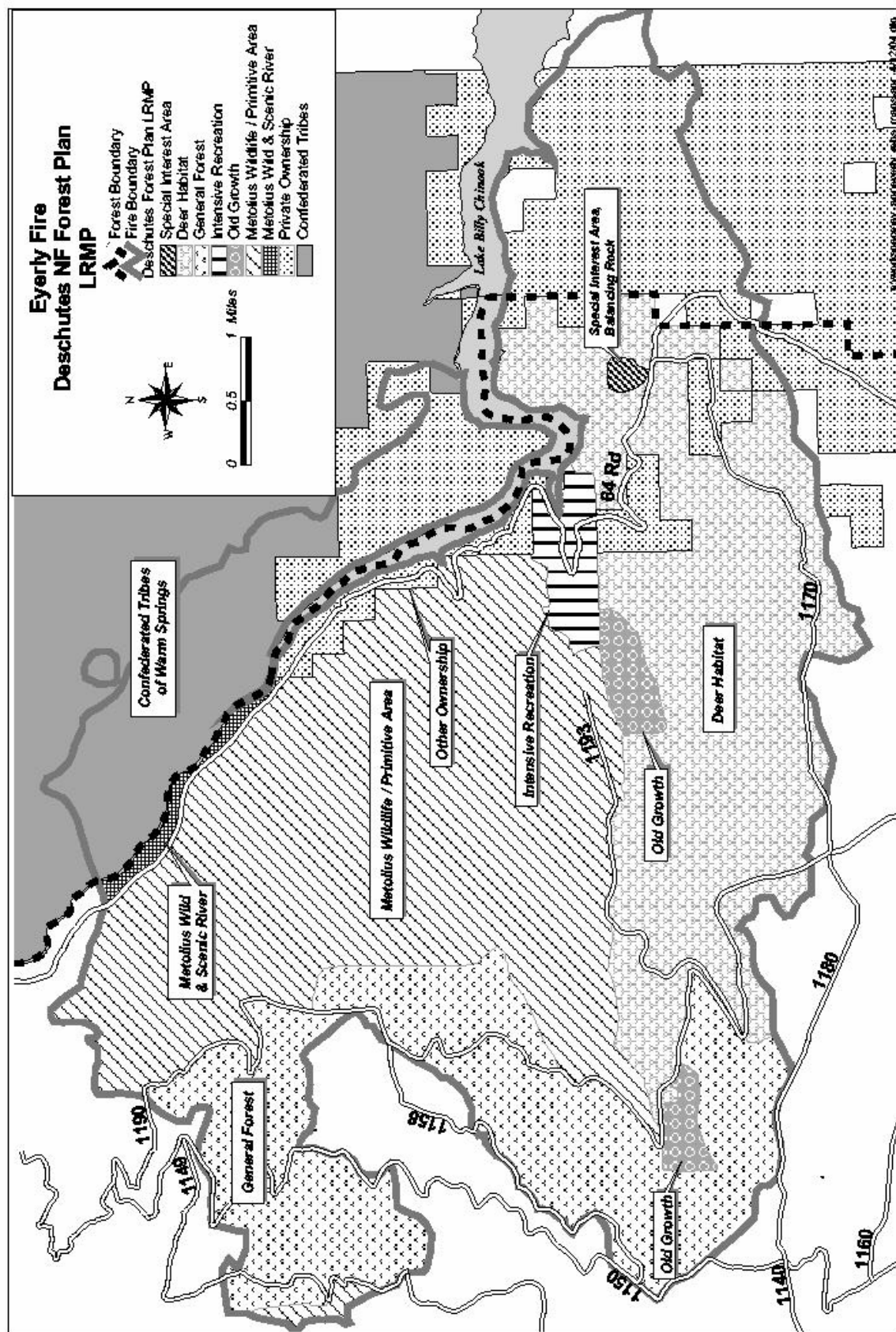
**Table 1.3-1. Land Ownership within the Eyerly Fire Area**

Land Ownership within the Eyerly Fire area		
Ownership	Acres	Percent
Deschutes National Forest	17,786	77
Other Federal	158	<1
Private	3,614	16
Confederated Tribes of Warm Springs	1,576	7
Total	23,134	100

The area burned on the Deschutes National Forest is the focus of this environmental impact statement, though all of the fire area and adjacent lands are considered in the analysis process (*Figure 1.3-3*). All of the area on the Deschutes NF is located on the Sisters Ranger District.

The project area is located on the north end of Green Ridge and ranges in elevation from 4500' to 2000'. It spans several plant association groups, including mixed conifer wet and juniper woodlands. The area encompasses lands within the Deschutes National Forest Land and Resource Management Plan (LRMP) as amended by the Northwest Forest Plan (NWFP), Inland Native Fish Strategy (INFISH), and Regional Forester's Eastside Forests Plan Amendment No.2 (Eastside Screens).

Figure 1.3-3. Land Ownership within Eyerly Fire Area



The Eyerly Fire Salvage Final EIS analysis includes portions of the Metolius Watershed, Lake Billy Chinook, multiple creek drainages, and Green Ridge. The effect of the Eyerly Fire on vegetation burn severity across the landscape was variable. Typically wildfires burn according to fuels, weather and topographic conditions. These conditions vary by location within a landscape and over time.

The effects on the resources surrounding (and adjacent to) the Eyerly Fire boundary have been considered, and are included in the project analysis. The proposed harvest of burned or severely damaged trees would only occur within the boundaries of the July 2002 Eyerly Fire.

The scale of the analysis is variable depending on the resource concern being evaluated, particularly for cumulative impacts of the proposed action and the impacts of past present and reasonably foreseeable future actions. As an example, nine wildfires (greater than 10 acres in size), including the Eyerly Fire, have occurred since the completion of the Metolius Late Successional Reserve Assessment (Metolius LSRA) in 1996. In total these fires have impacted 43% of the 75,000 acre Metolius LSR. Effects of the proposed action are described in this EIS, Chapter 3, and consider the cumulative impacts of other actions and events where appropriate to adequately disclose effects.

❖ 1.4 Other Resource Recovery Projects

The Eyerly Salvage proposal is one of several projects planned to occur within the Eyerly Fire Area. This EIS focuses on the activity of salvage of commercial timber and connected actions, such as reforestation and fuels treatment. Other projects aimed at fostering the recovery of resources affected by the fire are in various stages of planning or implementation. The following is a list of other projects planned or implemented for the Eyerly Fire area.

Fire Suppression Rehabilitation

These actions were completed as part of the fire suppression effort for the Eyerly Fire. The objective is to repair and rehabilitate impacts to resources caused by suppression activity.

- Water barring, ripping and leveling of dozer line: 84 miles

- Water barring, restoring drainage to hand line: 8 miles

- Ripping, disking, seeding staging areas: 24 acres

Burned Area Emergency Rehabilitation (BAER)

Several actions were identified as part of the BAER process. Following an analysis by resource specialists completed prior to the Eyerly Fire being declared controlled, these actions were identified as being needed to reduce fire effects to water quality and to protection soils from erosion. Actions were also identified to prevent the spread of noxious weeds.

Road maintenance actions identified by the BAER team have been completed. Drainage structures included culverts were cleaned, and in several cases replaced by larger capacity pipes improving the overall drainage within the Eyerly Fire area. Two culverts were

replaced with open-bottom arches on Road 11, one on Street Creek and one on Spring Creek.

Contour Felling: Approximately 250 acres of contour felling was completed in the Fall of 2002, and Spring 2003. Done to help hold soil in place on side slopes and reduce sediment delivery to stream courses.

Log Erosion Barriers: Log barrier installation was completed Spring 2003 on about 120 acres to reduce potential for soil erosion.

Seeding: Erosion seeding was completed Fall of 2002. Sterile winter wheat was broadcast seeded on approximately 2,000 acres of steep ground where erosion potential for erosion was determined to be high.

Shrub Planting: Planting of shrub species such as bitterbrush is planned for about 5,000 acres. About half of this has been completed, additional plantings will be accomplished in 2004.

Channel Buffer Felling: About 100 acres were completed in the Spring 2003. Project consists of felling burned trees adjacent to stream channels to replace down logs that had been consumed in the fire.

Weed Treatment: About 15 acres of noxious weed treatment was completed in the Fall of 2002. Monitoring of weed populations is ongoing.

Long-term Fire Restoration Projects

The projects described below are either planned or accomplished. These projects are intended to restore resources damaged by the Eyerly Fire. They are not part of BAER process. These projects are not connected to the activities proposed in the Eyerly Fire Salvage FEIS.

Bitterbrush Planting: Winter forage habitat for big game is proposed on suitable soils. Dependant on funding, propagation could begin in 2004 with planting in 2006.

Reforestation: Approximately 700 acres of conifer planting and 250 acres of riparian planting were accomplished in spring 2003.

Road Management: The Eyerly Roads Analysis document examined the condition of the transportation system within the fire area. Road management activities, including road decommissioning and road inactivation, are planned and will be addressed under separate NEPA analysis.

Water Impoundment: A project to improve function of the existing Alder Spring impoundment is being planned. Inspection and a determination of conditions is slated for late. Implementation could take place in summer 2004.

Weed Treatment: Treatment and monitoring of noxious weeds was approved under the BAER process. Treatment is ongoing and considered in the analysis. Other weed treatments may be planned as needed through the monitoring of weed populations.

Wildlife Guzzlers: Repair or replacement of five guzzlers that were damaged by the Eyerly Fire is ongoing.

❖ 1.5 Proposed Action

In March 2003 a proposed action was developed for the Eyerly Fire Salvage project. The proposed action was described in both the initial scoping for the project and in the Notice of Intent to prepare an environmental impact statement, published in the Federal Register on March 6, 2003.

Refinement of the proposed action has taken place based on better field data. The proposed action is fully described as Alternative 2, in Chapter of this FEIS.

Development of the proposed action was done in careful consideration of the context of the effects of Eyerly Fire on the resources and values within the area. The proposal takes a conservative approach for utilization of fire killed and damaged trees expected to die for commercial use. Salvage treatment and small diameter utilization is proposed on 4,846 acres, about 27% of the total 17,786 acres affected by the Eyerly Fire on National Forest lands. Within the Metolius Late Successional Reserve salvage is proposed on 1,426 acres, 28% of the total 5,096 acres affected by the Eyerly Fire.

No treatment is proposed within the Metolius Roadless area. The proposal for salvage includes an aggressive approach to mitigating and avoiding adverse impacts to soils, water quality, fish and wildlife resources through the inclusion of design elements.

This proposal is for salvage of commercial timber on 4,294 acres, and utilization of small diameter products such as posts, rails, house logs, chips, or firewood on approximately 552 acres on Sisters Ranger District. Reforestation of the same areas is also proposed. All timber and small diameter products proposed for salvage are killed or damaged trees expected to die within the perimeter of the July 2002 Eyerly Fire.

The intensity of the Eyerly Fire varied and resulted in some areas of no damage while other areas experienced complete stand mortality. The volume of burned timber ranges from 1 to 15 thousand board feet (MBF) per acre. Estimated total volume of fire-killed timber is in excess of 100 million board feet (MMBF). The proposed salvage harvest would yield approximately 23.3 MMBF (*Table 1.5-1*).

Salvage logging would be conducted by a combination of ground-based tractor, skyline and helicopter yarding. Dead and damaged trees expected to die in excess of wildlife habitat and soil protection needs would be salvaged and generally include trees greater than 12 inches diameter. Within the Metolius Late Successional Reserve only dead trees (no visible green needles) would be salvaged.

Table 1.5-1. Proposed Commercial Salvage Harvest

Logging System	Acres	Estimated Total Volume (MBF)	Percent
Cable/Skyline	858	5,421	24%
Ground Based	3,583	14,836	64%
Helicopter	406	3,068	12%
Total	4,846	23,324	100%

Table 1.5-2. Salvage of Small Diameter Forest Products

Logging System	Acres
Ground Based	466
Skyline/Cable	86
Total	552

The proposal includes construction of short temporary roads, totaling approximately 2.1 miles, to provide access. These temporary roads would be closed after use. About 3.8 miles of road decommissioning would be done. The road decommissioning is included as a mitigation measure to reduce the potential for sediment delivery to stream channels (see *Map 7*, beginning on *pg. 70*).

Areas proposed for salvage are located outside of Riparian Reserves and Riparian Habitat Conservation Areas (RHCA). Riparian Reserve and RHCA widths vary by stream class. Dead trees (snags) and down wood would be left at levels consistent with current standards.

No salvage or small diameter forest products activity is proposed within the Metolius Roadless Area.

The Deschutes Forest Plan requires the relocation of designated old growth areas when existing old growth is significantly altered by wildfire and no longer meets the minimum habitat needs for the indicator species (LRMP, p. 4-150, M15-5). There are two old growth areas affected within the Eyerly Fire Area. These old growth areas were burned at sufficient intensity so that the areas no longer provide old growth habitat. This alternative would relocate these old growth areas to areas currently providing old growth habitat. The relocation of the designated old growth areas would be an amendment to the Deschutes National Forest Land and Resource Management Plan (Reference *Map 5*, beginning on *pg. 70*).

❖ 1.6 Purpose Of and Need For Action

The purposes and needs for action in the Eyerly Fire Salvage project area are to:

- Recover the economic value of fire-killed and damaged trees expected die,
- Reduce future fuel loadings to be consistent with management direction,
- Accelerate the establishment of upland forest vegetation,
- Reduce hazards associated with danger trees along major roads, and
- Designate substitute old growth areas that were burned in the Eyerly Fire.

This action is needed in order to comply with the goals and objectives outlined in the 1990 Deschutes National Forest land and Resource Management Plan (LRMP), which guides natural resource management activities and establishes management standards for lands administered by the Deschutes National Forest.

The needs for the proposed action are derived from the differences between current and desired conditions. Desired conditions are based on LRMP direction and management objectives, and on recommendations from local assessments including the Metolius LSR Assessment and the Metolius Watershed Analysis. The proposed action is designed to move resource conditions closer to the desired conditions and address the management direction provided by the Deschutes LRMP as amended.

- *Recovery, through salvage, of the economic value of the burned timber and to provide timber products to the economy.*

This action is needed, because the area is currently characterized by fire-killed and damaged ponderosa pine and mixed conifer trees. Mixed conifer stands are composed of a mixture of tree species including: ponderosa pine, white fir, western larch, incense cedar, and Douglas-fir. These species quickly lose commercial value and their suitability as the raw material for sawtimber rapidly deteriorates following fire mortality. This action responds to the goals and objectives for the Deschutes National Forest Land and Resource Management Plan (beginning on pg. 17). The purpose of this project is to recover value in the wood in a timely and economically efficient manner from a portion of the area burned by the Eyerly Fire by putting it to beneficial use in the local and regional communities. There is a need and demand for wood and various wood products used throughout the region. The proposed action utilizes the opportunity to salvage harvest the fire-killed trees or trees expected to die as a result of fire injury, and to the desire to provide jobs and income.

There is a need to recover the timber volume in this instance where a catastrophic event clearly killed more trees (resulting in more snags and down logs in the short and long term) than are needed to maintain late-successional conditions (NWFP ROD, p. 66). Removing fire-killed trees through salvage logging will provide sawtimber and other wood products to the local and regional economies (NWFP ROD, A-1).

- *Establish fuel conditions that will reduce the potential for future high-severity fires and restore fire as an ecosystem component.*

The majority of the Eyerly Fire Salvage project area, historically, was a short-interval fire adapted ecosystem (Fire Regimes I and IIIa). These fire regimes make up 83% of the project area. Frequent, low-intensity fires swept the forest floor and maintained fuel and vegetation conditions supporting this fire disturbance process. High intensity fires did occur, but on a much smaller scale than the Eyerly Fire.

Prior to the Eyerly Fire forest stands that historically were characterized by open large-sized ponderosa pine had changed and become dominated by denser stands of smaller trees often in multi-strata structures, and with increasing amounts of Douglas-fir and white fir. These stand conditions were accompanied by an accumulation of surface fuel loadings. Together these changes resulted in a condition that supported high intensity fire behavior with potentially damaging results to existing forest stands over a large portion of the landscape. These stand and fuels conditions were present within the Eyerly area in amounts and distribution that represent a substantial departure from historic conditions.

Fire intensity was high on about 73% of the Eyerly Fire resulting in stand replacement effects to the existing forest vegetation, an uncharacteristic event compared to the fire regime. The fire consumed the litter layer, most of the existing down woody material and killed or severely damaged all of the standing trees. A dead and standing fuel component remains. For the next 10 years a high intensity fire is unlikely because fuels will not have accumulated to sufficient levels, and will not have developed adequate continuity to carry fire.

Approximately 10 to 30 years following the Eyerly Fire, the accumulation of fuels will be more rapid as smaller diameter dead trees fall, and as shrubs and other understory species become established. Minimal duff will have accumulated, thus a high burn severity would primarily occur where fuel is concentrated and has decomposed enough to support prolonged burning. The maximum surface fuel loading is predicted to occur during the period of 30 – 35 years following the Eyerly Fire. The average maximum surface fuel

loading for stand replacement burned areas is estimated to reach 36 tons per acre for Ponderosa pine and 59 tons per acre for mixed conifer stands.

After 30 years large wood will have considerable decay, and a litter and duff layer will be established, resulting in a potential for high burn severity to soils due to prolonged burning of this layer. Additionally, existence of a conifer overstory could support a crown fire, which would retard or eliminate vegetation recovery. The development of vegetative communities could be altered, perpetuating the departure from historic conditions under a short-interval/low-intensity fire regime. The potential for re-introduction of fire in the future, either by prescribed burning or wildland fire use, would be reduced because fuel conditions would be too high.

Table 1.6-1 displays the potential surface fuel loading compared to desired levels. Desired levels are described from the Metolius LSRA and recent science regarding management of coarse wood debris in a recovering forest (Brown et al, 2003).

Table 1.6-1. Potential Surface Fuel Loading

Plant Association Group	Projected Maximum Surface Fuels Tons/acre	Metolius LSRA Tons/acre	Brown et al Tons/acre
Ponderosa Pine Climatic Climax	36	10 - 15	5 - 20
Ponderosa Pine Fire Climax	36	5 - 10	5 - 20
Mixed Conifer Climatic Climax	59	12 - 35	10 - 30
Mixed Conifer Fire Climax	59	8 - 12	10 - 30

Based on the above comparison there is a need to remove large standing dead trees that will eventually fall and add to surface fuel loading. The salvage of the standing dead and dying trees and fuel treatments within salvage units would reduce future burn duration and reduce fire severity of future prescribed or wildfire events.

Desired condition is described further within the Metolius LSRA:

Bring fuel loads to a level that allows reintroduction of fire at the appropriate stages for the vegetation type. Move the Ponderosa Pine PAG towards fire-climax late-successional habitat conditions, and the Mixed Conifer PAG's to a mosaic of fire-climax and climatic climax late-successional habitats. Manage for late-successional habitat conditions in fire climax stands that allow for low-intensity/severity prescribed or natural fires (Metolius LSRA, p. 65).

Remove dead material necessary to reduce the potential for catastrophic habitat loss from wildfire (Metolius LSRA, p. 65).

- *Accelerate reforestation of the desired species in areas where no seed source remains and to provide habitat to species associated with late and old structured forests.*

Natural regeneration of conifer species after a fire is dependent on seed dispersal from remaining live trees. For much of the Eyerly Fire area, particularly within the interior areas of the fire, adjacent seed will not be available for conifer species such as ponderosa pine, Douglas-fir, western larch or sugar pine. These areas will require reforestation by planting. Replanting with the appropriate species will ensure timely establishment of species desirable for long-term objectives.

The restoration rate of late successional forest habitat can be increased with planting and competition reduction treatments. Without disturbances in a passive management scenario, it could take eighty (80) years for a conifer to grow to 10" dbh, however lack of seed source is a major concern for the Eyerly area and there would likely be large areas with no trees without tree planting. With reforestation and active management such as low intensity prescribed fire, tree sizes are estimated to range up to 14" dbh in the same timeframe, and the primary species composition would be ponderosa pine and Douglas-fir. It is estimated that a 25" tree would be available in 125 - 150 years with intermediate treatments such as thinning and prescribed burning.

Planting densities and patterns should reflect potential natural regeneration and mortality expected over time. Spacing between planted trees could average 15 feet dependant upon available protected micro-sites. *Table 1.6-2* displays stand conditions for mixed conifer and ponderosa pine plant association groups at an estimated age of 60 years (Metolius LSRA, 1996). These represent sustainable conditions for short-interval fire return regimes.

Table 1.6-2. Estimated 60 yr. Stand Condition by PAG

Plant Association Group	Estimated Size (average diameter, inches)	Trees Per Acre
Mixed Conifer	10	150 - 177
Ponderosa Pine	10	92 - 145

- *Reduce hazards associated with danger trees along major roads and developed campgrounds.*

There is a need to improve public safety in areas within the fire area. Dead trees posing a hazard to the public have been identified along Forest Roads 64 and 1170, and within Perry South and Monty Campgrounds. It is a forest management goal to provide safe, efficient access for the movement of people and materials involved in the use of the National Forest lands (LRMP, p. 4-2).

- *Designate substitute old growth areas that were burned in the Eyerly Fire.*

The Eyerly Fire burned through two old growth areas and significantly altered the conditions such that these areas no longer meet the minimum habitat requirements for the indicator species. One old growth area was primarily mixed conifer and provided habitat for pine martin, the other old growth area was primarily ponderosa pine with Goshawk as the indicator species.

The need for designation of substitute areas is based on direction the Deschutes Forest Plan “If the structure of an old growth area is significantly altered through a catastrophic event such as fire, windstorm, or insect epidemic, another stand would be substituted that meets the minimum requirements of the indicator species (Deschutes Forest Plan, p. 4-150).

❖ 1.7 Planning Framework

Current Laws

Development of this Environmental Impact Statement follows implementing regulations of the National Forest Management Act (NFMA); Title 36, Code of Federal Regulations, Part 219 (36 CFR 219); Council of Environmental Quality, Title 40; CFR, Parts 1500-1508, National Environmental Policy Act (NEPA).

Many federal and state laws, including the Forest and Rangeland Renewable Resources Act (RPA), Endangered Species Act, Clean Air Act, and Clean Water Act also guide this analysis. The following is a brief explanation of each of these laws and their relation to the current project planning effort.

The American Antiquities Act of 1906

This Act makes it illegal to appropriate, excavate, injure, or destroy any historic, prehistoric ruin or monument, or any object of antiquity, situated on lands owned by the Government of the United States, without permission of the Secretary of the Department of the Government having jurisdiction over the lands on which said antiquities are situated.

The National Historic Preservation Act of 1966, as amended

This Act requires Federal agencies to consult with American Indian Tribes, State and local groups before nonrenewable cultural resources, such as archaeological and historic structures, are damaged or destroyed. Section 106 of this Act requires Federal agencies to review the effects project proposals may have on the cultural resources in the Analysis Area.

The Endangered Species Act of 1973, as amended

The purposes of this Act are to “provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved, to provide a program for the conservation of such endangered species and threatened species, and to take such tests as may be appropriate to achieve the purpose of the treaties and conventions set forth in subsection (a) of this section.” The Act also states “It is further declared to be the policy of Congress that all Federal departments and agencies shall seek to conserve endangered species and threatened species and shall utilize their authorities in furtherance of the purposes of this Act.”

The Migratory Bird Treaty Act of 1918

The purpose of this Act is to establish an international framework for the protection and conservation of migratory birds. The Act makes it illegal, unless permitted by regulations, to “pursue, hunt, take, capture, deliver for shipment, ship, cause to be carried by any means whatever, receive for shipment, transportation or carriage, or export, at any time, or in any manner, any migratory bird, including in this Convention...for the protection of migratory birds...or any part, nest, or egg of any such bird” (16USC 703). The original 1918 statute implemented the 1916 Convention between the United States and Great Britain (for Canada). Later amendments implemented treaties between the United States and Mexico, Japan, and the Soviet Union (now Russia).

The National Environmental Policy Act (NEPA) of 1969, as amended

The purposes of this Act are “To declare a national policy which will encourage productive and enjoyable harmony between man and his environment, to promote efforts which will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of man; to enrich the understanding of the ecological systems and natural resources important to the Nations; and to establish a Council on Environmental Quality” (42 U.S.C. Sec. 4321). The law further states “it is the continuing policy of the Federal Government, in cooperation, to use all practicable means and measures, including financial and technical assistance, in a manner calculated to foster and promote the general welfare, to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of the present and future generations of Americans. This law essentially pertains to public participation, environmental analysis, and documentation.

The National Forest Management Act (NFMA) of 1976

This Act guides development and revision of National Forest Land Management Plans and has several sections to it ranging from required reporting that the Secretary must submit annually to Congress to preparation requirements for timber sale contracts. There are several important sections within the act, including Section 1 (purpose and principles), Section 19 (fish and wildlife resources), Section 23 (water and soil resources), and Section 27 (management requirements).

The Clean Water Act, as amended in 1977 and 1982

The primary objective of this Act is to restore and maintain the integrity of the Nation’s waters. This objective translates into two fundamental national goals: 1. Eliminate the discharge of pollutants into the nation’s waters; and 2. Achieve water quality levels that are fishable and swimmable. This Act establishes a non-degradation policy for all federally proposed projects. Under Section 303(d) of the Clean Water Act, the State has identified water quality-limited water bodies in Oregon. Lake Billy Chinook is the only water body in the project area that is on the 303(d) list.

The Clean Air Act, as amended in 1990

The purposes of this Act are “to protect and enhance the quality of the Nation’s air resources so as to promote the public health and welfare and the productive capacity of its population; to initiate and accelerate a national research and development program to achieve the prevention and control of air pollution; to provide technical and financial assistance to state and local governments in connection with the development and execution of their air pollution prevention and control programs; and to encourage and assist the development and operation of regional air pollution prevention and control programs.”

Multiple-Use Sustained-Yield Act of 1960

The Multiple Use – Sustained Yield Act of 1960 requires the Forest Service to manage National Forest System lands for multiple uses (including timber, recreation, fish and wildlife, range, and watershed). All renewable resources are to be managed in such a way that they are available for future generations. The harvesting and use of standing timber can be considered a short-term use of a renewable resource. As a renewable resource, trees can be re-established and grown in again if the productivity of the land is not impaired.

Migratory Bird E.O. 13186

On January 10, 2001, President Clinton signed an Executive Order (E.O. 13186) titled “Responsibilities of Federal Agencies to Protect Migratory Birds.” This E.O. requires the *“environmental analysis of Federal actions, required by NEPA or other established environmental review processes, evaluates the effects of actions and agency plans on migratory birds, with emphasis on species of concern.”*

Natural or Depletable Resource Requirements and Conservation Potential:

The Eyerly Fire Salvage Project has been designed to conform to applicable laws and regulations pertaining to natural or depletable resources, including minerals and energy resources. Regulations of mineral and energy activities on the National Forest, under the U.S. Mining Laws act of 1872 and Mineral Leasing Act of 1920, are shared with the Bureau of Land Management. The demand for access to National Forest System lands for the purpose of mineral and energy exploration and development is expected to increase over time.

Environmental Justice

On February 11, 1994, President Clinton signed Executive Order 12898. This order directs each Federal agency to make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations. On the same day, the President also signed a memorandum emphasizing the need to consider these types of effects during NEPA analysis. On March 24, 1995, the Department of Agriculture completed an implementation strategy for the executive order. Where Forest Service proposals have the potential to disproportionately and adversely affect minority or low-income populations,

these effects must be considered and disclosed (and mitigated to the degree possible) through the NEPA analysis and documentation (see Environmental Justice, Chapter 3).

Prime Farmland, Rangeland, and Forestland

All alternatives are in accordance with the Secretary of Agriculture Memorandum 1827 for prime farmland, rangeland, and forestland. “Prime” forestland is a term used only for non-Federal land, which would not be affected by proposed alternatives. Regardless of the alternative selected, National Forest System lands would be managed with sensitivity to adjacent private and public lands.

Floodplains and Wetlands (E.O. 11988 and 11990)

The purpose of these 1977 orders are to “...avoid to the extent possible the long and short term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct and indirect support of floodplain development...” and similarly “...avoid to the extent possible the long and short term adverse impacts associated with the destruction or modification of wetlands...”

Wetlands that meet the Jurisdictional Definition (Corps of Engineers) are found in the Eyerly Project Area. These areas are mapped and avoided during harvest and fuels treatments.

Forest and Rangeland Renewable Resources Planning Act (RPA) of 1974 (as Amended)

This act directed the Secretary of Agriculture to prepare a Renewable Resources Assessment and updates. These assessments include “an analysis of present and anticipated uses, demand for, and supply of the renewable resources with consideration of the international resource situation, and an emphasis of pertinent supply, demand and price relationships trends.” The USDA Forest Service Forest Inventory and Analysis unit provides updates for this assessment.

Forest Order 12962 (aquatic systems and recreational fisheries)

This 1995 order’s purpose is to conserve, restore, and enhance aquatic systems to provide for increased recreational fishing opportunities nationwide. It requires federal agencies to evaluate the effects of federally funded actions on aquatic systems and document those effects relative to the purpose of this order.

Executive Order 13112 (invasive species)

This 1999 order requires Federal agencies whose actions may affect the status of invasive species to identify those actions and within budgetary limits, “(i) prevent the introduction of invasive species; (ii) detect and respond rapidly to and control populations of such species... (iii) monitor invasive species populations... (iv) provide for restoration of native species and habitat conditions in ecosystems that have been invaded;...(vi) promote public education on invasive species... and (3) not authorize, fund, or carry out actions that it believes are likely to cause or promote the introduction or spread of invasive species... unless, pursuant to guidelines that it has prescribed, the agency had determined

and made public... that the benefits of such actions clearly outweigh the potential harm caused by invasive species; and that all feasible and prudent measures to minimize risk of harm will be taken in conjunction with the actions.”

Executive Order 13287 (preserve America)

This 2003 order’s intent is to preserve America’s heritage though “actively advancing the protection, enhancement, and contemporary use of the historic properties owned by the Federal Government... The Federal Government shall recognize and manage the historic properties in its ownership as assets that can support department and agency missions while contributing to the vitality and economic well-being of the Nation’s communities and fostering a broader appreciation for the development of the United States and its underlying values...”

Consumers, Civil Rights, Minorities, and Women

All Forest Service actions have potential to produce some form of impacts, positive or negative, on the civil rights of individuals or groups, including minorities and women. Analysis of this potential impact is required by Forest Service Manual and Forest Service Handbook direction (see Social Economics, Chapter 3).

Regulatory Framework

Forest Plan Direction

Guidance for management activities is provided by the Deschutes National Forest Land and Resource Management Plan of 1990 (LRMP) as amended. The LRMP establishes goals, objectives, standards, and guidelines for each specific management area of the Forest, as well as Forest-wide standards and guidelines. Management Areas and associated standards and guidelines are described in Chapter 4 of the LRMP. Management Areas affected by the fire within the project area include the following (*Figure 1.3-3, page 4*).

Special Interest Areas – Management Area 1, Balancing Rock (M1-J) (approximately 43 acres; <1% of the project area)

Goal: To preserve and provide interpretation of unique geological, biological, and cultural areas for education, scientific, and public enjoyment purposes (LRMP, p. 4-90).

No salvage activity is proposed within this management area.

Deer Habitat – Management Area 7 (approximately 5,353 acres; 30% of the project area)

Goal: To manage vegetation to provide optimum habitat conditions on deer winter and transition ranges while providing some domestic livestock forage, wood products, visual quality and recreation opportunities (LRMP, p. 4-113).

Forest Plan Standard and Guideline M7-3, Generally, programmed timber harvest is appropriate when required to regenerate new cover stands, maintain tree vigor for resistance to stand-threatening insect damage, or encourage desirable forage in deficient areas. (LRMP, p. 4-113)

Timber salvage is proposed within this management area.

**General Forest – Management Area 8
(approximately 4,292 acres; 24% of the project area)**

Goal: To emphasize timber production while providing forage production, visual quality, wildlife habitat and recreational opportunities for public use and enjoyment (LRMP, p. 4-117).

Timber salvage is proposed within this management area.

**Intensive Recreation – Management Area 11
(approximately 358 acres; 2% of the project area)**

Goal: To provide a wide variety of quality outdoor recreation opportunities within a forest environment where the localized settings may be modified to accommodate large numbers of visitors. (Undeveloped recreation opportunities may occur in this Management Area.) (LRMP, p. 4-135).

Utilization of hazard trees (danger trees) is proposed within this management area. Some hazard tree felling has already been completed within the Perry South and Monty Campgrounds. Utilization of commercially valuable felled trees and additional hazard trees is included in this proposal (LRMP, p. 4-138, M11-31).

Dispersed Recreation – Management Area 12

Goal: To provide a range of quality recreation opportunities in an undeveloped forest environment. (Some recreational development may occur in this Management Area.) (Forest Plan, p. 4-140)

Salvage activity is proposed within this management allocation (Forest Plan, p. 4-141, M12-9).

**Old Growth – Management Area 15
(approximately 354 acres; 2% of the project area)**

Goal: To provide naturally evolved old growth forest ecosystems for (1) habitat for plant and animal species associated with old growth forest ecosystems, (2) representations of landscape ecology, (3) public enjoyment of large, old-tree environments, and (4) the needs of the public from an aesthetic spiritual sense.

Old growth areas will also contribute to the biodiversity of the Forest. (LRMP, p. 4-149)

M15-5: If the structure of an old growth area is significantly altered through a catastrophic event such as a fire, windstorm, or insect epidemic, another stand would be substituted that meets the minimum requirements for the indicator species. The original area could then be salvaged and reforested.

An old growth area will be considered significantly altered if it no longer meets the minimum habitat needs for the indicator species. (LRMP, p. 4-150). The baseline conditions for this management area within the Eyerly Fire perimeter have been significantly altered. Minimum habitat needs cannot be met under current conditions; therefore, a Forest Plan amendment will re-designate the allocation of old-growth habitat impacted by wildfire.

**Metolius Wildlife/Primitive Area – Management Area 20
(approximately 6,993 acres, 39% of the project area)**

Goal: To protect and perpetuate a predominantly unmodified natural environment where natural ecological processes can continue. To provide habitat for a wide variety of wildlife species, and to specifically maintain or enhance habitat for bald eagles. To provide an opportunity for primitive dispersed recreation within this undeveloped forest environment. (LRMP, p. 4-169)

Includes portions of the Metolius Roadless Area (Deschutes LRMP FEIS, Appendix C, pp. C-36 through C-41).

Forest Plan Standard and Guideline M20-8, Timber harvest will be allowed in catastrophic situations. Efforts will be made to protect or create suitable wildlife habitat during any harvest activities. (LRMP, p. 4-170). The Eyerly Fire is determined to meet the definition of a catastrophic situation (LRMP, Glossary, p. G-2).

Timber salvage is proposed within this management allocation.

Metolius Special Interest – Castle Rock, Management Area 23

Goal: To preserve and provide interpretation of unique geological, biological, and cultural areas for education, scientific, and public enjoyment purposes (LRMP, p. 4-183).

No salvage activity is proposed within this management allocation.

Metolius Wild and Scenic River – Management Area 28 (approximately 376 acres; 2% of the project area)

Goal: To protect and enhance those outstandingly remarkable values that qualified segments of the Metolius River for inclusion in the National Wild and Scenic Rivers System. (LRMP, p. 4-200)

No salvage activity is proposed within this management allocation.

Management Indicator Species (MIS)

During the preparation of the Deschutes National Forest Land and Resource Management Plan (USDA 1990), a group of wildlife species were identified as management indicator species (MIS). These species were selected because their welfare could be used as an indicator of other species dependent upon similar habitat conditions. Indicator species can be used to assess the impacts of management actions on a wide range of other wildlife with similar habitat requirements. These species are not assigned Management Areas. Rather, Standards and Guidelines are applicable Forest-wide. The species selected for the Deschutes National Forest are listed in Chapter 3, in the Wildlife section, under MIS.

Northwest Forest Plan

In 1994, the Record of Decision for Amendments to the Forest Service and Bureau of Land Management Planning Documents within the Range of the Northern Spotted Owl (Northwest Forest Plan) amended the Deschutes National Forest Land and Resource Management Plan. Some of the project area became Late Successional reserve under the Northwest Forest Plan (*Figure 1.7-1, page 21*). The following Land Allocations occur within the project area.

Late Successional Reserve

(approximately 5,096 acres, 29% of the project area)

The objective of Late Successional Reserves is to protect and enhance conditions of late-successional and old-growth forest ecosystems, which serve as habitat for late-successional and old-growth related species including the northern spotted owl (NWFP, p. C-9). Standards and guidelines for LSRs include guidelines for salvage, which is defined as “removal of trees from an area following a stand replacement event” (NWFP, p. C-13). The Metolius Late Successional Reserve covers approximately 76,000 acres (*Map 10*, beginning on *pg. 70* of this document). An LSR Assessment was completed in 1996.

About 29% of the fire occurred within the Metolius Late Successional Reserve (LSR), located along the northern and western portions of the fire. Approximately 39% of the LSR experienced stand-replacement fire severity.

Prior to the fire, management within the area was following objectives in the Northwest Forest Plan and the Metolius LSR Assessment. The Metolius Late Successional Reserve Assessment identifies desired conditions and management strategy for the LSR designed to protect and enhance a composition of four types of late-successional habitats (Metolius LSRA, p. 66). Within the fire area, the late-successional forest habitat was 59% mixed conifer and 41% ponderosa pine. The overall objectives are to provide a mosaic of fire-climax and climatic climax late-successional habitats within the mixed conifer type, and to move the ponderosa pine type towards fire-climax late-successional conditions. Both types are to be managed for late-successional habitat conditions in fire climax stands that allow for low intensity/severity prescribed or natural fire (Metolius LSRA, p. 65).

Matrix (approximately 3,176 acres, 18% of the project area)

This management allocation consists of federal lands outside the other categories of designated areas. Most timber harvest and other silvicultural activities would be conducted in the matrix where there is suitable forest land, according to standards and guidelines. Most scheduled timber harvest takes place in the matrix (NWFP, p. C-39).

The portion of the Eyerly Fire in the Matrix land allocation, located mostly along the southern part of the fire, had a high percentage of stand replacement fire. The Matrix portion of the fire is composed primarily of the ponderosa pine forest type.

In the fire area, Matrix lands provided some late and old forest habitat components such as dense stand conditions, and large trees. Where stand replacement fire occurred these components have been lost. However, Matrix lands that experienced mixed or low severity fire effects retain some of these habitat components.

Administratively Withdrawn (approximately 2,233 acres, 13% of the project area)

These are areas identified in current Forest and District Plans or draft plan preferred alternatives that are already being managed to provide benefit to late and old species. Management emphasis precludes scheduled timber harvest (NWFP, p. C-29). In the Eyerly project area, the Administratively Withdrawn allocation corresponds to the Metolius Wildlife/Primitive Management Area and Old Growth Management Area of the Deschutes LRMP. The majority of this area had stand replacement fire.

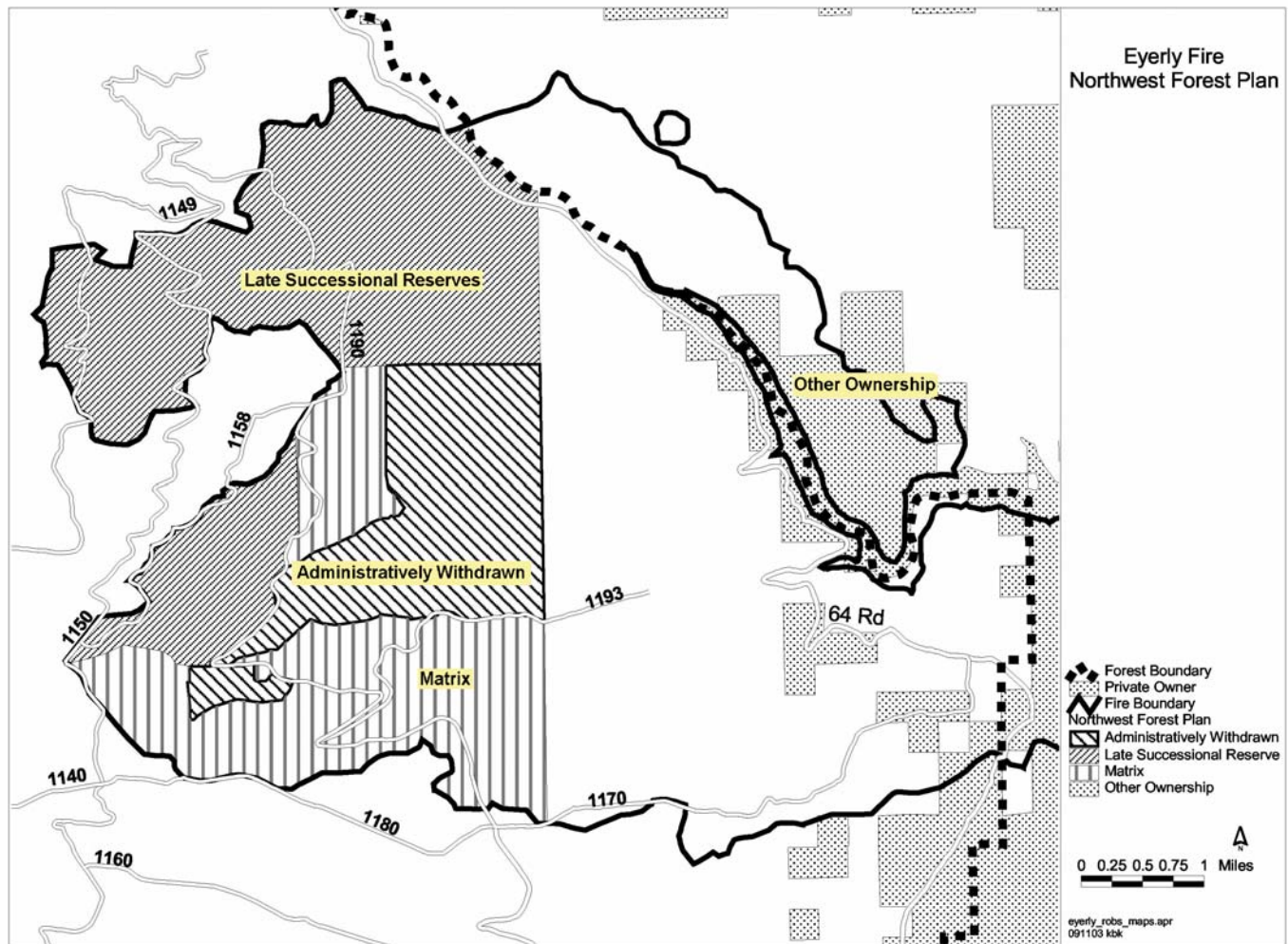
Riparian Reserve (approximately 2,638 acres, 15% of the project area)

Riparian Reserves overlap other management allocations and are one of four components of the Northwest Forest Plan's Aquatic Conservation Strategy (NWFP, p. B-12). They are portions of watersheds where riparian-dependent resources receive primary emphasis and where special standards and guidelines apply that prohibit and regulate activities that retard or prevent attainment of the Aquatic Conservation Strategy objectives.

Key Watershed (approximately 418 acres, 2% of the project area)

The Metolius Watershed is a Tier 1 Key Watershed, which contributes directly to the conservation of the threatened bull trout and resident fish populations. As another component of the Aquatic Conservation Strategy, key watersheds provide high quality habitat for at-risk stocks of resident fish species. They are refugia for maintaining and recovering habitat for these at-risk species. The key watershed designation overlaps other management allocations (NWFP, p. B-18).

Figure 1.7-1. Northwest Forest Plan Divisions



Outside the Northwest Forest Plan

Approximately 7,281 acres of the project area (41%) are outside the area covered by the Northwest Forest Plan, and fall under the direction of the Inland Native Fish Strategy (INFISH, 1995) and the Eastside Screens (1995). INFISH provides interim direction to protect habitat and populations of resident native fish, and the Eastside Screens provide direction for retention and promotion of late/old structural forest characteristics.

Stand replacement fire dominated this area due to the lower slope position, slope and dominance of dryer forest types. Several LRMP management areas are located within this portion of the fire including: Deer Habitat, Intensive Recreation, Metolius Wildlife/Primitive, Old Growth, Special Interest, and Metolius Wild and Scenic River.

Eastside Screens

The Revised Continuation of Interim Management Direction Establishing Riparian, Ecosystem, and Wildlife Standards for Timber Sales, or Eastside Screens, amended the Deschutes LRMP in 1995. It applies to the design and preparation of timber sales on eastside Forests, and is often referred to as “Regional Forester’s Forest Plan Amendment #2” or as the “Eastside Screens”. Salvage sales with incidental green volume, such as that proposed in this project are exempt from the ecosystem standard but must apply the interim riparian and wildlife standards.

Riparian Habitat Conservation Areas (RHCAs)

RHCAs are portions of watersheds that have been delineated through the Inland Native Fish Strategy (INFISH) and overlap with some of the Forest Plan Management Areas listed above. Riparian-dependent resources receive primary emphasis in these areas. In the Eyerly Fire area, RHCAs occur along perennial, intermittent, and ephemeral stream courses, and around the shore of Lake Billy Chinook.

Local Assessments

Watershed Assessment

In 1996, the Sisters Ranger District completed the Metolius Watershed Analysis. The Metolius watershed includes 8 subwatersheds and encompasses about 149,000 acres. About 418 acres within the Metolius Horn subwatershed is within the Eyerly Fire area.

The assessments present pre-fire conditions, processes, and trends that occur within the watersheds. These documents provide important background information for designing project work that will continue to move watersheds toward the desired conditions.

Since the completion of the Metolius Watershed Analysis in 1996, approximately 9 wildfires have occurred that were greater than 10 acres in size. These fires total about 82,683 acres, 55% of the watershed.

Late Successional Reserve Assessment

The Metolius LSR Assessment was prepared in 1996. The assessment is a strategic document that addresses the ecological significance of eastern Cascade disturbance regimes and the need to provide late-successional habitat conditions for species such as the northern spotted owl. The assessment identifies activities needed to: 1) reduce the risk of habitat loss from catastrophic disturbances such as fire, insects and disease, and 2) sustain late-successional habitats whether the goal is to provide fire or climatic late-successional conditions.

The LSR is divided into Management Strategy Areas (MSAs). For each MSA, existing condition, desired condition, objectives, management options, and monitoring and evaluation elements were identified.

Burned Area Emergency Rehabilitation (BAER)

Immediately following the Eyerly Fire, a Burned Area Emergency Rehabilitation (BAER) team met to evaluate threats to resources, property and human life. Values at risk included road erosion and sedimentation, spread of noxious weeds, and safety of forest users.

After conducting field surveys to identify impacts, the BAER team identified several emergency treatments that were necessary. Treatments are listed below:

- Contour felling, completed March 2003
- Weed treatment, pulling and monitoring weed populations, continuing
- Log erosion barriers, completed March 2003
- Grass seeding, completed Fall 2002
- Shrub planting, completed Spring 2004
- Channel buffer felling, completed Fall 2003.

Eyerly Fire Rapid Assessment

The information in the Watershed Analysis and Late Successional Reserve Assessment describe pre-fire conditions, though the functional relationships of most ecosystem elements remain relevant. Immediately following the Eyerly Fire, a rapid assessment was undertaken to assess the fire's effects on the landscape, provide a context for future actions to address the fire's effects, and facilitate program and budget development. General guidelines and recommendations were also provided. The assessment was used to update information contained in previous assessments and provide information about the area that was burned in 2002.

Roads Analysis

According to the Forest Service Road Management Policy published January 12, 2001, all NEPA decisions signed after January 12, 2002, which involve certain changes in the transportation system, must be informed by a Roads Analysis. A project-level Roads Analysis was completed for the Eyerly Fire area. The Roads Analysis was an interdisciplinary process that provides the decision maker information on the needs,

opportunities, and priorities for the road system. The report concluded that a sufficient transportation system can be kept in place while at the same time road closures and decommissioning can move the fire area towards LRMP standards and guidelines for road density, address concerns about habitat effectiveness since the fire, and reduce impacts to streamside habitat. These recommendations will be carried forward in a subsequent analysis.

The National Fire Plan

The purpose of the National Fire Plan is to help protect communities and natural resources, and most importantly, the lives of firefighters and the public. An overall framework for implementing fire management and forest health problems was presented in the September 2000 report *Managing Impacts of Wildfires on Communities and the Environment* (The National Fire Plan). The *Cohesive Strategy* was approved in October 2000. This report provides a strategic framework for reducing hazardous fuels buildup within priority areas such as the wildland-urban interface. The *10-Year Comprehensive Strategy* was signed August 2001. It established four goals and a set of actions for each to facilitate progress in attaining each goal. The *10-Year Comprehensive Strategy Implementation Plan* was signed in 2002 establishing a collaborative, performance based framework for achieving the goals and actions set forth in the Comprehensive Strategy. The Implementation Plan also provides a framework for measuring progress toward achieving the goals of the 10-Year Strategy.

❖ 1.8 Scoping and Public Involvement _____

❖ 1.8.1 Scoping

Scoping and public involvement are ongoing processes used to invite public participation and to obtain input on a particular proposed action. Information received during these processes are used to determine the extent of analysis needed to reach an informed decision. The Council on Environmental Quality regulations (40 CFR 1501.7) were followed to determine the scope of issues and opportunities to be addressed in the environmental analysis and to identify major concerns related to the Proposed Action. Public comment was sought through several means, including those summarized below.

❖ 1.8.2 Individuals and Agencies Contacted

Individuals and agencies contacted include identified stakeholders; elected officials; federal, state, and local agency personnel; press and media in communities affected; and others on the Sisters Ranger District mailing list. Those contacted for scoping and identified to receive a copy of this FEIS document are listed in Appendix H.

❖ 1.8.3 Public Notices

Public notices concerning the Proposed Action and project include the following:

- Fall 2002-Schedule of Projects
- Winter 2002-Schedule of Projects
- January 24, 2003-Scoping Letter
- January 28, 2003-Press Release
- March 6, 2003-Notice of Intent to Prepare an EIS, Federal Register
- December 19, 2003–Notice of Availability, DEIS, Federal Register
- December 22, 2003 –Press Release
- July 2, 2004-Notice of Availability, FEIS, Federal Register (*scheduled*)
- July 5, 2004-Press Release (*scheduled*)

❖ 1.8.4 Consultation with Affected Tribes and Agencies

As the result of scoping at a government-to-government level, the Confederated Tribes of the Warm Springs Reservation was informed, and provided comments on the proposed action. Communications with representatives of Confederated Tribes of Warm Springs Reservation continued throughout development of the project.

Coordination has occurred with federal, state, and local government officials. The U.S. Fish and Wildlife Service has been kept informed of proposed activities.

❖ 1.9 DEIS Comments/Responses _____

The Eyerly Fire Salvage DEIS was completed in December 2003, and was made available to the public the week of December 15, 2003. The 45-day review period began on December 19, 2003, the day the Notice of Availability was printed in the Federal Register. The review period ran through February 2, 2004. The DEIS was mailed to about 200 interested publics. Additional copies were given to individuals, agencies, and groups following the initial mailing. Substantive written comments were received from approximately 30 individuals, agencies and groups. These comments, with agency responses, are located in Appendix I.

❖ 1.10 Issues _____

Comments received from the public generated issues and are discussed in this document. The interdisciplinary team (IDT) reviewed and evaluated comments received from the scoping process and are incorporated as key issues. In the NEPA process, key issues are

defined as resource or other values that drive the development of an alternative, may be adversely affected by the proposed action, or involve unresolved conflicts regarding alternative uses of available resources. Key issues provide focus for the analysis and are used directly in formulation of the alternatives. Listed with each key issue are indicators to show a measurement of how each key issue is affected by proposed activities for each alternative.

In addition to key issues identified by the IDT, there are “analysis” issues addressed in the effects analysis and often used to compare alternatives. For example, heritage resources will always be addressed in actions that have site-specific ground-disturbing actions. Although alternatives may not be designed specifically to address heritage resources, the consequences of all the alternatives must be measured against compliance with direction to provide adequate protection for these resources (see Analysis Issues, this chapter).

Issues selected as key issues for this Final EIS are listed below. They are not listed in any particular order. They will be discussed in detail in the analysis and throughout the remaining chapters of this document.

❖ 1.10.1 Key Issues

The alternatives respond to the following key issues identified during scoping. The key issues are specific to the proposed action and the project area. Measures for each issue will help to evaluate how each of the alternatives address key issues.

Soils

There is concern for the effects on soils considering the proposed use of ground-based yarding systems for salvage (tractor yarding) and fuel treatment (grapple piling). Ground-based yarding systems and grapple piling may increase soils erosion, and may affect soils productivity by increasing soil compaction and displacement.

The following measures will be evaluated for each of the alternatives:

- Acres of ground-based (tractor) salvage harvest and fuels treatment (grapple piling).
- Percent of detrimental soil conditions (compaction, displacement, and severely burned areas) by activity unit.

Water

Some comments suggest that any ground disturbing activity following a fire like Eyerly should be avoided. Others suggest that some level of activity can be conducted, such as salvage harvest, without interrupting the processes of long-term ecosystem recovery.

- ▶ This issue centers on the concern that salvage harvest following a major wildfire could increase erosion and sediment delivery to streamcourses.

The following measures will be evaluated for each of the alternatives:

- Number of potentially hydrologically connected road ditches.
- Acres of proposed harvest within the sediment delivery zone.

- Proposed miles of road for timber haul within Riparian Reserves or Riparian Habitat Conservation Areas.

Fish Habitat

Bull Trout are listed as a threatened and endangered species. Fish surveys have found bull trout to inhabit Street Creek within the Eyerly Project Area.

- ▶ The effects of the proposed activities on fish habitat are of concern expressed by several comments. This key issue is strongly associated with the issues described above for soils and water.
- The effects of the alternatives on bull trout are measured by an estimate of percent increase of sediment to the Street Creek system.

Wildlife Habitat

There are two active bald eagle nests within the Eyerly Project Area. Hazard tree removal within Bald Eagle habitat is a concern. Dead trees greater than 21 inches in diameter provide potential perch sites.

The effects of the alternatives will be measured by:

- ▶ An estimate of the number of potential perch trees removed with essential bald eagle habitat.
- ▶ The current and future levels of snags and down wood habitat is a concern expressed by several commenters. There is a direct connection between the number of trees removed for salvage and those left to provide snag and down log habitat.

The following measures will be evaluated for each of the alternatives:

- Number of snags retained per acre within harvest areas.
- Level of snags provided within the entire Eyerly Fire area.
- Percent cover of down wood habitat.

❖ 1.10.2 Analysis Issues

Issues or concerns listed below (identified by the IDT Team or through the scoping process) were identified and have been tracked through the analysis. These issues did not drive alternatives. Some issues are already addressed through other processes or in the Forest Plan, some led to mitigation measures (see Design Elements in Chapter 2), and some are analyzed in Chapter 3.

Air Quality

The action alternatives include prescribed fire (i.e. underburning, jackpot burning, pile burning) activities for treating fuels related to the salvage operations. The effects of smoke on Class I and II areas, communities, residences, or recreation sites are a concern.

All prescribed burning would comply with the Clean Air Act and would be coordinated with the Oregon State Department of Environmental Quality and Oregon State Department of Forestry. All burning would be in compliance with State smoke management plans. Prescribed fires would only be ignited under prescribed conditions. Under prescribed fire conditions there is less fuel consumption, fewer emissions, and conditions for smoke dispersal are favorable.

Effects of the alternatives on air quality will be measured by the emissions expected.

Fire and Fuels

Comments were received expressing concern for the potential of heavy fuel loading which may occur as a result of salvage operations or as standing dead trees fall contributing to the potential intensity of future wildfire. Treatment of fuels resulting from the proposed salvage activity is a connected action included in the action alternatives.

Effects of the alternatives on fire and fuels will be measured by displaying the acres with surface fuels within sustainable levels and reduced hazard.

Heritage Resources

Comments were received expressing concern for the effects of the proposed salvage to Native American traditional uses and heritage resources. Alternative design includes protection for heritage resources. The effects on heritage resources and traditional uses is described in Chapter 3 of the DEIS.

Insect and Disease

Comments were received related to damage from insects and disease. Potential for insect and disease related damage and effects on forest trees is addressed in the DEIS, Chapter 3.

Noxious Weeds

Comments were received expressing concern for the effects of the proposed actions on noxious weeds. Design elements aimed at preventing the spread of noxious weeds are incorporated into the action alternatives. The effects of the alternatives on noxious weeds are described in Chapter 3 of the DEIS.

Recreation

Several comments were received in response to scoping expressing concern over proposed road management, specifically against any road closures that would reduce access for motorized recreational pursuits. Most of the comments favored road closures because of the benefits of reducing the potential for soil erosion and associated effects on water quality and fish habitat.

Road management proposed actions have been identified as a result of an interdisciplinary road analysis for the Eyerly Fire area. The road management proposal will be addressed in a separate environmental document. The proposed road management includes actions to implement road strategies identified in the road analysis for existing roads. The road management actions are intended to aid the restoration of the Eyerly Fire area and are not connected to the actions proposed in the Eyerly Fire Salvage DEIS.

The effects of the alternatives on recreation will be measured by describing changes to the recreation experience (Recreation Opportunity Spectrum – ROS).

There is concern that the proposed activities could affect recreation. The effects of the alternatives on recreation are described in Chapter 3.

Roadless and Unroaded

No salvage or connected actions are proposed within the Metolius Roadless Area. The roadless area is located on the breaks of the Metolius River and is allocated to Metolius Wildlife-Primitive Management Area 20.

Scenic Quality

There is concern for the effects of the Eyerly Fire and proposed actions on the scenic quality of the area. The Eyerly Project area does not include a Scenic View (MA-9) management area, the current allocation areas are required to meet basic Scenic Quality Objective standards and guidelines as stated in the Deschutes LRMP, including Altered Landscape with low to moderate Scenic Integrity Level ratings.

The effects of the proposed salvage and connected actions on scenic quality are described for alteration or enhancement of scenery and amount of affected area on short-term scenery within middle and foreground landscapes.

Threatened, Endangered and Sensitive (TES) Species

Several comments were received regarding the effects of the proposed action on TES species. The effects of the proposed salvage and connected actions on TES species are described in Chapter 3, in the Wildlife, Fish, and Botany Sections.

Forest Vegetation

There is a concern that natural reforestation may not be successful, and conversely, that planting may not be necessary to establish forest vegetation. This is discussed in the Forest Vegetation section of Chapter 3.

There is an issue that the future forest vegetation needs to be more resilient and sustainable and able to withstand periodic natural disturbances. This is discussed in Chapter 3 in the Forest Vegetation section. Measures include species composition, and density of the future forest.

Wildlife Habitat

There is an issue that salvage logging and fuels treatment activities could adversely affect management indicator species (MIS). Effects of the alternatives are discussed in the Wildlife section, Chapter 3.

Some populations of neotropical migratory birds are considered in decline. There is a concern that salvage logging could contribute to further population decline. This concern is addressed in the Wildlife section, Chapter 3.

❖ 1.10.3 Issues Not Addressed in Detail

Issues or concerns that were either already addressed through alternative design or mitigation, are not affected by the proposed actions, or are beyond the scope of this project. These resource areas are not discussed further in this analysis.

Range

There is currently no permitted livestock use within the Eyerly Project Area.

Wilderness

There is no designated Wilderness within or adjacent to the project area. The nearest is Mt. Jefferson Wilderness, approximately 6 miles west of the project area.

Wild and Scenic River

The Eyerly Project area includes portions of the Metolius Wild and Scenic River (MA-28). No salvage or connected actions are proposed within the wild and scenic river management area.

❖ 1.11 Decision Framework

The Responsible Official for this proposal is the Forest Supervisor of the Deschutes National Forest. Based on response to the Draft EIS and the analysis disclosed in this Final EIS, the Responsible Official will make a decision and document it in a Record of Decision (ROD), which will follow within 30 days of the Final EIS. The Responsible Official can decide to:

- Select the proposed action, or
- Select an action alternative that has been considered in detail, or
- Modify an action alternative, or
- Select the no-action alternative.

Alternatives 2 and 3 will require a non-significant amendment to the Deschutes Forest Plan related to the relocation of old growth (see *Map 5*, beginning on *pg. 70*). The

Responsible Official will also determine if the selected alternative is consistent with the Forest Plan, as amended, or whether to amend the Forest Plan.

❖ 1.12 Project Record

This EIS incorporates by reference the Project Record (40 CFR 1502.21). The Project Record contains specialist reports and other technical documentation used to support the analysis and conclusions of this EIS. These specialist reports are for Soils, Water, Fisheries, Wildlife, Vegetation, Fire and Fuels, Botany, Heritage, Recreation, Roads/Access, and Socio-Economics.

Incorporating these specialist reports and the Project Record helps implement the CEQ Regulations' provision that agencies should reduce NEPA paperwork (40 CFR 1500.4), that EIS's shall be "analytic rather than encyclopedic" and that EIS's "shall be kept concise and no longer than absolutely necessary" (40CFR 1502.2). The objective is to furnish enough site-specific information to demonstrate a reasoned consideration of the environmental impacts of the alternatives and how these impacts can be mitigated, without repeating detailed analysis and background information available elsewhere. The Project Record is available for review at the Sisters Ranger District Office, Pine Street and Highway 20, *PO Box 249*, Sisters, Oregon, Monday through Friday, 8 a.m. to 4 p.m.

2.0 ALTERNATIVES, INCLUDING THE PROPOSED ACTION

❖ 2.1 Introduction

Chapter 2 describes the proposed action and alternatives to the proposed action, including a no action alternative. This chapter also describes how the alternatives were generated, reviewed, and either eliminated from detailed study or considered in detail. Measures necessary to mitigate environmental effects (design elements) and monitoring are described for the alternatives. Alternatives proposed by the Interdisciplinary (ID) Team and generated through the public scoping process are discussed. This chapter also includes a comparison of the alternatives. Mileage and acreage figures used throughout this document are approximate figures.

The Eyerly Fire Salvage Project FEIS incorporates information and relies on direction provided by the Deschutes LRMP, as amended. All alternatives are designed to adhere to State and Federal laws and regulations.

This chapter is divided into the following sections.

- Changes made between Draft and Final EIS
- Development of Alternatives
- Alternatives Considered but Eliminated from Detailed Study
- Alternatives Considered in Detail
- Design Elements (Mitigation Measures)
- Monitoring
- Comparison of Alternatives

Affected environment and environmental consequences of implementing alternatives for the Eyerly Fire Salvage Project area can be found in Chapter 3. The analysis file is referenced throughout this document and contains additional documentation and analysis.

❖ 2.2 Changes Between Draft and Final EIS

The following changes were made between the Draft and Final EIS. This listing does not include correction, explanations, or edits to grammar and spelling. Some of the changes resulted from comments made to the DEIS.

7. Only dead trees would be salvage harvested within the Metolius LSR.
8. Two units were dropped from Alternative 2. Units number 66 and 125, identified in the Draft EIS, totaling 31 acres have been dropped from Alternative 2.
9. The amount of temporary road needed to access salvage areas has been reduced from 3 miles to 2.1 miles for Alternative 2.
10. Reforestation acres have been revised for both Alternatives 2 and 3 based on field verification. Revised acres for tree planting are shown in the alternative descriptions.
11. The amount of helicopter logging has been increased in Alternative 2 based on field review.
12. In response to public comment and additional field review 3.8 miles of road decommissioning is included in Alternatives 2 and 3. Five roads are proposed and are listed in the alternative description section. These roads are located within the sediment transport zone of adjacent streamcourses. Decommissioning of these roads is included to mitigate the potential for sediment delivery and to foster recovery of riparian vegetation.

❖ 2.3 Development of Alternatives

The process used in developing the alternatives began with a review of the purpose of and need for action by the ID Team and District Ranger. The ID Team also considered the Metolius Watershed Analysis, Metolius Late Successional Reserve Assessment, Eyerly Burned Area Emergency Rehabilitation (BAER) report, Eyerly Fire Rehab Implementation Plan, comments received during the scoping process and in response to the DEIS, the Beschta Report (Beschta 1995) and the applicable direction in the Forest Plan.

Three alternatives are analyzed in detail. All action alternatives meet, to varying degrees, the purpose of and need for action section of Chapter 1 (*Section 1.6*):

- Recover the economic value of the fire-killed and damaged trees expected to die,
- Reduce future fuel loadings to be consistent with management direction,
- Accelerate the establishment of upland forest vegetation,
- Reduce hazards associated with danger trees along major roads, and
- Designate substitute old growth areas that were burned in the Eyerly Fire.

The action alternatives respond to one or more of the key issues.

One of the goals in developing the action alternatives for this Final EIS was to ensure that each option was “technically and physically feasible,” as well as reasonable as specified by 40 CFR 1502.14. The alternatives developed should provide the Forest Service decision-maker and the public with a range of reasonable options to consider. The following questions describe guidance from the District Ranger to be considered by the ID team during the alternative development process.

- ▶ Do the action alternatives meet the purposes and needs described in Chapter 1?
- ▶ Do the action alternatives conform to the time restrictions anticipated for timber harvest given the expected deterioration of the timber resource after the fire?
- ▶ Can the action alternatives be implemented with little or no new road construction while fully utilizing the existing Forest road system within the Eyerly Fire burned area?
- ▶ Do the alternatives protect soils, water quality, fish, and wildlife habitat while allowing for economic recovery of the timber resource?
- ▶ Are the action alternatives technically feasible?
- ▶ Would the alternatives, while meeting the purpose and need of the action, result in a low level of environmental degradation?
- ▶ Do the alternatives interfere with any rights or obligations of the Forest Service or other Government agencies under their legal and regulatory jurisdiction?

❖ 2.4 Alternatives Considered but Eliminated from Detailed Study

An alternative was considered that included broader application of salvage and fuel treatment activities. In the case of fuels treatments, much of the increased area that would have been treated under this alternative would not have resulted in any timber material produced, and as such would not have met the purpose and need to salvage timber and provide products to the economy, nor would it provide for accelerated development of LSR late and old structure conditions.

The interdisciplinary team also considered an alternative that would have included salvage of burnt timber within the Metolius Roadless Area. This would have provided an estimated additional volume of 5 million board feet (MMBF). Due to steep slopes and erodible soils, salvage within this area would have required helicopter logging. This area could not have been harvested economically, helicopter logging would result in a net loss to the government, and hence was dropped from detailed analysis.

Some comments were received that expressed a desire for a “restoration only” alternative to be considered. A restoration only alternative would not have met the purpose and need to recover economic value of fire-killed and damaged trees. Additionally, the salvage activities proposed in this FEIS are part of a larger effort aimed at restoration of the resource conditions and economic recovery within the Eyerly Fire Salvage area. Several restoration projects are being considered, reference Chapter 1. These restoration projects are not connected to the salvage proposal, and will be documented in separate environmental analyses. The selection of the No Action alternative would result in no salvage or connected actions being implemented, while the separate environmental analyses for other restoration projects could proceed unaffected.

❖ 2.5 Alternatives Considered in Detail

Alternatives were developed and analyzed in response to the purpose and need of the proposed action. Additionally, they address social and environmental issues, respond to public and agency concerns and input, and satisfy regulations of the National Environmental Policy Act (NEPA). The NEPA process requires the Forest Service to consider a range of reasonable alternatives, which may include a multitude of options.

Under the action alternatives, harvest would take place within designated units, subject to legal, safety, and environmental stipulations established by the Forest Service. Each of the action alternatives (2 and 3) would, by design, subject to these conditions (outlined in *section 2.9 Project Design Elements*). All harvest units offered for competitive sale would be bound by the provisions of the standard Forest Service timber sale contract and additional clauses used to implement mitigation measures selected by the decision maker.

Table 2.11-1, Comparison of Eyerly Salvage Alternatives (pg. 66), presents a comparison of the various components of all alternatives. The locations of the units proposed for timber harvest are displayed (beginning on *pg. 70*) on *Map 1, Alternative 2 Proposed Timber Harvest*, and *Map 2, Alternative 3 Proposed Timber Harvest*. Locations of units being proposed for fuels treatment are displayed in *Map 3, Alternative 2 Proposed Fuels Treatment*, and *Map 4, Alternative 3 Proposed Fuels Treatment*. The layout of numbered salvage units are displayed on *Map 6, Proposed Salvage Units*.

Within each designated harvest and treatment unit, practices would be carried out as detailed in *section 2.9 Project Design Elements*.

A description of the alternatives analyzed in detail is presented in the discussion that follows.

❖ 2.6 Alternative 1 – No Action

Objective

The purpose of this alternative is to allow current processes to continue, along with associated risks and benefits.

The “No Action” alternative is required by NEPA. In this document the “no action” alternative means the proposed project (which includes all activities identified in the proposed action) would not take place in the Eyerly project area at this time. Alternative 1 is designed to represent the existing condition. It serves as a baseline to compare and describe the differences and effects between taking no action and implementing action alternatives.

Under the No Action Alternative, current management plans would continue to guide management of the project area. Activities such as motorized access travel management, road maintenance, dispersed recreation, noxious weed management, and fire protection would be allowed to continue as they currently take place in the project area. Separate resource recovery projects (*section 1.4, pg. 6*) would not be affected with the selection of this (or any other) alternative.

Salvage Harvest/ Fuels Treatment

No salvage or fuels treatment activities would be implemented to accomplish project goals to recover economic value of the dead and dying trees or reduce future fuel loading.

Forest Vegetation

There would be no planting under this alternative. For the purpose of comparison of alternatives, this alternative would analyze the effect of natural regeneration as a baseline condition.

Hazard Trees

Trees that pose a hazard to public safety on open roads and in recreation areas would continue to be monitored and felled when identified as a hazard. Utilization of felled trees for commercial use would not occur under this alternative.

Substitute Old Growth

Alternative 1 would not identify substitute Old Growth areas.

❖ 2.7 Alternative 2 – Proposed Action

Objective

This alternative was designed to meet the District Ranger guidance and purpose and need. Proposed activities were designed to emphasize capturing the economic value of fire-killed and damaged trees and reducing fuel loading within treated units. Alternative 2 also provides for accelerating the establishment of upland forest vegetation through tree planting, reduces hazards associated with danger trees along major roads and designates substitute old growth areas. *Maps 1, 1a, and 2* at the end of this chapter, beginning on *page 70*, display proposed timber harvest and proposed fuels treatments.

Salvage Harvest

Alternative 2 is the proposed action. Salvage was considered in all stand replacement stands and mixed severity stands (reference *Map 6*, beginning on *pg. 70*). This alternative would salvage most of the most economically feasible dead stands outside of the roadless area and riparian reserves, and treat dead small diameter stands to meet desired future conditions for fuels and fire management.

With the implementation of Alternative 2, salvage would remove dead or severely damaged trees on approximately 4,846 acres. Minimum diameter of salvage trees would generally be 12 inches for all species. The marking guide outlined in *section 2.8 Design Elements: Damaged Tree Criteria (Section 2.9.6, pg. 56)* would be used to determine trees

expected to die as a result of the fire, insect, or drought stress. Severely damaged trees would be removed if they meet one or more of the criteria. Utilization of small diameter products --such as posts, rails, house logs, chips, or firewood-- would occur on 552 of the 4,846 acres proposed. An estimated total volume of 23.3 million board feet (MMBF) from dead and damaged trees would be harvested under this alternative (*Table 2.7-3*).

Within the Metolius LSR only dead trees (trees with no green needles) would be salvaged.

No salvage would occur in the Metolius Roadless Area.

No salvage or small diameter utilization activity would occur within Riparian Reserves or Riparian Habitat Conservation Areas (RHCA). Salvage activity would be prohibited in association with stream courses as shown below:

- Fish-bearing streams: 320 feet slope distance each side of stream channel
- Permanently flowing nonfish-bearing stream: 160 feet slope distance each side of stream channel.
- Seasonally flowing or intermittent streams: 160 feet slope distance each side of stream channel.

The design of this alternative relating to salvage activity and riparian areas as noted above is not a change in the interim riparian reserve or RHCA widths. This relates to the design of this project only.

Skyline corridors or tail trees may occur within riparian reserves or RHCA's. Trees within these areas which may need to be felled for skyline corridors or tail holds for skyline yarding would be left on-site.

Activity areas where detrimental soil conditions exceed 20% of the area would receive subsoiling utilizing a winged subsoiler. Approximately 116 unit acres would require subsoiling to meet appropriate Forest Plan Standards and Guides.

Table 2.7-1. Alternative 2 Salvage Acres by NWFP Allocation

NWFP Allocation	Acres	Acres Salvaged Alt. 2	Percent of Area Salvaged
Admin. Withdrawn	2233	619	27.7%
Late Successional Res.	5096	1426	28.0%
Matrix	3176	1644	51.8%
Non-NWFP	7281	1157	15.9%
Total	17786	4846	27.2%

Table 2.7-2. Alternative 2 Salvage Acres by LRMP Management Area

LRMP Man. Area	Acres	Acres Salvaged Alt. 2	Percent of Area Salvaged
Deer Habitat	5353	1934	36.1%
General Forest	4293	1805	42.1%
Intensive Recreation	358	0	0.0%
Metolius Wildlife/Primitive	6993	977	14.0%
Old Growth	354	130	36.9%
Other Ownership	16	0	0.0%
Special Interest Area	43	0	0.0%
Metolius River Scenic Seg.	376	0	0.0%
Total	17786	4846	27.2%

Table 2.7-3. Alternative 2 Logging Systems by Acres and Volume

Logging System	Prescription	Alt. 2 Acres	Alt. 2 Volume (MBF)
Cable	Salvage-Mixed Severity	28	70
Cable	Salvage-Stand Replacement	175	795
Cable	Special Forest Prod. Salvage-Stand Repl.	86	0
Summary: Cable		290	865
Ground Based	Salvage-Mixed Severity	184	581
Ground Based	Salvage-Stand Replacement	2933	14254
Ground Based	Special Forest Prod. Salvage-Mixed Sev.	39	0
Ground Based	Special Forest Prod. Salvage-Stand Repl.	426	0
Summary: Ground Based		3583	14836
Helicopter	Salvage-Mixed Severity	26	198
Helicopter	Salvage-Stand Replacement	380	2870
Summary: Helicopter		406	3068
Skyline	Salvage-Mixed Severity	78	541
Skyline	Salvage-Stand Replacement	385	3084
Summary: Skyline		462	3625
Skyline w/Temp. Road Constr.	Salvage-Mixed Severity	61	539
Skyline w/Temp. Road Constr.	Salvage-Stand Replacement	45	392
Summary: Skyline w/Temp. Road Constr.		106	931
Grand Totals		4846	23324

Table 2.7-4. Alternative 2 Salvage Acres by NWFP Allocation and LRMP Management Area

NWFP Allocation	LRMP Man. Area	Acres	Acres Salvaged Alt. 2	Percent of Area Salvaged
Admin. Withdrawn	Metolius Wildlife/Primitive	2088	490	23.5%
Admin. Withdrawn	Old Growth	145	129	89.0%
Late Successional Res.	General Forest	2749	1139	41.5%
Late Successional Res.	Metolius Wildlife/Primitive	2180	287	13.2%
Late Successional Res.	Metolius River Scenic Segment	168	0	0.0%
Matrix	Deer Habitat	1631	978	60.0%
Matrix	General Forest	1545	666	43.1%
Non-NWFP	Deer Habitat	3722	955	25.7%
Non-NWFP	Intensive Recreation	358	0	0.0%
Non-NWFP	Metolius Wildlife/Primitive	2724	200	7.3%
Non-NWFP	Old Growth	209	2	0.7%
Non-NWFP	Other Ownership	16	0	0.0%
Non-NWFP	Special Interest Area	43	0	0.0%
Non-NWFP	Metolius River Scenic Segment	208	0	0.0%
Total		17786	4846	27.2%

Hazard Trees

Trees determined to be a hazard to human life or property, according to the evaluation criteria in Harvey, Jr., Hessburg, Sr., 1992, would be felled and utilized in this alternative. Hazard trees are included in salvage operations within Perry South Campground, Monty Campground, Road 64, Road 1170, and along haul routes for the salvage operations (reference *Map 8*, beginning on *pg. 70*).

Forest Roads

Access to designated units for harvest and hauling of logs would primarily be on existing forest roads. An estimated 2.1 miles of temporary road construction would be required to access harvest units not readily accessible from existing forest roads. Existing fireline comprises one of the three miles of temporary road construction. Temporary roads would require minimal excavation, would be native surface, and would be sub-soiled after logging operations were complete.

A total of 33.4 miles of road reconstruction are included in this alternative. The reconstruction activities on existing forest system roads would include the reconditioning of the existing travel way, surface and/or resurfacing with crushed aggregate, spot surfacing, and drainage restoration.

About 3.8 miles of road decommissioning would be done under Alternative 2. The road decommissioning (road obliteration) would entail activities to return these roads to a productive condition by a combination of sub-soiling, ripping, re-contouring, and restoring drainage. The road decommissioning is included as a mitigation measure to reduce the potential for sediment delivery and to restore the function of riparian areas. Roads identified for decommissioning are: 1170800, 1170890, 1170810, 1170820, and 1170860.

Fuels Treatment

Approximately 4,846 acres of National Forest land within salvage harvest units would receive fuels treatment (as outlined in *Table 2.7-5*). Slash generated during the harvest of merchantable trees, as well as fuels from small trees would be treated. Reference *Map 1* at the end of this chapter.

Table 2.7-5. Alternative 2 Fuels Treatment

Fuel Treatments Within Salvage Units	Acres
Lop and Scatter	1877
Grapple Piling and Burning	2051
Underburning/Jackpot Burning	608
Hand Piling and Burning	310
Total	4846

Reforestation

Alternative 2 would reforest 3,918 acres primarily where stand replacement burn severity occurred.

The objectives of conifer planting are to more quickly establish tree cover for species needing it, i.e. goshawks, spotted owls, and deer and elk. This would involve planting at a wide spacing (12 by 12 feet, or about 300 trees per acre) and using big game repellents as necessary. These sites are estimated to be about 80 percent plantable, so the actual number of trees planted would be about 240-250 per acre. Control of gophers is not expected to be necessary. Much of the Eyerly area is characterized as harsh sites with droughty soils and seedling survival is estimated to be relatively low at 50 – 60 %. It is expected that planting at this density would eliminate the need for precommercial thinning, and leave about 100-150 trees per acre averaging around 14 in. diameter at age 80.

Alternative 2 proposes about 1,426 acres of reforestation treatments in LSR with a diversity of species including ponderosa pine, Douglas-fir, western larch, and sugar pine. Reforestation includes site preparation in the form of scalping sufficient to clear duff and litter from the plating site, about 12” by 12”.

Snags and Down Wood

Alternative 2 includes design elements to leave snags consistent with levels described in the Metolius LSRA. These snag levels would apply to areas within and outside of the Metolius LSRA. Snag levels are shown in *Table 2.7-6*. Snags would be left at levels shown in the table based on whether the area is identified as Ponderosa Pine or Mixed Conifer Plant Association Groups (PAG).

Table 2.7-6. Post-salvage snag retention for Alternative 2

Size Class (diameter in inches)	Metolius LSRA Snag Level (Snags per Acre)			
	Mixed Conifer Wet	Mixed Conifer Dry	Ponderosa Pine Wet	Ponderosa Pine Dry
10 – 14.9”	1.92	1.04	0.96	0
15 – 19.9”	3.0	1.07	1.04	0.74
20 – 24.9”	3.0	1.07	1.04	0.74
25+ “	5.0	3.33	1.33	1.0
Total	12.92	6.51	4.37	2.48

Snags would be left individually and in clumps based on the patch size and home range requirements of the Lewis’ Woodpecker, which is 15 acres.

Table 2.7-7 Metolius LSRA down wood

PAG	LSRA Down Wood in tons per acre
MCW (Climatic)	25 – 35 tons/ac
MCD (Fire Climax)	8 – 12 tons/ac
PPW (Fire Climax)	6 – 10 tons/ac
PPD (Fire Climax)	5 – 8 tons/ac
Note: Bold numbers indicate tons per acre that will be met as standards and guidelines for the LSR.	

Down wood levels retained in Alternative 2 within the Metolius LSR are shown in Table 2.7-7.

For all units not in the LSR allocation leave a minimum of 120 linear feet of logs per acre greater than or equal to 16” in diameter and 16 feet long should be retained in regeneration units. Down wood should represent the species composition of the stand. Decay class 1 and 2 logs can be counted toward this total (ROD C-40).

Down woody material already on the ground would be retained and protected to the greatest extent possible from disturbance during treatment (e.g. fuels treatments and yarding) which might otherwise destroy the integrity of the substrate (NWFP ROD C-40).

Old Growth

The Deschutes Forest Plan requires the relocation of designated old growth areas when existing old growth is impacted by wildfire. There are two old growth areas affected within the Eyerly Fire Area (*Map 5*, beginning on *pg. 70*). These old growth areas were burned at sufficient intensity so that the areas no longer provide old growth habitat. This alternative would relocate these old growth areas to areas which currently provide old growth habitat. The relocation of the designated old growth areas would be a non-significant forest amendment to the Deschutes National Forest Land and Resource Management Plan.

There are two existing areas allocated to the old growth management area located within the Eyerly Fire area. The first old growth area is predominantly ponderosa pine (Dry) plant association group and estimated at 208 acres in size. The proposed replacement area is also dominated by the ponderosa pine (Dry) plant association group and is about 238 acres.

The second existing old growth area is comprised primarily of the mixed conifer (Wet and Dry) plant association group and is about 145 acres in size. The proposed replacement area is mixed conifer plant association group (Wet and Dry) and is about 183 acres.

Location of existing and proposed old growth areas is displayed on *Map 5* at the end of Chapter 2, beginning on *page 70*.

❖ 2.8 Alternative 3

Objective

Proposed activities in this alternative were designed in part to address the Soils, Water, and Fish Habitat key issues. Proposed activities emphasize reduced area of disturbance from post-fire activities within subwatersheds to limit effects on watershed health, while also promoting vegetative recovery within the fire perimeter to intercept rainfall and reduce overland flow magnitudes. The emphasis on reducing post-fire disturbance to resources would result in fewer units receiving salvage harvest and fuels treatment. The alternative maps (*Maps 3-4*, beginning on *page 70*) display the proposed salvage harvest and fuels treatments for Alternative 3.

Salvage Harvest

Salvage would remove dead or severely damaged trees with the implementation of this alternative, but on a more limited scale than Alternative 2 – 10.9 million board feet (MMBF) on approximately 2,893 acres. Reference *Table 2.8-3. Map 3- Alternative 3 Salvage Harvest Map* (beginning on pg. 70) is located at the end of Chapter 2. Utilization of small diameter products -- such as posts, rails, house logs, chips, or firewood -- would occur on 361 of the proposed 2,893 acres. All of the small diameter products units would be designated for ground based logging systems. No salvage or fuels treatment would occur in mixed severity stands under this alternative. No salvage would occur in the Metolius Roadless Area. Only dead trees would be salvaged within the Metolius LSR.

Table 2.8-1. Alternative 3 Salvage Acres by NWFP Allocation

NWFP Allocation	Acres	Acres Salvaged Alt. 3	Percent of Area Salvaged
Admin. Withdrawn	2233	270	12.1%
Late Successional Res.	5096	1049	20.6%
Matrix	3176	959	30.2%
Non-NWFP	7281	615	8.4%
Total	17786	2893	16.3%

Table 2.8-2. Alternative 3 Salvage Acres by LRMP Management Area

LRMP Man. Area	Acres	Acres Salvaged Alt. 3	Percent of Area Salvaged
No Data	3	0	0.0%
Deer Habitat	5353	1202	22.5%
General Forest	4292	1209	28.2%
Intensive Recreation	358	0	0.0%
Metolius Wildlife/Primitive	6993	372	5.3%
Old Growth	354	110	31.0%
Other Ownership	16	0	0.0%
Special Interest Area	43	0	0.0%
Metolius River Scenic Seg.	376	0	0.0%
Total	17786	2893	16.3%

Table 2.8-3. Alternative 3 Logging Systems by Acres and Volume

Logging System	Prescription	Alt. 3 Acres	Alt. 3 Volume (MBF)
Cable	Salvage-Stand Replacement	80	312
Ground Based	Salvage-Stand Replacement	1768	6638
Ground Based	Special Forest Prod. Salvage-Stand Repl.	361	369
Summary: Ground Based		2129	7007
Helicopter	Salvage-Stand Replacement	262	1262
Skyline	Salvage-Stand Replacement	227	1467
Skyline w/Temp. Road Constr.	Salvage-Stand Replacement	194	880
Grand Totals		2893	10929

Table 2.8-4. Alternative 3 Salvage Acres by NWFP Allocation and LRMP Management Area

NWFP Allocation	LRMP Man. Area	Acres	Acres Salvaged Alt. 3	Percent of Area Salvaged
Admin. Withdrawn	Metolius Wildlife/Primitive	2088	161	7.7%
Admin. Withdrawn	Old Growth	145	108	74.7%
Late Successional Res.	No Data	1	0	0.0%
Late Successional Res.	General Forest	2747	839	30.5%
Late Successional Res.	Metolius Wildlife/Primitive	2180	211	9.7%
Late Successional Res.	Metolius River Scenic Seg.	168	0	0.0%
Matrix	Deer Habitat	1631	589	36.1%
Matrix	General Forest	1545	370	24.0%
Non-NWFP	No Data	2	0	0.0%
Non-NWFP	Deer Habitat	3722	613	16.5%
Non-NWFP	Intensive Recreation	358	0	0.0%
Non-NWFP	Metolius Wildlife/Primitive	2724	0	0.0%
Non-NWFP	Old Growth	209	1	0.7%
Non-NWFP	Other Ownership	16	0	0.0%
Non-NWFP	Special Interest Area	43	0	0.0%
Non-NWFP	Metolius River Scenic Seg.	208	0	0.0%
Total		17786	2893	16.3%

No salvage or small diameter utilization activity would occur within Riparian Reserves or Riparian Habitat Conservation Areas. Riparian Reserves and Riparian Habitat Conservation Areas would be avoided as follows:

- Fish-bearing streams: 320 feet slope distance each side of stream channel
- Permanently flowing nonfish-bearing stream: 320 feet slope distance each side of stream channel (including all mainstems of Spring Creek and Street Creek).
- Seasonally flowing or intermittent streams: 200 feet slope distance each side of stream channel.

The design of this alternative relating to salvage activity and riparian areas as noted above is not a change in the interim riparian reserve or RHCA widths. This relates to the design of this project only.

Skyline corridors or tail trees may occur within riparian reserves or RHCA's. Trees within these areas which may need to be felled for skyline corridors or tail holds for skyline yarding would be left on-site.

Activity areas where detrimental soil conditions exceeded 20% of the area would receive subsoiling utilizing a winged subsoiler. An estimated 47 unit acres would require subsoiling to meet appropriate Forest Plan Standards and Guides.

Hazard Trees

Trees determined to be a hazard to human life or property, according to evaluation criteria in Harvey, Jr., Hessburg, Sr., 1992, would be felled and utilized in this alternative. Hazard trees are included in salvage operations within Perry South Campground, Monty Campground, Road 64, Road 1170, and along haul routes for the salvage operations. (reference *Map 8*, beginning on *pg. 70*).

Forest Roads

Access to designated units for harvest and hauling of logs would primarily be on existing forest roads. An estimated 1 mile of temporary road construction would be required to access harvest units not readily accessible from existing forest roads. Temporary roads would require minimal excavation, would be native surface, and would be sub-soiled after logging operations were complete.

A total of 33.4 miles of road reconstruction are included in this alternative. The reconstruction activities on existing forest system roads would include the reconditioning of the existing travel way, surface and/or resurfacing with crushed aggregate, spot surfacing, and drainage restoration.

About 3.8 miles of road decommissioning would be done under Alternative 3. The road decommissioning (road obliteration) would entail activities to return these roads to a productive condition by a combination of sub-soiling, ripping, re-contouring, and restoring drainage. The road decommissioning is included as a mitigation measure to reduce the potential for sediment delivery and to restore the function of riparian areas. Roads identified for decommissioning are: 1170800, 1170810, 1170820, 1170860, and 1170890.

Fuels Treatment

With the implementation of Alternative 3, approximately 2,893 acres are proposed to receive fuels treatment (*Table 2.8-5*). Slash generated during the harvest of merchantable trees and fuels from small trees would be treated.

Table 2.8-5. Alternative 3 Fuels Treatment

Fuel Treatments Within Salvage Units	Acres
Lop and Scatter	785
Grapple Piling and Burning	1524
Underburning/Jackpot Burning	405
Hand Piling and Burning	179
Total	2893

Reforestation

Alternative 3 would reforest 2,532 acres primarily within where stand replacement burn severity occurred.

The objectives of conifer planting are to more quickly establish tree cover for species needing it, i.e. goshawks, spotted owls, and deer and elk, on about 2,500 acres of the fire area. This would involve planting at a wide spacing (12 by 12 feet, or about 300 trees per acre) and using big game repellents as necessary. These sites are estimated to be about 80 percent plantable, so the actual number of trees planted would be about 240-250 per acre. Control of gophers is not expected to be necessary. Much of the Eyerly area is characterized as harsh sites with droughty soils and seedling survival is estimated to be relatively low at 50 – 60 %. It is expected that planting at this density would eliminate the need for precommercial thinning, and leave about 100-150 trees per acre averaging around 14 in. diameter at age 80.

Alternative 3 proposes about 1,049 acres of reforestation treatments in LSR with a diversity of species including ponderosa pine, Douglas-fir, western larch, and sugar pine. Reforestation includes site preparation in the form of scalping sufficient to clear duff and litter from the plating site, about 12” by 12”.

Snags and Down Wood

Alternative 3 includes design elements to leave snags at a higher level than that described in the Forest Plan. Snag and green tree replacements would be left at levels shown in *Table 2.8-6* where snags exist at or above these levels. Based on analysis of habitat of the Lewis’ Woodpecker Forest (LEWO), these snag and green tree replacement levels represent a moderate level (50% tolerance level) of habitat assurance. Snags would be left at levels shown in the table according to whether the area is identified as Ponderosa Pine or Mixed Conifer Plant Association Groups (PAG).

Table 2.8-6. Post-salvage snag numbers Alternative 3

Size Class (Inches in diameter)	Snags needed to meet 30% TL for LEWO while meeting Forest Plan Std. (Snags per Acre)				Snags needed to meet 50% TL for LEWO while meeting Forest Plan Std. (Snags per Acre)			
	Mixed Conifer Wet	Mixed Conifer Dry	Ponderosa Pine Wet	Ponderosa Pine Dry	Mixed Conifer Wet	Mixed Conifer Dry	Ponderosa Pine Wet	Ponderosa Pine Dry
10 – 14.9”	1.9	2.5	3.5	3.5	7.8	9.3	9.3	8.9
15 – 19.9”	3.0	2.6	3.6	4.3	8.9	9.4	9.4	9.7
20 – 24.9”	3.0	1.1	1.0	0.7	3.0	2.0	3.0	3.0
25+ “	5.0	3.3	1.3	1.0	5.0	4.2	3.3	3.3
Total	12.9	9.5	9.5	9.5	24.8	24.8	24.8	24.8

Snags would be left individually and in clumps based on the patch size and home range requirements of the Lewis’ Woodpecker, which is 15 acres. Based on analysis of habitat of the Lewis’ Woodpecker using the DECaId tool, snag and green tree replacement levels represent a moderate level (varying between 30% and 50% tolerance level) of habitat assurance.

Table 2.8-7 Metolius LSRA down wood

PAG	LSRA Down Wood in tons per acre
MCW (Climatic)	25 – 35 tons/ac
MCD (Fire Climax)	8 – 12 tons/ac
PPW (Fire Climax)	6 – 10 tons/ac
PPD (Fire Climax)	5 – 8 tons/ac
Note: Bold numbers indicate tons per acre that will be met as standards and guidelines for the LSR.	

Down wood levels retained in Alternative 3 within the Metolius LSR are shown in *Table 2.8-7*.

For all units not in the LSR allocation leave a minimum of 120 linear feet of logs per acre greater than or equal to 16” in diameter and 16 feet long should be retained in regeneration units. Down wood should represent the species composition of the stand. Decay class 1 and 2 logs can be counted toward this total (ROD C-40).

Down woody material already on the ground would be retained and protected to the greatest extent possible from disturbance during treatment (e.g. fuels treatments and yarding) which might otherwise destroy the integrity of the substrate (NWFP ROD C-40).

Old Growth

The Deschutes Forest Plan requires the relocation of designated old growth areas when existing old growth is impacted by wildfire. There are two old growth areas affected within the Eyerly Fire Area. These old growth areas were burned at sufficient intensity so that the areas no longer provide old growth habitat. This alternative would relocate these old growth areas to areas which currently provide old growth habitat. The relocation of the designated old growth areas would be a non-significant forest amendment to both Deschutes National Forest Land and Resource Management Plan and Northwest Forest Plan.

There are two existing areas allocated to the old growth management area located within the Eyerly Fire area. The first old growth area is predominantly ponderosa pine (Dry) plant association group and estimated at 208 acres in size. The proposed replacement area is also dominated by the ponderosa pine (Dry) plant association group and is about 238 acres.

The second existing old growth area is comprised primarily of the mixed conifer (Wet and Dry) plant association group and is about 145 acres in size. The proposed replacement area is mixed conifer plant association group (Wet and Dry) and is about 183 acres.

Location of existing and proposed old growth areas is displayed on *Map 5* (map file begins on *pg. 70*) at the end of Chapter 2.

❖ 2.9 Project Design Elements

Elements and features of the action alternatives (2 and 3) are similar. They are described here to avoid repetition. Design elements are intended to meet standards and guidelines set forth in the Deschutes Forest Plan (as amended), and for protection of water quality in the State of Oregon through planning, application and monitoring of Best Management Practices.

The Forest Service would require that Best Management Practices (BMPs) and mitigation measures be used to minimize possible adverse effects associated with timber salvage operations. *Appendix D, Best Management Practices*, outlines Forest Service standard practices which would be followed during timber salvage operations to minimize or avoid adverse impacts to the environment.

Implementation of Design Elements, BMPs and mitigation measures would be the responsibility of the Forest Service and those companies contracted to conduct salvage operations. Enforcement of BMPs and mitigation measures would be within the jurisdiction of the Forest Service and other government agencies issuing permits and approvals for timber salvage activities. Mitigation measures and design elements were developed to target specific resource needs. It is anticipated that BMPs would have a moderate to high degree of effectiveness relative to reducing adverse impacts.

Application of appropriate Best Management Practices (BMPs) would be included in Alternatives 2 and 3 for all ground-disturbing management activities as described in General Water Quality Best Management Practices (Pacific Northwest Region, 1988). These BMPs are tiered to the Soil and Water Conservation Practices (SWCP) Handbook (FSH 2509.22), which contains conservation practices that have proven effective in protecting and maintaining soil and water resource values. The Deschutes Forest Plan states that BMPs will be selected and incorporated into project plans in accordance with the Clean Water Act for protection of waters of the State of Oregon (Forest Plan 4-69). Specific BMPs commonly used to minimize the effects of road systems, fuels and timber management activities on soil and water resources are described for this project proposal.

❖ 2.9.1 Project Design Elements for Soils

- Use harvest methods designed to lessen impacts on the soil resource, including some or all of the following: 1) use existing logging facilities or designate locations for new skid trails and landings; 2) restrict skidders to trails and limit off trail travel of other harvest equipment to two or fewer round trips; 3) use of ground-based mechanized equipment on portions of units with slopes greater than 30 percent, would require additional requirements for ground-based operations such as winch lining, to reduce impacts to soils; 4) Hand-fell and Skyline or Helicopter yard material within activity units having slopes exceeding 30% and located immediately adjacent or upslope of RHCA buffers along intermediate or perennial stream reaches. (Timber Management BMP T-5, T-9, T-12, T-13). *Moderate effectiveness.*
- In all units, skid trails and landings would be designated prior to the logging operations. Skid trails, landings and temporary roads would be rehabilitated as needed to meet the 20% Standard for detrimental conditions following salvage and fuels treatments. Maintain spacing of greater than 75 feet for all primary (main) skid trail routes, except where converging toward landings. Closer spacing of skid trails due to complex terrain is to be approved in advance by the Timber Sale Administrator. (LRMP SL-1 & SL-3; Timber Management BMP T-10, T-11, T-14 & T-16). *Moderate effectiveness.*
- Promote the harvest and yarding of merchantable material in ground-based salvage units during winter season conditions that can provide frozen ground and/or snow cover sufficient to reduce direct mechanical impacts to the soil resource.
- Use old landings and skidding networks whenever possible. Assure that water control structures are installed and maintained on skid trails that have gradients of 10 percent or more. Ensure erosion control structures are stabilized and working effectively (LRMP SL-1; Timber Management BMP T-10, T-16, T-18). *High effectiveness.*
- Where proposed ground-based unit boundaries parallel intermittent or perennial streams harvest and mechanical fuel treatments will be planned to limit grapple and mechanical yarding traffic to designated trails located to minimize disturbance within the first 75 ft. Pull line to yard material where significant gouging would occur (Timber Management BMP T-2, T-3, T-7, T-11). *High effectiveness*
- Protect Soils and Water resources by piling slash to be burned on existing areas of detrimental compaction such as skid trails or landings in order to reduce incurring additional detrimental impacts between skid trails. Promote the use of grapple piling machinery capable of operating from skid trails and landings used during harvest operations. Promote the use of hand-piling of slash located between skid trails and out of reach grapple Limit off-trail traffic of any machinery used for piling to two or fewer passes (Fuels Management BMP F-3; Timber Management BMP T 11, 13) *Moderate-high effectiveness.*
- A burn plan addressing compliance with all applicable Forest Plan standards and guidelines and Best Management Practices will be completed before the initiation of prescribed fire treatments in planned activity areas. Prescribed burn plans need to include soil moisture guidelines to minimize the risk of heat induced, adverse impacts to the soil resource from the fire (LRMP SL-1 & SL-3; Fuels Management BMP F-2, F-3).

- Strive to maintain fine organic matter (organic materials less than 3-inches in diameter; may be commonly referred to as the duff layer) over at least 65 percent of an activity area (pertains to both harvesting and post harvesting operations). The preference is for the fine organic matter to be undisturbed, but, if disturbed, it should be of sufficient quantity and quality to avoid detrimental nutrient cycle deficits (short term nutrient cycling). If the soil and site potential are not capable of producing fine organic matter over 65 percent of the area, adjust minimum amounts to reflect potential soil and vegetation capabilities (LRMP SL-6; Fuels Management BMP F-2; Timber Management BMP T-13). *Moderate effectiveness.*
- Use sale area maps for designating soil and water protections needs (Timber Management BMP T-4). *Moderate effectiveness.*
- Restrict mechanical disturbance from within narrow draw and drainage dissection locations defined by Soil Resource Inventory (SRI) map unit 10. Confine equipment impacts to designated upslope areas that can be mitigated following harvest and post-harvest activities.
- Locate designated skid trails and log landings on well-drained sites, upslope from toe and lower foot slope locations capable of contributing sediment. Restrict equipment operations to existing roads and designated logging facilities at all times. Exceptions would be subject to Forest Service approval. Hand fell merchantable material and utilize cable to yard this material to skid trails or landings located on non-sensitive soil types.
- Portions of proposed activity units 9, 15, 18, 43-47, 53, 54, and 106-108 units are within or adjacent to narrow draws or drainage dissections defined by SRI map unit 10 and have slopes capable of contributing sediment to associated intermittent or perennial stream reaches.
 - **Note:** Activity unit numbers listed above are for Alternative 2 which proposes the greatest number of acres utilizing mechanized equipment for salvage treatments and/or piling operations off of designated logging facilities. Some of these units are not included under Alternative 3.
 - **Objective:** Protect or maintain the quality of soil properties and shallow rooted vegetation by controlling equipment operations to locations and conditions that are less susceptible to soil puddling and compaction damage. Confine multiple pass equipment impacts to designated areas that can be mitigated following harvest and post-harvest activities.
- Restrict mechanical disturbance on slopes greater than 30 percent to designated areas (i.e., existing roads, landings, and skid trails) within proposed ground-based activity units at all times and require operators to winch logs to skidders. Exceptions for areas that make up less than 10 percent of an activity area would be subject to Forest Service approval. Hand felled trees shall be directionally felled toward pre-approved skid trails, and the leading end of logs shall be suspended while skidding. Assure that water control structures are installed and maintained on skid trails that have gradients of 10 percent or more. Grapple piling of slash would not be authorized off of designated areas in activity areas that contain slopes over 30 percent.
 - **Objective:** Reduce displacement and compaction damage to soils by limiting equipment operations to specified areas and ground conditions.

- Reclaim temporary roads, log landings and primary skid trails by applying appropriate rehabilitation treatments in activity areas where detrimental soil conditions are expected to exceed 20 percent of the unit area. Decommission (obliterate) logging facilities that will not be needed for future management. Proposed activity units 1-3, 5, 8, 14, 16, 21, 22, 25, 28, 41-43, 45-50, 53, 58-65, 67, 69, 70, 73, 74, 78, 80-84, 86, 89, 91, 97-99, 101, 108, 112-115, 123, 124, and 126, with areas ranging in size from 3 to 221 acres, are predicted to exceed the 20 percent limit in detrimental soil conditions following the mechanical treatments proposed with this project. Proposed activity units 13, 33, 35, 37, 39 and 68 would require temporary road construction in order to implement skyline harvest systems.
- Options for mitigating the effects of project activities include the use of subsoiling treatments to relieve compacted soils, redistributing humus-enriched topsoil in areas of soil displacement, re-contouring cut-and-fill slopes on excavated skid trails, and pulling available slash and woody materials over the treated surface to establish effective ground cover protection.
 - **Note:** Activity unit numbers listed above apply to Alternative 2, which proposes the greatest number of acres utilizing mechanized equipment for thinning and/or piling slash and natural fuels. Some of these activity units are not included under Alternative 3.

❖ 2.9.2 Project Design Elements for the Protection of Fish Habitat

Direction for the protection of fish habitat for the Eyerly project area is described in the NWFP and INFISH, biological opinions, and Deschutes Forst Plan. The provisions of interagency conservation agreements also continue to apply. Therefore, projects must contribute toward attainment of appropriate Riparian Management Objectives (RMOs), as defined in NWFP and INFISH, and be consistent with appropriate biological opinions. Projects cannot retard attainment of “properly functioning” condition of relevant indicators (as described within NOAA Fisheries and FWS matrices of pathways and indicators). No salvage or fuels treatments are proposed within Riparian Reserves (NWFP) or RHCA’s (INFISH) in Alternatives 2 and 3. Some connected actions; hazard tree removal, log haul, tail trees, or skyline corridors are located within Riparian Reserves or RHCA’s.

- **Large wood**
 1. Standing/down wood would be left on-site within Riparian Reserves or RHCAs unless health and safety and/or forest health issues require treatment to meet Aquatic Conservation Strategy or Riparian Management Objectives.
 - a. Project must not retard attainment of coarse down woody debris objectives within Riparian Reserves or RHCAs as determined by vegetation type within the immediate project site.
 - b. Project must not retard attainment of in-stream wood objectives established in watershed analysis. A portion of the Eyerly project area is within the Metolius Watershed Analysis. If a watershed analysis is not completed, the project will not retard attainment of a minimum of 20 pieces of large wood per mile that are at least 12 inches in diameter and 35 feet in length.

2. Allow hazard trees that can reasonably fall into the water body to be placed in the water body to maintain fish habitat and hydrologic function.
 - a. Hazard tree felling or placement in streams will not disturb listed fish or spawning areas. Hazard trees felled within Riparian Reserves or RHCAs would be left on-site. Hazard tree felling would avoid spawning areas.
 - b. Hazard trees within the Riparian Reserves or RHCAs that represent an opportunity for topping for wildlife needs may be retained as snags.
 - c. Hazard trees may be removed from Riparian Reserves or RHCAs if needed to allow for the normal operation of the recreation/special use site, or if a liability issue arises. Whenever possible leave large woody debris on site.
- **Water Temperature**
 1. Do not allow land management activities that lead to measurable increases in stream temperature due to the loss of shade. No activities are proposed which would reduce stream shade.
- **Sediment and Substrate**
 1. Use of ground-based machinery would be prohibited within Riparian Reserves, RHCAs. Within designated campgrounds (within Riparian Reserves or RHCAs), machinery would not leave designated roads or parking areas.
 2. No landings would be located within Riparian Reserves or RHCAs.
 3. No firelines would be constructed within Riparian Reserves or RHCAs.
 4. Ignite controlled burns outside of Riparian Reserves or RHCAs (except for hand pile burning). Fires that back into Riparian Reserves or RHCAs will be coordinated with a fish biologist. Prescribed fire will not reduce ground cover that will expose soil to erosion within Riparian Reserves or RHCAs.
 5. All hand piling and pile burning of slash in Riparian Reserves and RHCAs will occur a minimum of 50 feet from the outer edge of riparian vegetation, but the actual distance may be greater depending on surrounding slope, existing ground cover, and soil type. Placement of hand piles will focus on upslope areas outside of "washes" or depressions that may facilitate concentrations of upslope water run off (e.g., caused by heavy rain events) and hence, sediment transport to the stream. Piles would not cover more than 5% of the RHCA within the project area. Burning would occur in conditions that would not allow for creeping greater than 10 feet from the pile.
 6. Proposed temporary roads would be located outside of sediment delivery zones (as determined by soil type, ground vegetation, and slope), and would be designed for relief drainage, and would be hydrologically closed.
 7. Commercial road use, including hauling/blading, will not contribute to siltation off the road.
 8. Snow plowing will allow water/runoff to drain off road with filtration (vegetation buffer) before reaching creeks.
 9. Culvert replacements on Class III and IV streams (i.e. non-fish bearing streams) would be designed with adequate road ditch relief, cross drains, wing

wall rip-rapping to decrease sediment input both during and after construction activities.

10. Road traffic during wet periods would be controlled to prevent damage to Riparian Reserves and RHCAs.

- **Bank Stability**

There are no activities proposed which would impact streambank stability.

- **Cumulative Effects to Watershed Condition (use for either 5th or 6th field watersheds)**

1. The alternatives are designed so that there is no increase in Equivalent Clear-cut Area (ECA) in any watershed that already exceeds 25% with these indices.
2. If the open road density within a watershed exceeds 2.5 miles per square mile on the Deschutes NF do not allow project activities to increase open road densities. Project activities are designed to result in no increase in open road densities.

- **Timing of work**

1. Eliminate impacts to spawning, incubating, rearing, and migrating fish by observing seasonal operating restrictions when implementing stream channel or road maintenance work within Riparian Reserves or RHCAs.
2. Within Riparian Reserves or RHCAs, do not allow near stream or instream work that exposes soil to erosion processes from August 15 to May 15 for bull trout and from February 15 to July 15 in steelhead waters.

- **Fish Passage and Screens**

Road crossings and culverts would be designed and to maintain fish passage.

- **Water Drafting**

The following PDC should be applied to project activities that occur in streams that have listed species and that require short-term water drafting (e.g., minor road maintenance, prescribed burning). It is not intended for use on large wild fires or extensive project activities.

1. Water drafting areas can only occur in streams that are at least 10 cfs. Water drafting in streams less than 10 cfs is outside the scope of this document.
2. Water intakes must meet NOAA Fisheries fish screen criteria.
3. Water drafting applies to short-term water withdrawals, defined as those occurring less than 8 hours/day, not longer than 3 consecutive days, and less than 10% of flow volume removed where the flow volume is measured at the time of the withdrawal.

❖ **2.9.3 Project Design Elements for the Protection of Wildlife Habitat**

- **Mitigation Measures for Threatened, Endangered, and Sensitive Fauna Species**

1. Restrict disturbance activities within ¼ mile non-line-of-sight or ½ mile line-of-sight for any known or newly discovered bald eagle nests from January 1 through August 31.

2. Project activities that have potential to disturb bald eagle winter roosts shall be restricted within 400 meters of the roosting area from November 1 through April 30.
 3. Protect existing bald eagle roost and perch trees along the Metolius River and Lake Billy Chinook that are not hazards to public safety.
 4. Disturbance activities (logging, post-sale activities, etc.) will be restricted within ¼ mile of known spotted owl activity centers from March 1 through September 30 unless non-nesting is verified. Consult a Wildlife Biologist to determine what activities are restricted. Blasting and helicopter use may be restricted for up to 1 mile from known activity centers.
 5. Surveys will be conducted for spotted owls according to R-6 protocol to maintain adequacy of said surveys.
 6. Protect potential bufflehead nest trees (snags) along the Metolius River and Lake Billy Chinook that are not hazards to public safety.
 7. Protect existing snag habitat outside of recreation areas and down woody material along the river corridor.
- **Wildlife Tree Retention within LSRA**
 1. For all units within the LSR add additional trees to meet LSRA requirements (*Table 2.9-1*). The Wildlife Report describes analysis used to get trees per acre needed in excess of snag requirements.
 2. For all units not in the LSR allocation leave a minimum of 120 linear feet of logs per acre greater than or equal to 16" in diameter and 16 feet long should be retained in regeneration units. Down wood should represent the species composition of the stand. Decay class 1 and 2 logs can be counted toward this total (ROD C-40).
 3. Down woody material already on the ground should be retained and protected to the greatest extent possible from disturbance during treatment (e.g. fuels treatments and yarding) which might otherwise destroy the integrity of the substrate (ROD C-40).
 4. Protect large snags identified for retention during harvest and post harvest activities.

Table 2.9-1. Additional trees per acre needed to meet the LSRA tons per acre requirement.

DBH	Alt 2 Ft³ per acre converted to trees per acre	Alt 3 (30%) Ft³ per acre converted to trees per acre	Alt 3 (50%) Ft³ per acre converted to trees per acre
Mixed Conifer Wet			
10 – 14.9"	16.00	16.00	0
15 – 19.9	0	0	0
20 – 24.9	0	0	0
25 +	0	0	0
Totals	16.00	16.00	0
Mixed Conifer Dry			
10 – 14.9"	4.35	0	0
15 – 19.9	0	0	0
20 – 24.9	0	0	0
25 +	0	0	0
Totals	4.35	0	0
Ponderosa Pine Wet			
10 – 14.9"	5.92	3.12	0
15 – 19.9	2.08	0	0
20 – 24.9	0.1	0.09	0
25 +	0	0	0
Totals	8.10	3.21	0
Ponderosa Pine Dry			
10 – 14.9"	5.43	0	0
15 – 19.9	1.75	0	0
20 – 24.9	0.25	0.25	0
25 +	0	0	0
Totals	7.43	0.25	0

If there are insufficient large trees, substitute 10 to 19.9" dbh trees for the larger trees to average 9.5 snags per acre in the units with 30% tolerance level retention and 24.5 snags per acre for the 50% tolerance level.

❖ 2.9.4 Project Design Elements for Temporary Roads and Landings

The Best Management Practices applied to the project (*Appendix C*), will be implemented to control erosion from roads within the project area. Specific Road BMP elements and their effectiveness follow.

1. All temporary roads and landings will be located outside riparian and stream areas. (Road BMP R-1) *High effectiveness.*
2. All temporary roads will be rehabilitated by ripping and/or tilling, have water bars installed where necessary, and be closed immediately following harvest operations to restore hydrologic function.(Road BMP R-23) *High effectiveness.*
3. Surface Drainage – minimized erosive effects of concentrated water and the degradation of water quality through the proper design and construction of temporary roads (Road BMP R-7). *Moderate effectiveness*

4. Maintenance – conduct regular preventive maintenance to avoid deterioration of the road surface and minimize the effects of erosion and sedimentation (Road BMP R-18, R-19). *Moderate-high effectiveness.*

❖ 2.9.5 Logging Systems to be utilized in Action Alternatives

Logging systems and fuels treatments by unit for Alternatives 2 and 3 are displayed in Appendix B, Proposed Activity by Unit.

Ground-Based Systems (G)

One (or a combination) of the following three types of ground-based systems would be employed:

- A system consisting of a track-mounted knuckle-boom (16 ft. reach) feller-bunchers for cutting and rubber-tired grapple skidders or hydraulic loaders for yarding trees.
- A system consisting of a rubber-tired tree processor (cut-to-length machine, with 25'-30' reach) for cutting and bucking trees and a rubber-tired forwarder which carries the logs to the landing.
- A system of feller/ bunchers with grapple skidders would generally be used on slopes ranging from 0-25 percent, with the allowance for occasional pitches up to 35 percent, where hand felling and log-winchng would be required. Processor/ forwarder systems would be used up to 30% slope.

Cable Yarding (C)

Movement of logs to landings with cables would be employed where slopes are too steep or otherwise unsuitable for ground-based systems, but not steep enough to require skyline yarding. Trees would be hand-felled. Examples of the type of equipment that would be employed are small mobile yarders, cable loaders with tongs, and winches mounted on various types of equipment- in all cases, equipment would remain on existing roads.

This designation is different from Skyline Yarding (see below) in that there is no requirement for one-end log suspension, and would be employed on slopes generally ranging from 25-40 percent. Suspension of the leading end of the log would be achieved in many cases, depending on the terrain, height of the boom or tower, and the distance from the landing.

Skyline Yarding (S)

Movement of logs to landings with cables would be employed where slopes are too steep or otherwise unsuitable for a ground-based system and steepness and/or soil and water concerns dictate requirements for one-end log suspension. This system was prescribed on slopes generally >40 percent, and/or on units above intermittent streams. Small mobile yarders would be used for this.

Skyline Yarding with Temporary Road Construction (S-TRC)

Same as Skyline Yarding (see above), with temporary road construction to access landings. These temporary roads would generally be along ridgelines and require minimal excavation; they would be sub-soiled after logging is completed.

Helicopter (H)

Helicopters would be used to yard logs where road access does not exist, and temporary road construction was not deemed feasible or cost-effective. It was also prescribed for some units in Alternative 3 as an alternative to skyline.

❖ 2.9.6 Guidelines for the Assessment of Tree Survival

Factors for Determining Tree Survival Capability

The following factors (from Scott et al 2002) would be used for determining which trees are likely to survive in all treatments and burn severities:

1. **Season of Fire-** Eyerly was an early-season fire (before Aug. 1), and damage is expected to be higher because tissues were actively growing.
2. **Pre-Fire Vigor, Growth Rate, and Site Quality-** the ponderosa pine sites are generally poor growing sites, and the mixed conifer sites are good to moderate quality growing sites; tree growth was low on all sites due to high stand densities, and this affects the tree's ability to withstand damage from fire.
3. **Arrangement or Distribution of Down Woody Material-** down woody material was common in the area, and many trees experienced damage to roots and cambium from heat from this burning material.
4. **Dwarf Mistletoe Occurrence-** both Douglas-fir and ponderosa pine dwarf mistletoe is found in this area, and many trees are/were infected; dwarf mistletoe infection weakens the tree and its ability to withstand damage from fire. Dwarf mistletoe ratings ≥ 3 indicate that a tree is heavily infected and less likely to survive a fire, other factors being equal.
5. **Root Disease Occurrence for True Firs and Douglas-fir-** armillaria and annosus root diseases are known to occur in this area; root disease infection weakens the tree and its ability to withstand damage from fire.
6. **Bark Beetle Pressure-** bark beetle populations were low in this area prior to the fire.
7. **Crown Volume Scorch-** trees of all species experienced high rates of crown scorch; scorch rates $> 40\%$ for Douglas-fir and $> 50\%$ for ponderosa pine indicate higher levels of damage.
8. **Bole Scorch-** trees of all species experienced high rates of bole scorch; charring of the bole over greater than 50% of the circumference to 8 feet or more indicates a high level of damage.
9. **Total Scorch Height-** total scorch height was commonly > 75 ft. indicating moderate to high levels of cambial and crown damage from this factor.
10. **Duff Consumption-** complete duff consumption occurred in greater than 85 percent of the stands within the fire, indicating high levels of root damage must have occurred.

Damaged Tree Guidelines

The following indicators would be used to determine which trees are highly unlikely to survive for an extended period of time. These guidelines are based on the 10 factors listed above from (Scott et al 2002), and were written to simplify the on-site process of determining which trees are dying due to fire damage (or are highly likely to be attacked by bark beetles) by focusing on the dominant injuries sustained by the tree, and applying site factors for root damage and dwarf mistletoe where appropriate. Also taken into account are the additional site factors for site quality, root disease, and duff consumption which are described in above for the areas within the Eyerly Fire where salvage is being proposed. The guideline for bark consumption >50 percent of the bole circumference is from Ryan (1990)- this author stated the general rule that if a tree sustains cambial damage in less than a quarter of its bole circumference it is likely to survive, but survival is very low if cambial damage is greater than 75 percent of bole circumference (our guideline uses the midpoint of these two situations as the starting point for evaluation of the tree's potential for survival).

A number of trees marked for removal according to these guidelines were evaluated in the field by applying the tree guidelines developed by Scott. All of these trees were rated as having a low probability of survival.

- **Ponderosa Pine**

1. Trees with less than 20% live green crown remaining (measured as a percent of the total tree height); trees have sustained crown volume scorch ranging from 50 to 99% and bole scorch ranging from 30 to 99%, **or**
2. Trees with basal bole scorch where bark has been consumed (visible cambial damage) by fire >50% of bole, **or**
3. Trees with abundant evidence of boring dust and/or pitch tubes around bole (western/mountain pine/pine engraver beetles and ambrosia beetles), indicating successful bark beetle attacks, **or**
4. Trees with abundant evidence of woodpecker feeding (bark removed) around bole, indicating the presence of western pine/mountain pine/pine engraver beetles in the trees, **or**
5. Trees with damage, but less than stated #1 and/or #2 above, and evidence of charring of lateral roots in two quadrants, **or**
6. Trees with damage, but less than #1 and/or #2 above, and a dwarf mistletoe infection rating >3 in remaining live crown.

- **Douglas-fir**

1. Trees with >= 40% crown scorch, AND bole scorch >8 feet high and >50% of bole circumference, **or**
2. Trees with >80% crown scorch, **or**
3. Trees with basal bole scorch where bark has been consumed (visible cambial damage) by fire >50% of bole circumference, **or**
4. Trees with abundant evidence of boring dust and/or pitch tubes on bole (Douglas-fir beetle), **or**
5. Trees with abundant evidence of woodpecker feeding (bark removed) around bole indicating successful beetle attacks, **or**

6. Trees with damage, but less than #1 above, and evidence of charring of lateral roots in two quadrants, **or**
 7. Trees with damage less than #1 above, and a dwarf mistletoe infection rating >3 in remaining live crown.
- **White Fir**
 1. Trees with >20% crown scorch AND >40% bole scorch (any height), **or**
 2. Trees with 100% bole scorch (any height), **or**
 3. Trees with basal bole scorch where bark has been consumed (visible cambial damage) by fire >50% of bole circumference, **or**
 4. Trees with >80% crown scorch.
 - **Western Larch**

Trees with 100% bole char (not scorch, but char) for >80% of total tree height AND >=90% crown scorch.
 - **Incense Cedar**
 1. Trees with less than 15% live green crown remaining (measured as a percent of the total tree height); trees have sustained crown volume scorch ranging from 50 to 99% and bole scorch ranging from 30 to 99%, **or**
 2. Trees with basal bole scorch where bark has been consumed (visible cambial damage) by fire >50% of bole circumference.

Species Considerations

Ponderosa pine and Douglas-fir are the main species of concern for future bark beetle infestations. Most white fir that experienced any degree of crown and/or bole scorch have already been attacked by the fir engraver beetle. Western pine beetle is expected to be the main beetle on the larger pine, the pine engraver beetle is expected to be the main beetle on smaller pine, and the Douglas-fir beetle is expected to be the main beetle on Douglas-fir.

Diameter Considerations

Larger trees have the capacity to produce larger beetle broods, and hence the damage on these trees is of more concern in reducing the number of additional trees killed. The following guidelines would be used for determining beetle risk and concern for future brood production:

- **Ponderosa Pine**
 - Trees >= 20 in. dbh
- **Douglas-fir**
 - Trees >=16 in. dbh

❖ 2.9.7 Protection of Healthy Green Trees

Protection of Healthy Green Trees within Units and in Lightly Burned Areas within and Adjacent to Units

Healthy green trees will be left within harvest units, even those with evidence of fire damage. Trees with low-moderate crown and bole scorch, trees with healthy live crowns at least 20 percent of the total height of the tree, and trees with little or no evidence of bark beetles, are the types of trees that are considered to be healthy and that are expected to survive for an extended period. These trees will provide genetic diversity, through their seed, to the regenerating stands. Some incidental cutting of healthy green trees may occur in order to facilitate the use of cables to move logs in units calling for skyline or cable logging systems.

Areas exist within proposed salvage unit boundaries that experienced an underburn and have little or no tree mortality. These areas are generally along the final or interior containment lines and along roads, and were not always possible to exclude from the unit due to the need for road access to the unit boundary. Some areas also may end up having higher than expected tree survival at the time of implementation, and trees in these areas will be evaluated using the guidelines in *Section 2.9.6*, pg. 56 of this document, so that only trees expected to die will be removed. Areas where the majority of trees are healthy and green will be excluded from the unit where possible, or designated as no-treatment areas within units to provide natural seeding and wildlife habitat.

❖ 2.9.8 Fuels Treatment Practices

Grapple Pile and Burn

The practice of machine piling would involve using either a tracked backhoe, a tracked vehicle with a grapple arm or similar equipment to collect fuels into large piles. Operation of machines would be confined to existing skid trails. Piles will typically be burned in the fall and creep may be allowed where fuel reduction and positive resource objectives are being met. Grapple pile and the burning of fuels would occur in units on slopes less than 30%. The location of most of the machine pile units are typically along ridges or paralleling roads where they may provide defensible corridors.

Hand Pile

Hand piling would involve stacking the tops and branch wood of harvested trees by hand and burning them in the fall of the year. Piles will typically be burned in the fall and creep may be allowed where fuel reduction and positive resource objectives are being met. This treatment is generally proposed on slopes greater than 30%. Some units where green foliage is present on trees may also be hand piled.

Underburn/Jackpot Burning

The practice of underburning would involve using prescribed fire to reduced fuel loading. Units with an anticipated volume between 4 and 7 MBF being removed are targeted to be underburned. Natural fuels accumulation and decay rates will be monitored and evaluated to assess potential fire behavior over time. Underburn units will be monitored and may allows lop and scatter as a treatment if residual fuel loading is within acceptable limits.

Jackpot burning would be done to reduce fuel loading where fuels are concentrated in patches. The entire unit may not have prescribed fire applied where fuels are light.

Lop and Scatter

Lop and scatter treatment would involve cutting tops and branch wood, and then scattering the concentration so that the residual fuels in less than 18" high. Treatment would include options to hand pile concentrations, and underburning/jackpot burning.

This treatment is proposed on stands where the volume being removed is less than 4 MBF or on a variety of slopes where existing fuel loading is less than 5 tons per acre.

Post Harvest Prescribed Fire Maintenance

All harvest units would be analyzed to evaluate opportunities for the reintroduction of fire into the stands. This would provide post harvest reduction and maintenance of natural fuels as they accumulate. This would be accomplished by prescribed burning at intervals that mimic historic range of variability as represented by Fire Regime and Condition Class.

❖ 2.9.9 Project Design Elements for Noxious Weed Treatment

The listed Botany mitigations apply to the Eyerly Fire Salvage area, and are derived from BAER Team Botanical Report recommendations, Sisters Ranger District best management practices (BMP), and recommendations from the Eyerly project interdisciplinary team (IDT).

A. Noxious Weeds: Mitigations for Noxious Weeds Common to all Alternatives

i. Ongoing Mitigations from the Eyerly Fire BAER Team Botanical Report:

1. Detect and map all known noxious weed populations within and adjacent to the fire.
2. Patrol, monitor and treat noxious weeds that occur in areas of disturbance associated with fire suppression, for at least three growing seasons after completion of project.
3. Identify potential noxious weed seed-dispersing vectors associated with the fire suppression.
4. Predict seed maturation periods of weeds and plan control treatments accordingly.
5. Use available control measures on the maturing knapweed at selected sites in the Fly Creek drainage.
6. Hand-pull, bag, remove, and properly dispose of scattered, smaller, existing populations along roadsides.
7. Implement road closures to help prevent spread of noxious weeds (see Eyerly Roads Analysis).

ii. Other Ongoing Mitigations:

8. Continue existing CFR Off-Road Vehicle closure throughout the Eyerly Fire area.
9. Improve effectiveness of prevention practices through weed awareness and education. Provide information and training and develop incentive programs for locating new invaders.

iii. Management Recommendations from the Eyerly Fire BAER Team Botanical Report:

1. Assess the adequacy of the current Forest-level noxious weed EA in facilitating management of invasive plant species in newly burned areas.

2. Develop a cooperative noxious weed treatment plan with adjacent federal, state, county and private land owners.

B. Noxious Weeds: Mitigations Common to Action Alternatives

1. Prioritize and pre-treat existing weed populations before ground disturbance.
2. Use contract clauses to prevent the introduction or spread of noxious weeds by contractors (clause C6.36; see Appendix C).
3. Known weed sites will be shown on the Sale Area Map- landings and skid trails will not be allowed within these sites.
4. Minimize soil disturbance to the maximum extent possible (see Soil Mitigations/Best Management Practices).
5. Encourage operators to maintain weed-free equipment parking and staging areas.
6. Operators will be required to wash all equipment (including log trucks) after completing operations with travel along Rd. 1170-600 before moving to a new area within the Eyerly Fire Salvage.
7. Equipment will not be allowed on the fill slope of Rd. 1170-600 (winching required).
8. Conduct post-sale monitoring and control of noxious weeds within and adjacent to the sale area and along haul routes. KV funds and Title II funds would be sought as funding sources.

C. Noxious Weeds: Mitigations Common to Action Alternatives

The requirements pertain to the use of Special Provisions C and CT6.35 Equipment Cleaning in the FS-2400-6 and -6T contracts, Standard Provision 36 in the FS-2400-3 contracts, Other Condition 14 in the FS-2400-4 contract, and R6 Special Project Specification (SPS) 601.011.

All off-road equipment shall be cleaned prior to coming onto National Forest lands as to be free of soil, seeds, vegetative matter, or other debris that could contain or hold seeds. Notify the Purchaser/Contractor of this requirement in the six-month sale program announcement and General section of the Prospectus.

When NEPA analysis concludes that the cleaning of off-road equipment is needed, the following actions are required:

1. For timber sales, in the General Section of the Prospectus, notify the Purchaser/Contractor that cleaning of off-road equipment will be required. Include specific requirements; prior to bringing onto National Forest lands, after operations in Units 2, 4, etc. Also include the appraisal allowance (\$/CCF) made for this work.
2. Have maps of known infested sites available for review by Purchaser/Contractor.
3. Cost the required work as shown above.
4. When using the FS-2400-6 and -6T contracts, include specific cleaning requirements in Special Provision C or CT6.315# - Sale Operation Schedule. See the provision Instructions for a sample. Also, show the infested sites on

the Sale Area Map, per B or BT1.1, using map symbol “NXW”. In the FS-2400-3T or -3P contract, list cleaning requirements in Special Provision 21.3# Sale Operation Schedule, and on the Sale Area Map. In the FS-2400-4 contract, list cleaning requirements in Other Condition 22#, and on the Sale Area Map.

5. Engineering has developed Special Project Specification R6/SPS 601.011 specifying cleaning requirements.
6. Inspect equipment prior to off-loading from transportation vehicle. Move off National Forest lands if cleaning is needed prior to start of operations, unless otherwise agreed.
7. Required cleaning on National Forest lands will be with compressed air, high pressure water, or other specified methods to assure equipment is free of soil, seeds, vegetative matter, or other debris that could contain or hold seeds. Use of solvents, detergents, etc. to clean equipment on National Forest lands is prohibited.
8. Cleaning of equipment after operations in infested units will be in areas specified by the Forest Service. Run-off will not be allowed to enter streams and will be contained with methods specified to minimize movement of water from the cleaning site. Soil contaminated with invasive plants and seedpods will be disposed of by the Purchaser/Contractor off National Forest land.
9. Stockpiles of rock and other materials related to road construction and reconstruction, and road maintenance that contain Invasive Plants shall have the top six (6) inches scraped off, set aside, and treated. Monitor the pile and treat again if invasive plants reappear. The remaining stockpile can be used as needed.
10. Equipment such as skyline yarders, brush cutters or flailers, all terrain vehicles (ATV) or similar equipment, which operate on or from road surfaces shall be considered off-road equipment. Required cleaning will be for those equipment components that operate off the road surface, i.e., road graders and ATV's that operate infested areas, flailer head, cable, drums, blocks, motorized carriages and other carriages that may get into the ground, etc.
11. Inspections should be complete and thorough without the use of specialized equipment and done in a manner similar to fire inspections. While inspections do not require the disassembly of components, opening of hoods, panels, storage places, etc. is appropriate.
12. Close communication and coordination between project and contract personnel, and persons doing the inspecting, are essential for successful implementation and administration of invasive plant requirements.

D. Sensitive (TES) and Survey and Manage (S&M) Plant Species: Mitigations Common to Action Alternatives.

1. Conduct surveys for TES/S&M plant species in and immediately adjacent to units proposed for salvage harvest. Survey all such units with a burn classification of Mixed Severity. For units with a burn classification of Stand Replacement, initially survey only selected units that collectively represent an array of former plant communities, slopes, aspects and elevations. Modify surveys in Stand Replacement units as field observations suggest.
2. Insure that all newly located TES/S&M known sites are promptly entered into Eyerly Salvage Project GIS coverage.
3. Assess number and condition of mountain lady's slipper plants at all documented sites within and immediately adjacent to the project area. Develop protection plan utilizing personal communications with Nan Vance of the Pacific Northwest Research Station at Corvallis, Oregon, Management Recommendations for Clustered Lady Slipper Orchid (2002), and Management Recommendations for Mountain Lady's Slipper Version 2.0 (1998). At minimum, protect existing plants from direct mechanical injury and provide or maintain local vegetative structure that will provide partial shade for plants during the growing season. Arrange with Forest engineers for protection of plants on road cut banks during road maintenance activities.
4. Determine extent of the Four Corners Peck's penstemon population. Determine appropriate protection measures of population if found to extend into a salvage unit. Consult Species Conservation Strategy, Peck's Penstemon, Deschutes National Forest Sensitive Species Program (1992), during consideration of protection.
5. Use flagging, or otherwise conspicuously delineate protection zones associated with TES/S&M known sites situated in or adjacent to proposed salvage harvest units.

Management Recommendations

For any existing or newly detected TES/S&M sites, use existing management guidelines in determining measures that are appropriate for protection during salvage harvesting, and other threatening activities. Instances in which known sites exist on the edge of the known range of the species require special consideration in protection planning.

❖ **2.9.10 Project Design Elements for Air Quality**

Use signing and public notice when burning during hunting season or other times when public use of the area is high.

All prescribed fire operations, including pile burning, would be in accordance with Oregon State Smoke Management Guidelines. Weather conditions would be favorable for smoke dispersal so that smoke pooling in valleys, drainages or intrusions into other areas would be minimized.

❖ **2.9.11 Project Design Elements for Heritage Resources**

Known heritage resource sites would be avoided by all proposed activities.

Heritage resource sites discovered during harvest operations would be avoided from any further disturbance.

❖ **2.10 Monitoring**

Vegetation Monitoring (Silviculturist)

Tree marking will be monitored to ensure compliance with the silvicultural prescription and marking guide. Monitoring will check for correct selection and designation of trees expected to live and snags to be left for wildlife habitat and resource protection.

All areas planned for tree planting will be examined prior to planting. Exams will assess levels of competing vegetation, pocket gopher activity, and other environmental conditions. Seedling species and stock type will be prescribed as well as planting and protection methods.

Planted areas will be monitored for seedling survival, growth, and damaging agents. Stocking surveys will occur periodically until planting areas are certified adequately stocked and “free to grow”. Deficient areas will be replanted to at least minimum stocking. Protection measures may be implemented to increase tree survival.

Soil Monitoring (Soil Specialist)

Detrimental soil impacts would be monitored to check how closely they are predicted. Sampling would be done by a method similar to the soil assessment used initially to determine soil conditions. About 25% of the ground-based harvest units would be sampled within three years of completion of activities. This would show the cumulative effects of harvest plus fuel treatment.

Monitoring would be conducted along unit boundaries to determine if sediment is transported outside of units. Amount of sediment and distance traveled would be estimated and documented if observed.

Watershed And Fisheries (Hydrologist And Fisheries Biologist)

Monitor Best Management Practices (BMPs): Five to fifteen percent of the activity areas by harvest system will be monitored to ensure BMP standards are being met. Monitoring would be done by the District Hydrologist, fisheries biologist, soil scientist, or trained technicians after completion of the project.

Monitor Unit Boundaries along Riparian Reserves and Riparian Habitat Conservation Areas: Monitor 10% of units adjacent to RRs and RHCAs to ensure adequate buffering of mechanized harvest and fuels reductions activities.

Monitor Road Decommission and Reconstruction Activities: Implementation monitoring would be conducted to determine if decommission or reconstruction activities were completed. Following completion of road decommission or reconstruction activities, effectiveness monitoring would be completed at year 1 and 3. Monitoring would consist of ocular surveys completed by hydrology or fisheries personnel, and would include establishing a photo record, on decommissioned road prisms within 100 feet of streams and at stream crossings to check for erosion and/or establishment of ground cover on the prism and sediment transport to streams.

Noxious Weed Monitoring (Botanist or Range Specialist)

Monitoring will occur for three years, 2004 through 2006, to determine whether noxious weeds were introduced into the burned area by any means or expanded from known locations. Monitoring activities will include a survey of landings, roads, and other areas where soil disturbance could have deposited weed seed. These actions should reduce the risk that weeds could spread or existing populations could enlarge.

❖ 2.11 Comparison of Alternatives

This section provides a summary of the effects of implementing each alternative. Information in the tables is focused on activities and effects where different levels of effects or outputs can be distinguished quantitatively or qualitatively among alternatives.

Table 2.11-1. Description of Eyerly Fire Salvage Alternative Elements

Element of Alternative	Alternative		
	1	2	3
Acres of Salvage Harvest	0	4846	2893
Volume of Salvage (million BF)	0	23.3	10.9
Context of Salvage Activity			
Percent of Eyerly Fire Area proposed for Salvage	0	27%	16%
Percent of Stand Replacement Acres Treated (does not include plantation or unsuitable areas)	0	53%	35%
Percentage Removal of Dead Trees 21 in. and Greater from Total Fire Area	0	19%	11%
Logging Systems Based on Acres-acres (%)			
Ground-Based Logging Systems	0	3,583 (74%)	2,129 (74%)
Cable/Skyline Logging Systems	0	858 (18%)	501 (17%)
Helicopter	0	406 (8%)	262 (9%)
Logging Systems Based on Volume–mmbf (%)			
Ground-Based Logging Systems	0	14,836 (64%)	7,007 (64%)
Cable/Skyline Logging Systems	0	5,421 (23%)	2,659 (24%)
Helicopter Logging Systems	0	3,068 (13%)	1,262 (12%)
Fuel Treatment			
Acres of Post-Harvest Fuels Treatment	0	4,846	2,893
Grapple Piling (acres)	0	2,051	1,524
Lop and Scatter (acres)	0	1,877	785
Underburn/Jackpot Burn (acres)	0	608	405
Handpile (acres)	0	310	179
Reforestation			
Planting (acres)	0	3,918	2,532
Road Management			
Temporary Road Construction (miles)	0	2.1	1.4
Road Reconstruction (miles)	0	33.4	33.4
Road Decommissioning (miles)	0	3.8	3.8
Road Maintenance (miles)	0	107.6	89.6
Soil			
Subsoiling (acres)	0	116	47

Table 2.11-2. Comparison of Eyerly Fire Salvage Alternatives

Purpose and Need	Alternative 1 – No Action	Alternative 2 – Proposed Action	Alternative 3
Recovery of Economic Value of Fire-killed and Severely Damaged Trees Expected to Die			
Total Volume (Million BF)	0	23.3 MMBF	10.9 MMBF
Net Sale Value (Million \$)	0	\$ 2.3 M	\$.9 M
Jobs	0	130.4	60.5
Employee Income (Million \$)	0	\$ 2.28 M	\$ 1.06 M
Reduce Future Fuel Loadings			
Acres by PAG meeting desired Fuel Loading (estimated for year 2032)			
PP PAG (desired range 5 – 20 tons/acre)	1,518 ac	5,058 ac	1,518 ac
MC PAG (desired range 12 – 35 tons/acre)	1,345 ac	2,308 ac	1,345 ac
Accelerate reforestation			
Acres Planted	0	3,918 ac	2,532 ac
Estimated average diameter of conifers at 80 years (dbh inches)	10 dbh	14 dbh	14 dbh
Reduce hazards along Major Roads			
Areas proposed for hazard tree removal	Forest Roads 64 & 1170 Perry South and Monty Campgrounds	Forest Roads 64 & 1170 Perry South and Monty Campgrounds and along haul routes.	Forest Roads 64 & 1170 Perry South and Monty Campgrounds and along haul routes.
Designation of Substitute Old Growth			
Substitute Old Growth designated	No	Yes	Yes
Key Issue	Alternative 1 – No Action	Alternative 2 – Proposed Action	Alternative 3
Soils			
Acres of ground based salvage	0	3,583 ac	2,129 ac
Ground based fuel treatment (grapple piling)	0	2,051 ac	1,524 ac
Average % Detrimental Soils Condition within Units	8%	15%	14%
Water			
Number of potentially hydrologically connected road ditches	0	90	80
Acres of proposed harvest within sediment delivery zone	0	1,206 ac	433 ac

Key Issue		Alternative 1 – No Action	Alternative 2 – Proposed Action	Alternative 3
Proposed miles of road for timber haul within Riparian Reserves or Riparian Habitat Conservation Areas		0	8.8 mi	5.5 mi
Fish				
Estimated percent increase in sedimentation		0	4.1%	1.5%
Wildlife				
Number of potential perch trees removed within essential bald eagle habitat, by diameter class.	<21 inches dbh	850	850	850
	>21 inches dbh	120	120	120
Hazard trees along Roads 64 and 1170, and within Perry South and Monty Campgrounds. These trees are felled in all alternatives. They would be removed for salvage in Alternatives 2 and 3. Minimum number of snags retained per acre within harvest units, by PAG.	Mixed Conifer Wet	No Harvest	12.92	12.9
	Mixed Conifer Dry	“	6.51	9.5
	Ponderosa Pine Wet	“	4.37	9.5
	Ponderosa Pine Dry	“	2.48	9.5
Level of snags provided within the entire Eyerly Fire Area. For this measure the DecAID tool is used, and tolerance levels (TL*) are shown.	Acres with snags (>9 inches dbh) at <TL 30	3,906 ac	5,758 ac	3,927 ac
	Acres with snags (>9 inches dbh) at TL 30	4,567 ac	7,175 ac	5,501 ac
	Acres with snags (>9 inches dbh) at TL 50	2,507 ac	2,752 ac	2,955 ac
	Acres with snags (>9 inches dbh) at TL 80	14,461 ac	9,756 ac	13,058 ac
Level of snags provided within the entire Eyerly Fire Area. For this measure the DecAID tool is used, and tolerance levels (TL*) are shown.	Acres with snags (>21 inches dbh) at TL <30	12,867 ac	12,869 ac	12,867 ac
	Acres with snags (>21 inches dbh) at TL 30	506 ac	506 ac	506 ac
	Acres with snags (>21 inches dbh) at TL 50	7,221 ac	8,750 ac	8,110 ac
	Acres with snags (>21 inches dbh) at TL 80	4,847 ac	3,318 ac	3,957 ac
Down Wood Provided	Within Metolius LSR (tons per acre)			
	Mixed Conifer Wet Mixed Conifer Dry Ponderosa Pine Wet Ponderosa Pine Dry	No Harvest	25 t/ac 12 t/ac 10 t/ac 8 t/ac	25 t/ac 12 t/ac 10 t/ac 8 t/ac
	Outside Metolius LSR	No Harvest	120 linear feet, ≥ 16 inches diameter and 16 feet long	120 linear feet, ≥ 16 inches diameter and 16 feet long

Table 2.11-3. Numbers of Snags by DecAID Tolerance Level

Tolerance Level	30%		50%		80%	
DBH (inches)	<u>≥</u> 9	<u>≥</u> 21	<u>≥</u> 9	<u>≥</u> 21	<u>≥</u> 9	<u>≥</u> 21
Ponderosa Pine PAGES (snags/acre)	1.3	1.1	2.7	1.1	7.2	2.5
Mixed Conifer PAGES (snags/acre)	6.7	2.7	12.6	4.3	25.3	8.6

❖ 2.12 Identification of the Preferred Alternative _____

Alternative 2 has been identified as the preferred alternative for the Eyerly Fire Salvage Project. This alternative is described in detail in this chapter under Alternative 2 in Alternatives Considered in Detail, and includes Project Design Elements described for Alternative 2.

❖ 2.13 Maps Displaying Proposed Alternatives _____

The following twelve maps present a geographical representation of the proposed actions described throughout the Alternatives chapter, as follows:

❖ **Map1. Alternative 2 Salvage Harvest**

Salvage harvest representation of Mixed Severity and Stand Replacement units, as described on pg. 36.

❖ **Map1a. Alternative 2 Temporary Roads and Helicopter Landings**

The approximately 2.1 mi. of temporary roads (which would be decommissioned and brought back to a natural state post-harvest) are displayed, along with estimated locations of helicopter landing sites.

❖ **Map 2. Alternative 2 Fuels Treatment**

Proposed fuels treatment units for the proposed action, as described on pg. 38.

❖ **Map 3. Alternative 3 Salvage Harvest**

As described, beginning on pg. 42, proposed Alternative 3 salvage in Stand Replacement units is displayed.

❖ **Map3a. Alternative 3 Temporary Roads and Helicopter Landings**

Approximately 1 mi. of temporary road segments (which would be decommissioned and brought back to a natural state post-harvest) are displayed, in conjunction with estimated locations of helicopter landing sites.

❖ **Map 4. Alternative 3 Fuels Treatment**

Units proposed to receive fuel treatment with the selection of Alternative 3 are shown.

❖ **Map 5. Old-Growth MA15 Existing and Replacement Areas**

The proposed MA15 Old-Growth existing and replacement areas are represented.

❖ **Map 6. Proposed Salvage Units**

Units proposed for salvage under Alternative 2 (*Map 1*), those Stand Replacement units would be proposed for salvage in Alternative 3 (*Map 3*).

❖ **Map 7. Alternatives 2 & 3 Road Decommissioning**

A smaller scale representation of the 3.8 mi. of 1170800 road decommissioning proposed under both action alternatives (*pp. 39; 44*).

❖ **Map 8. Alternatives 2 & 3 Hazard Tree Utilization**

Representation of hazard tree corridor from the 1170 and 64 roads, leading to Perry South and Monty Campgrounds.

❖ **Map 9. Recent Activities Within Metolius Watershed (2002-2004)**

Maps 9 and 10 represent landscape-scale events described in Chapter 3, effects analysis.

❖ **Map 10. Metolius Late Successional Reserves with Recent Large Fires (1996-2003)**

❖ 2.13 Maps Displaying Proposed Alternatives _____

The following twelve maps present a geographical representation of the proposed actions described throughout the Alternatives chapter, as follows:

❖ **Map1.** Alternative 2 Salvage Harvest

Salvage harvest representation of Mixed Severity and Stand Replacement units, as described on pg. 36.

❖ **Map1a.** Alternative 2 Temporary Roads and Helicopter Landings

The approximately 2.1 mi. of temporary roads (which would decommissioned and brought back to a natural state post-harvest) are displayed, along with estimated locations of helicopter landing sites.

❖ **Map 2.** Alternative 2 Fuels Treatment

Proposed fuels treatment units for the proposed action, as described on pg. 38.

❖ **Map 3.** Alternative 3 Salvage Harvest

As described, beginning on pg. 42, proposed Alternative 3 salvage in Stand Replacement units is displayed.

❖ **Map3a.** Alternative 3 Temporary Roads and Helicopter Landings

Approximately 1 mi. of temporary road segments (which would decommissioned and brought back to a natural state post-harvest) are displayed, in conjunction with estimated locations of helicopter landing sites.

❖ **Map 4.** Alternative 3 Fuels Treatment

Units proposed to receive fuel treatment with the selection of Alternative 3 are shown.

❖ **Map 5.** Old-Growth MA15 Existing and Replacement Areas

The proposed MA15 Old-Growth existing and replacement areas are represented.

❖ **Map 6.** Proposed Salvage Units

Units proposed for salvage under Alternative 2 (*Map 1*), those Stand Replacement units would be proposed for salvage in Alternative 3 (*Map 3*).

❖ **Map 7.** Alternatives 2 & 3 Road Decommissioning

A smaller scale representation of the 3.8 mi. of 1170800 road decommissioning proposed under both action alternatives (*pp. 39; 44*).

❖ **Map 8.** Alternatives 2 & 3 Hazard Tree Utilization

Representation of hazard tree corridor from the 1170 and 64 roads, leading to Perry South and Monty Campgrounds.

❖ **Map 9.** Recent Activities Within Metolius Watershed (2002-2004)

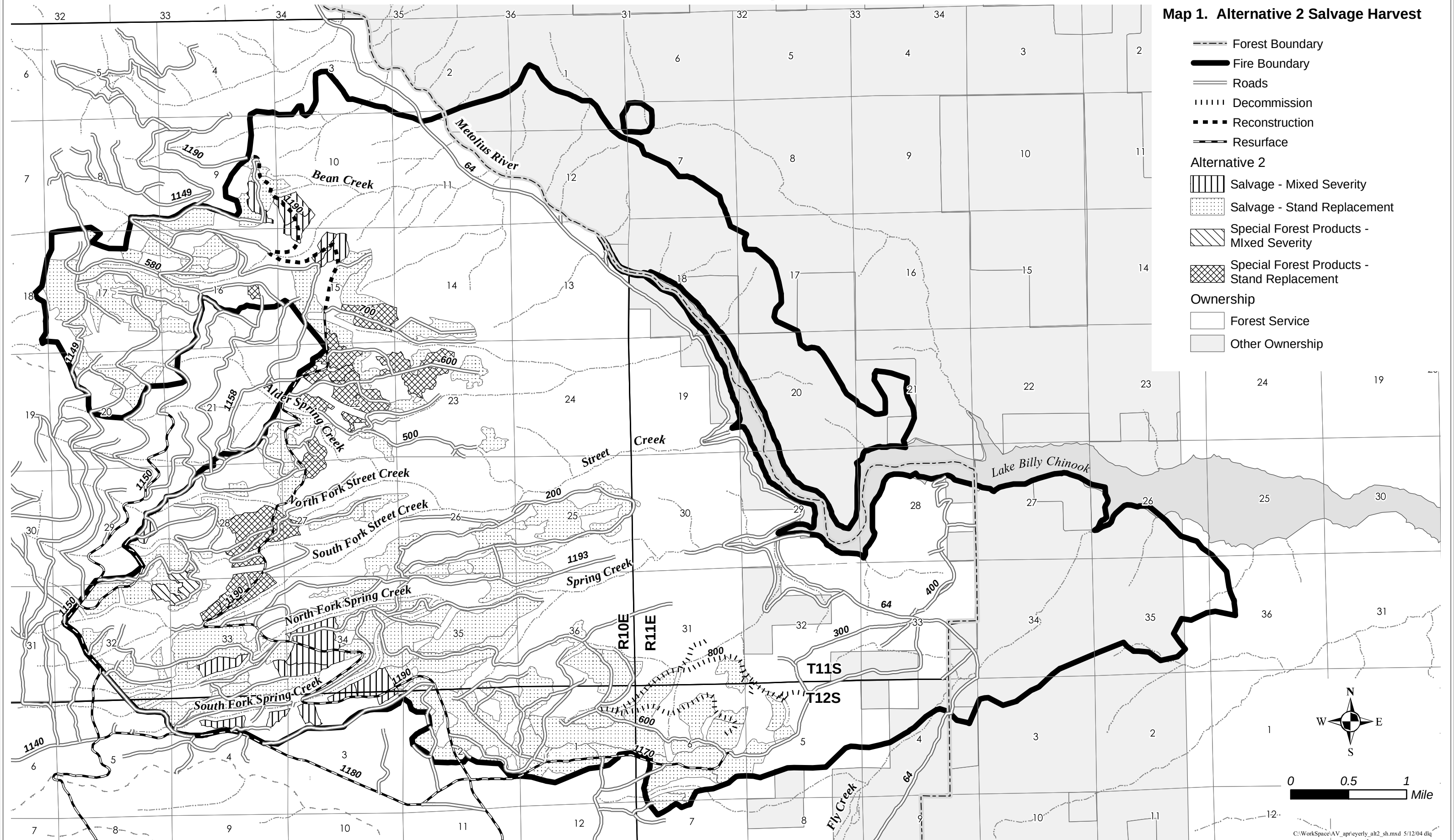
Maps 9 and 10 represent landscape-scale events described in Chapter 3, effects analysis.

❖ **Map 10.** Metolius Late Successional Reserves with Recent Large Fires (1996-2003)

Eyerly Salvage FEIS

Alternative 2 Salvage Harvest

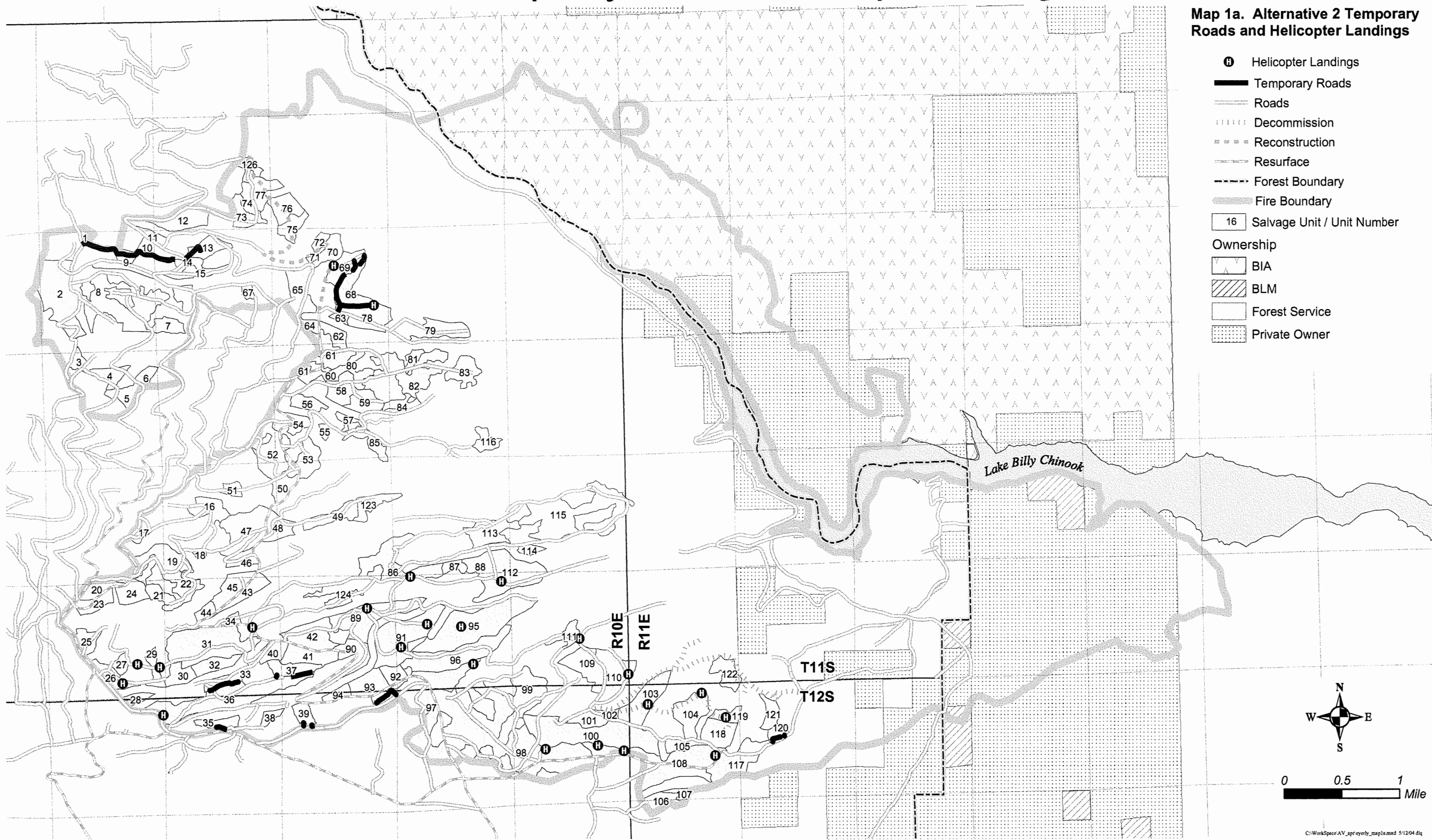
Map 1. Alternative 2 Salvage Harvest



Eyerly Salvage FEIS

Alternative 2 Temporary Roads and Helicopter Landings

Map 1a. Alternative 2 Temporary Roads and Helicopter Landings



**Eyerly Salvage FEIS
Alternative 2 Fuels Treatment**

Map 2. Alternative 2 Fuels Treatment

Legend:

- Forest Boundary
- Fire Boundary
- Roads
- Decommission
- Reconstruction
- Resurface

Alternative 2 Fuel Treatment

- machine pile & burn
- hand pile
- lop & scatter
- underburn

Ownership

- Forest Service
- Other Ownership

Map features include: Bean Creek, Alder Spring Creek, North Fork Street Creek, South Fork Street Creek, North Fork Spring Creek, South Fork Spring Creek, Spring Creek, Fly Creek, Lake Billy Chinook, and various section numbers (1-36) and township/range coordinates (T11S, T12S, R10E, R11E).

Scale: 0 to 1 mile.

North arrow pointing North.

Source: C:\Work\eyerly\eyerly_m02_fuel02_91104.dwg

**Eyerly Salvage FEIS
Alternative 2 Fuels Treatment**

Map 2. Alternative 2 Fuels Treatment

Legend:

- Forest Boundary
- Fire Boundary
- Roads
- Decommission
- Reconstruction
- Resurface

Alternative 2 Fuel Treatment

- machine pile & burn
- hand pile
- lop & scatter
- underburn

Ownership

- Forest Service
- Other Ownership

Map features include: Bean Creek, Meadus River, North Fork Street Creek, South Fork Street Creek, North Fork Spring Creek, South Fork Spring Creek, Lake Billy Chinook, Fly Creek, and sections R10E, R11E, T11S, T12S. A grid of sections is overlaid on the map. A north arrow and a scale bar (0 to 1 mile) are located in the bottom right corner.

-
- Eyerly Salvage FEIS
Alternative 2 Fuels Treatment**
- Map 2. Alternative 2 Fuels Treatment**
- Legend:
- Forest Boundary
 - Fire Boundary
 - Roads
 - Decommission
 - Reconstruction
 - Resurface
- Alternative 2 Fuel Treatment**
- machine pile & burn
 - hand pile
 - lop & scatter
 - underburn
- Ownership**
- Forest Service
 - Other Ownership
- Map features include: Bean Creek, Alder Spring Creek, North Fork Street Creek, South Fork Street Creek, North Fork Spring Creek, South Fork Spring Creek, Spring Creek, Fly Creek, Lake Billy Chinook, and various section numbers (1-36) and township/range coordinates (T11S, T12S, R10E, R11E).
- Scale: 0 to 1 mile.
- North arrow pointing North.
- Source: C:\Work\eyerly\eyerly_feis\map2.dwg 9/19/04 dfg

**Eyerly Salvage FEIS
Alternative 2 Fuels Treatment**

Map 2. Alternative 2 Fuels Treatment

Legend:

- Forest Boundary
- Fire Boundary
- Roads
- Decommission
- Reconstruction
- Resurface

Alternative 2 Fuel Treatment

- machine pile & burn
- hand pile
- lop & scatter
- underburn

Ownership

- Forest Service
- Other Ownership

Map features include: Bean Creek, Meadus River, North Fork Street Creek, South Fork Street Creek, North Fork Spring Creek, South Fork Spring Creek, Lake Billy Chinook, Fly Creek, and sections R10E, R11E, T11S, and T12S. A north arrow and a scale bar (0 to 1 mile) are also present.

-
- Eyerly Salvage FEIS
Alternative 2 Fuels Treatment**
- Map 2. Alternative 2 Fuels Treatment**
- Legend:
- Forest Boundary
 - Fire Boundary
 - Roads
 - Decommission
 - Reconstruction
 - Resurface
- Alternative 2 Fuel Treatment**
- machine pile & burn
 - hand pile
 - lop & scatter
 - underburn
- Ownership**
- Forest Service
 - Other Ownership
- Map features include: Bean Creek, Meadus River, North Fork Street Creek, South Fork Street Creek, North Fork Spring Creek, South Fork Spring Creek, Lake Billy Chinook, Fly Creek, and sections R10E, R11E, T11S, and T12S. A north arrow and a scale bar (0 to 1 mile) are also present.

**Eyerly Salvage FEIS
Alternative 2 Fuels Treatment**

Map 2. Alternative 2 Fuels Treatment

Legend:

- Forest Boundary
- Fire Boundary
- Roads
- Decommission
- Reconstruction
- Resurface

Alternative 2 Fuel Treatment

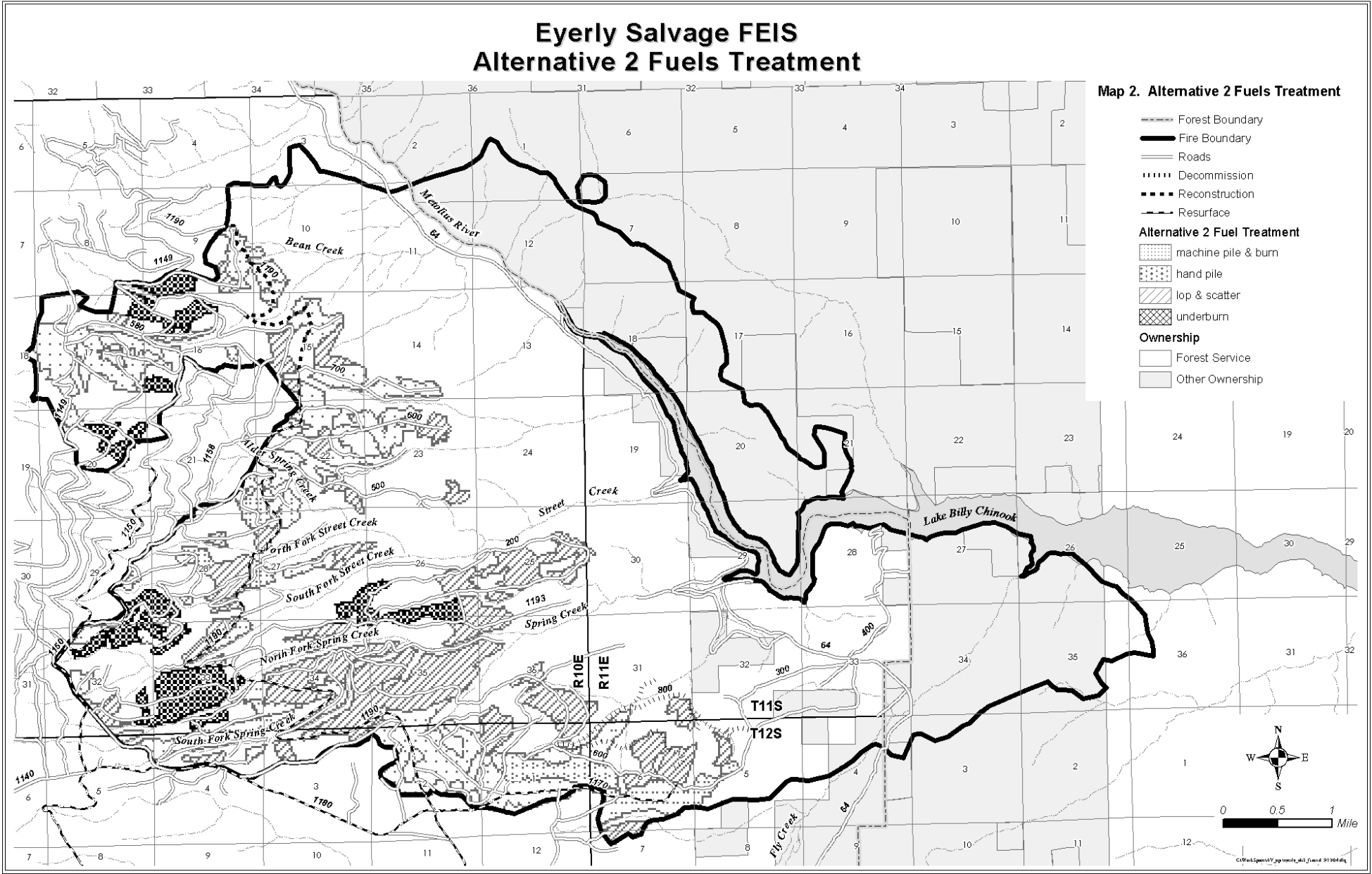
- machine pile & burn
- hand pile
- lop & scatter
- underburn

Ownership

- Forest Service
- Other Ownership

Map features include: Bean Creek, Meadus River, North Fork Street Creek, South Fork Street Creek, North Fork Spring Creek, South Fork Spring Creek, Lake Billy Chinook, Fly Creek, and sections R10E, R11E, T11S, T12S. A grid of sections is overlaid on the map. A north arrow and a scale bar (0 to 1 mile) are located in the bottom right corner.

-
- Eyerly Salvage FEIS
Alternative 2 Fuels Treatment**
- Map 2. Alternative 2 Fuels Treatment**
- Legend:
- Forest Boundary
 - Fire Boundary
 - Roads
 - Decommission
 - Reconstruction
 - Resurface
- Alternative 2 Fuel Treatment**
- machine pile & burn
 - hand pile
 - lop & scatter
 - underburn
- Ownership**
- Forest Service
 - Other Ownership
- Map features include: Bean Creek, Meadus River, North Fork Street Creek, South Fork Street Creek, North Fork Spring Creek, South Fork Spring Creek, Lake Billy Chinook, Fly Creek, and sections R10E, R11E, T11S, T12S. A north arrow and a scale bar (0 to 1 mile) are also present.



**Eyerly Salvage FEIS
Alternative 2 Fuels Treatment**

Map 2. Alternative 2 Fuels Treatment

Legend:

- Forest Boundary
- Fire Boundary
- Roads
- Decommission
- Reconstruction
- Resurface

Alternative 2 Fuel Treatment

- machine pile & burn
- hand pile
- lop & scatter
- underburn

Ownership

- Forest Service
- Other Ownership

Map features include: Bean Creek, Alder Spring Creek, North Fork Street Creek, South Fork Street Creek, North Fork Spring Creek, South Fork Spring Creek, Spring Creek, Fly Creek, Lake Billy Chinook, and various section numbers (1-36) and township/range coordinates (T11S, T12S, R10E, R11E).

Scale: 0 to 1 mile.

North arrow pointing North.

Source: C:\Work\eyerly\eyerly_feis\fig2\fig2_21104.dwg

**Eyerly Salvage FEIS
Alternative 2 Fuels Treatment**

Map 2. Alternative 2 Fuels Treatment

Legend:

- Forest Boundary
- Fire Boundary
- Roads
- Decommission
- Reconstruction
- Resurface

Alternative 2 Fuel Treatment

- machine pile & burn
- hand pile
- lop & scatter
- underburn

Ownership

- Forest Service
- Other Ownership

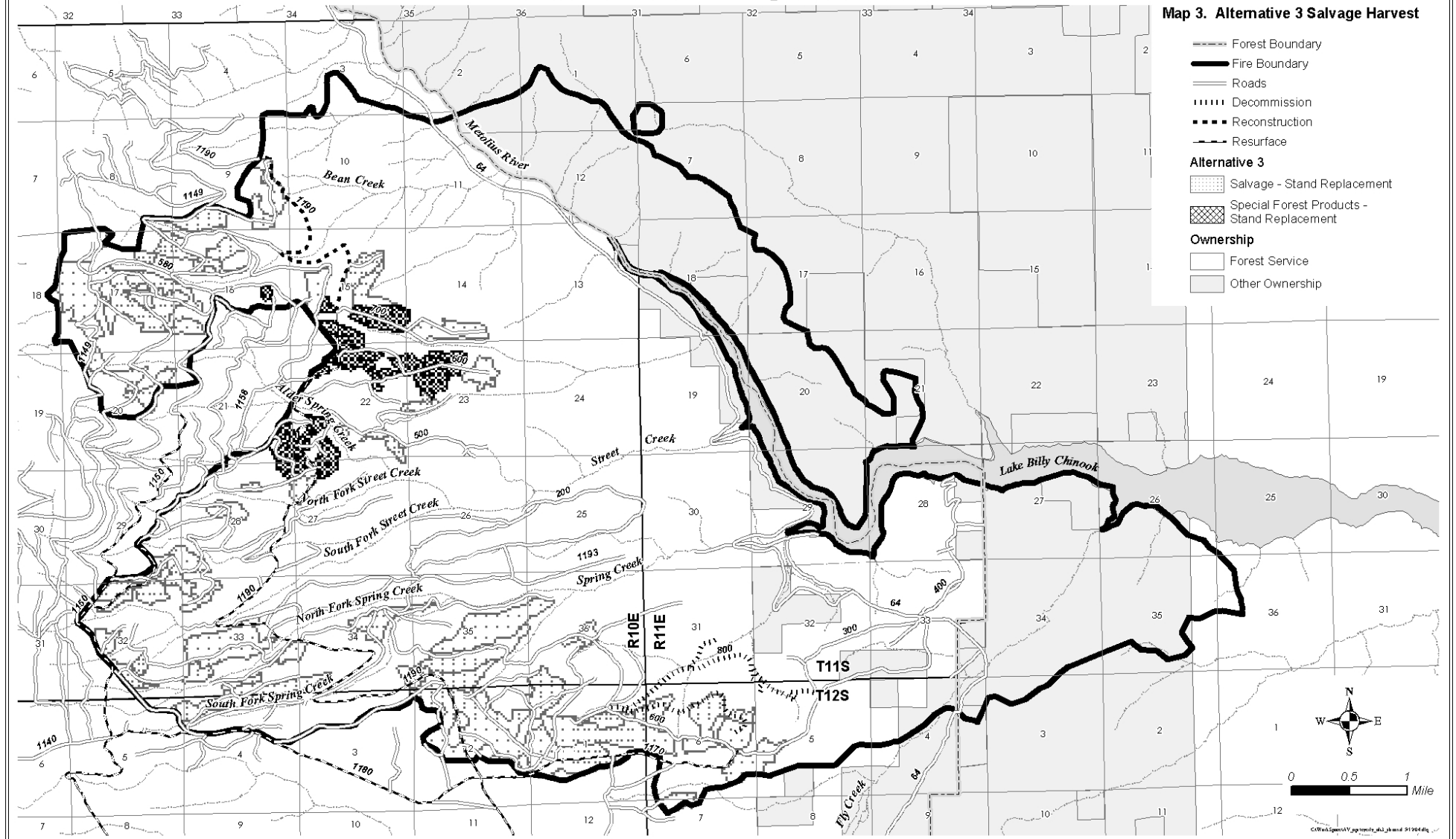
Map features include: Bean Creek, Alder Spring Creek, North Fork Street Creek, South Fork Street Creek, North Fork Spring Creek, South Fork Spring Creek, Spring Creek, Fly Creek, Lake Billy Chinook, and various section numbers (1-36) and township/range coordinates (T11S, T12S, R10E, R11E).

Scale: 0 to 1 mile.

North arrow pointing North.

Source: C:\Work\eyerly\eyerly_salvage\fig2\fig2_21104.dwg

Eyerly Salvage FEIS Alternative 3 Salvage Harvest



Alternative 3 Temporary Roads and Helicopter Landings



**Eyerly Salvage FEIS
Alternative 3 Fuels Treatment**

Map 4. Alternative 3 Fuels Treatment

- Forest Boundary
- Fire Boundary
- Roads
- Decommission
- Reconstruction
- Resurface

Alternative 3 Fuel Treatment

- machine pile & burn
- hand pile
- lop & scatter
- underburn

Ownership

- Forest Service
- Other Ownership

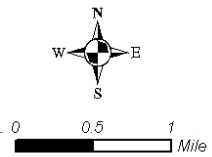
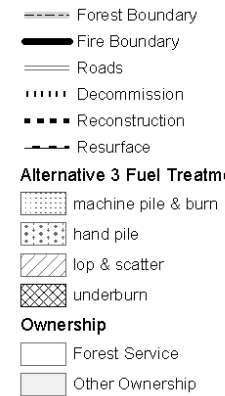
Scale: 0 0.5 1 Mile

North Arrow

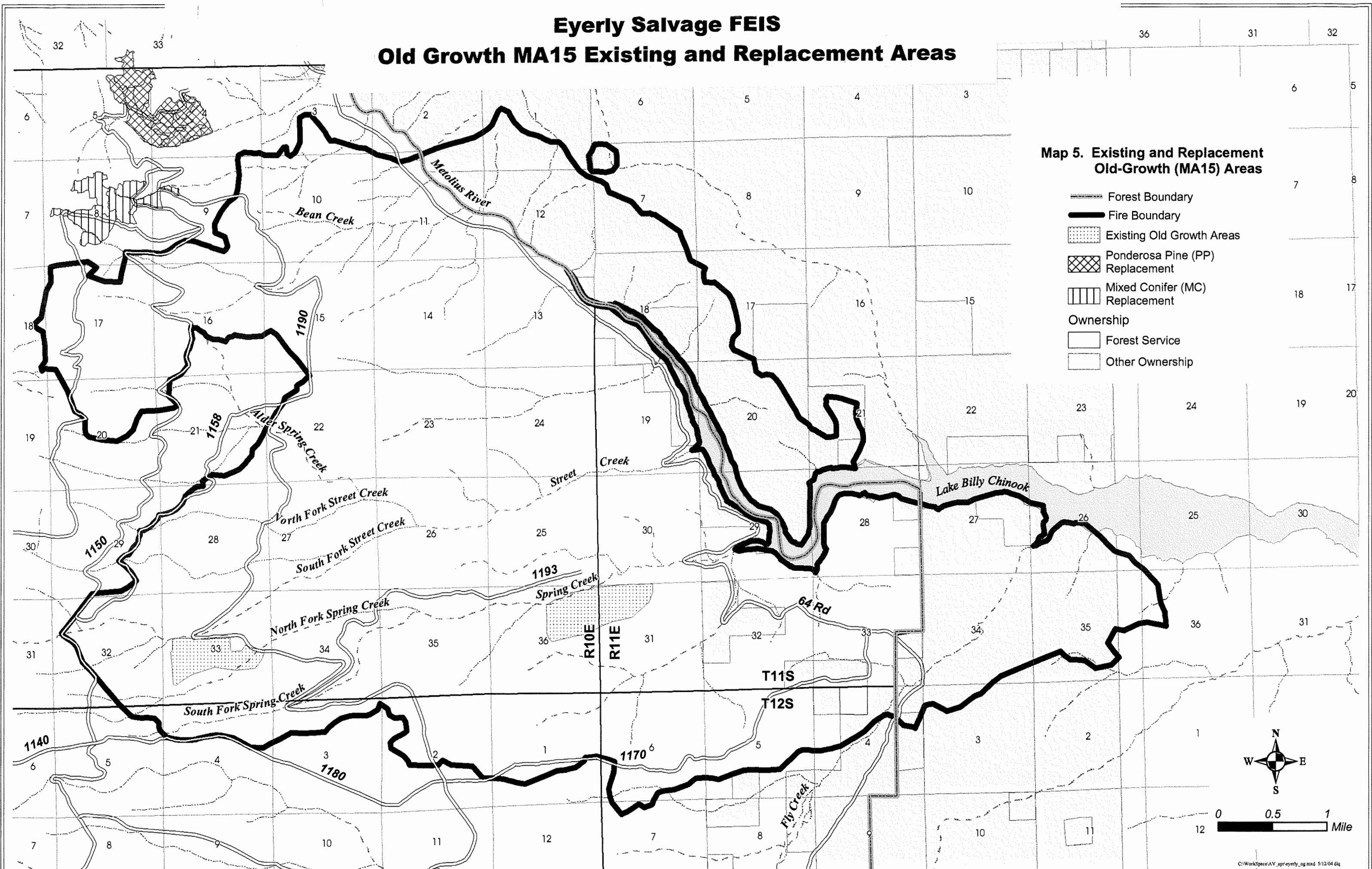
Grid Numbers: 1-36

Geographic Labels: Meadus River, Bean Creek, North Fork Street Creek, South Fork Spring Creek, Lake Billy Chinook, R10E, R11E, T11S, T12S, My Creek.

Map 4. Alternative 3 Fuels Treatment

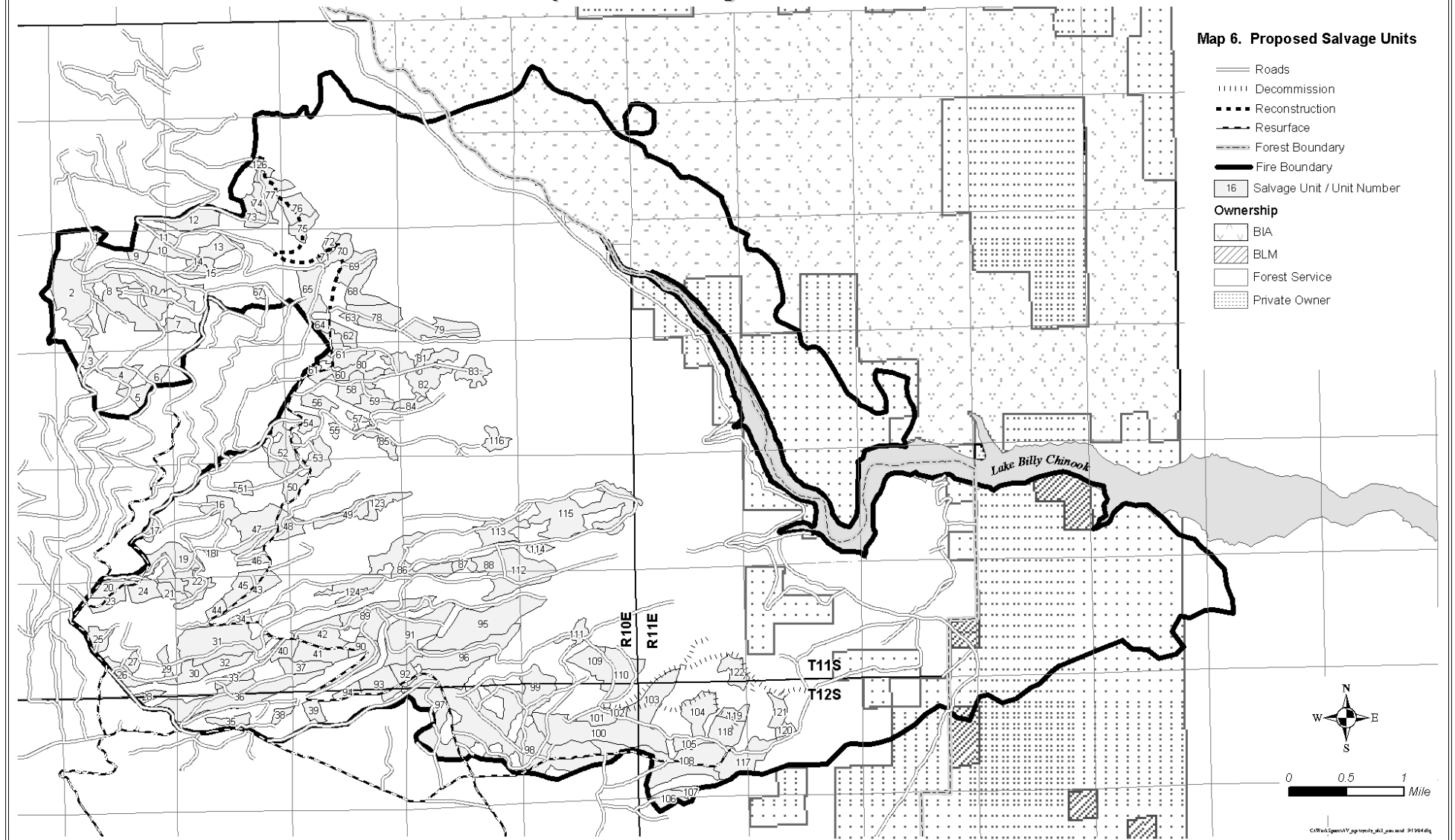


Eyerly Salvage FEIS
Old Growth MA15 Existing and Replacement Areas

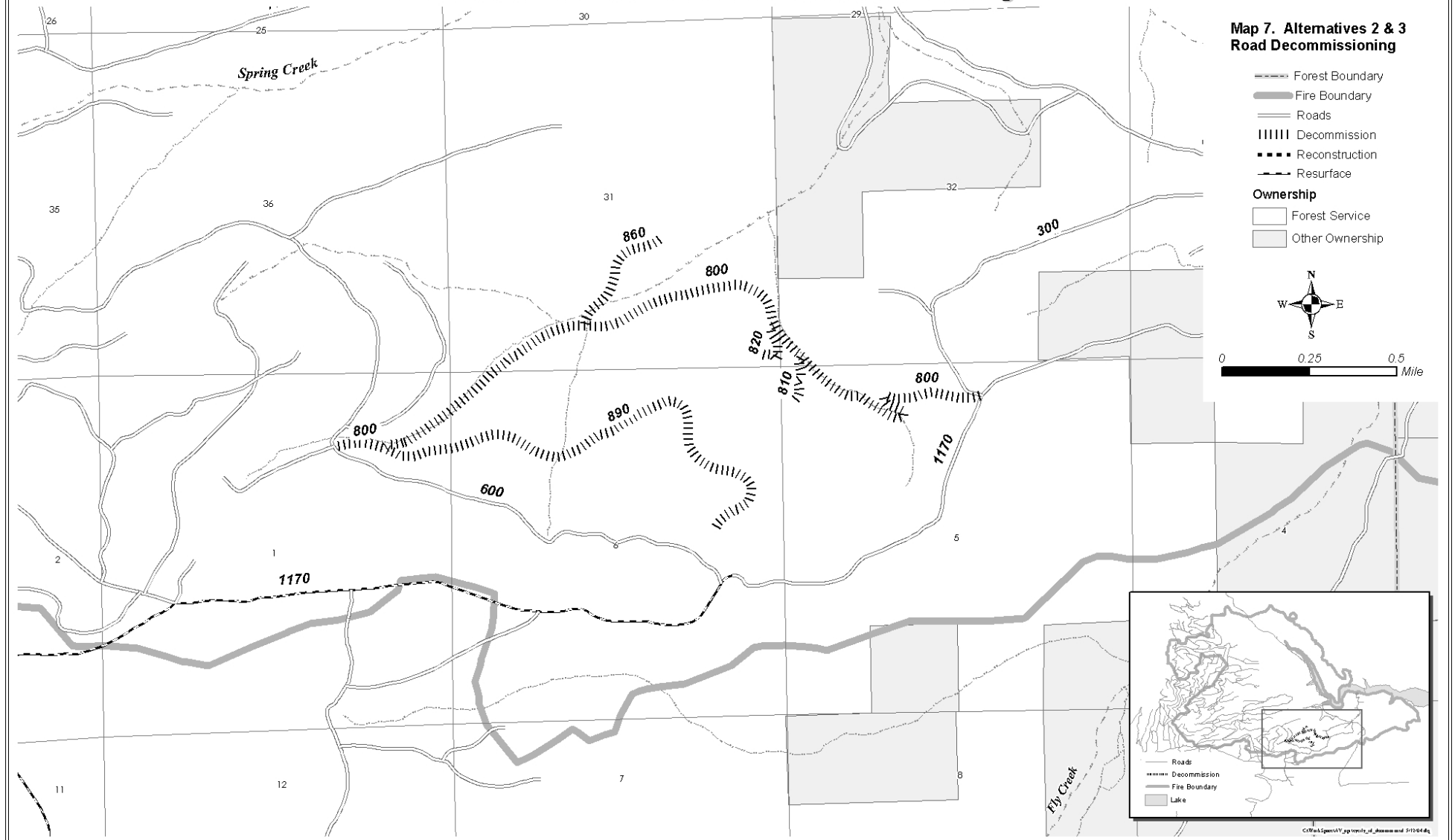


Eyerly Salvage FEIS Proposed Salvage Harvest

Map 6. Proposed Salvage Units

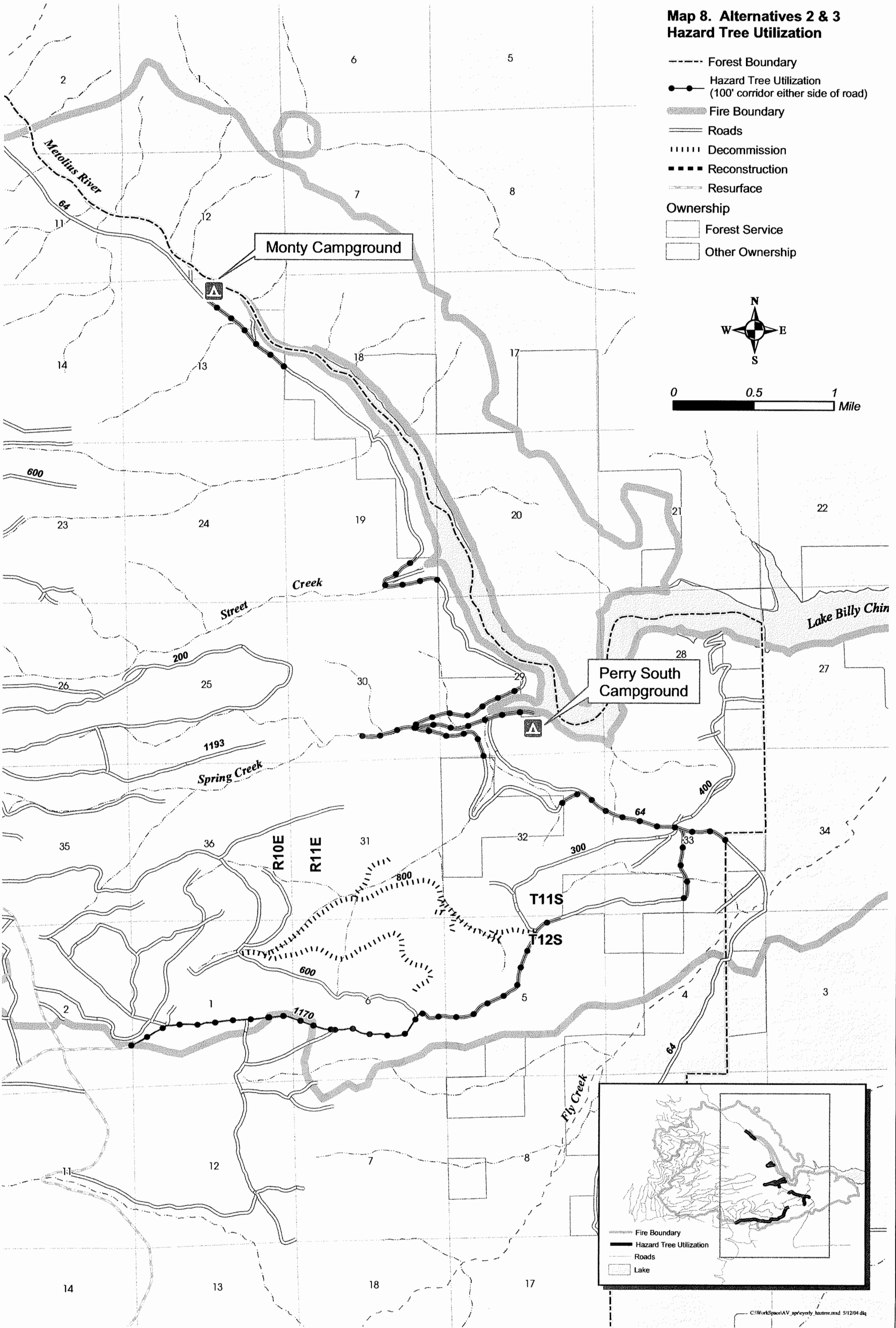


Eyerly Salvage FEIS Alternatives 2 and 3 Road Decommissioning

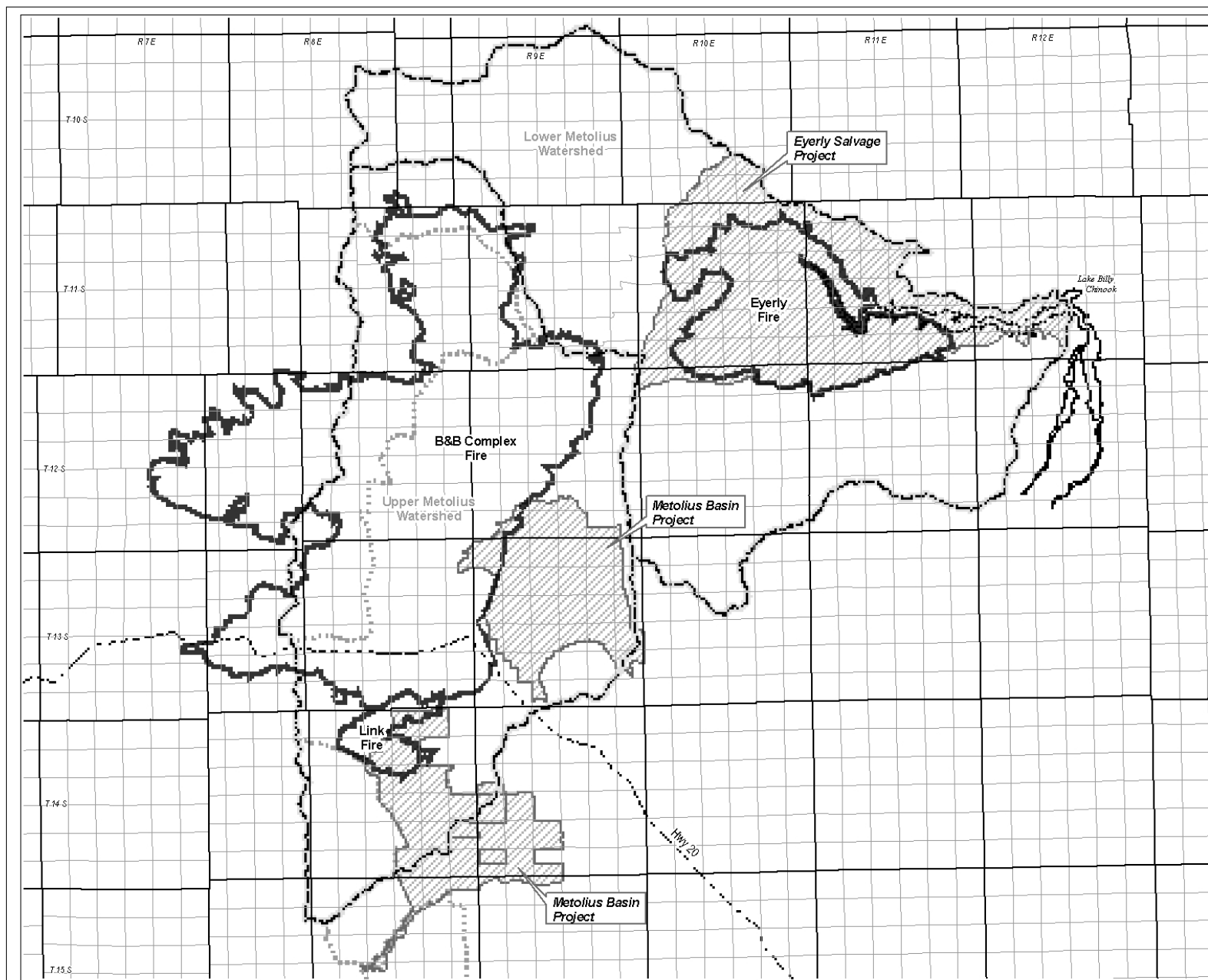


Eyerly Salvage FEIS

Alternatives 2 and 3 Hazard Tree Utilization



**Map 9. Eyerly Salvage FEIS
Recent Activities Within Metolius
Watershed (2002-2004)**



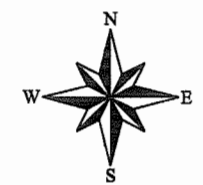
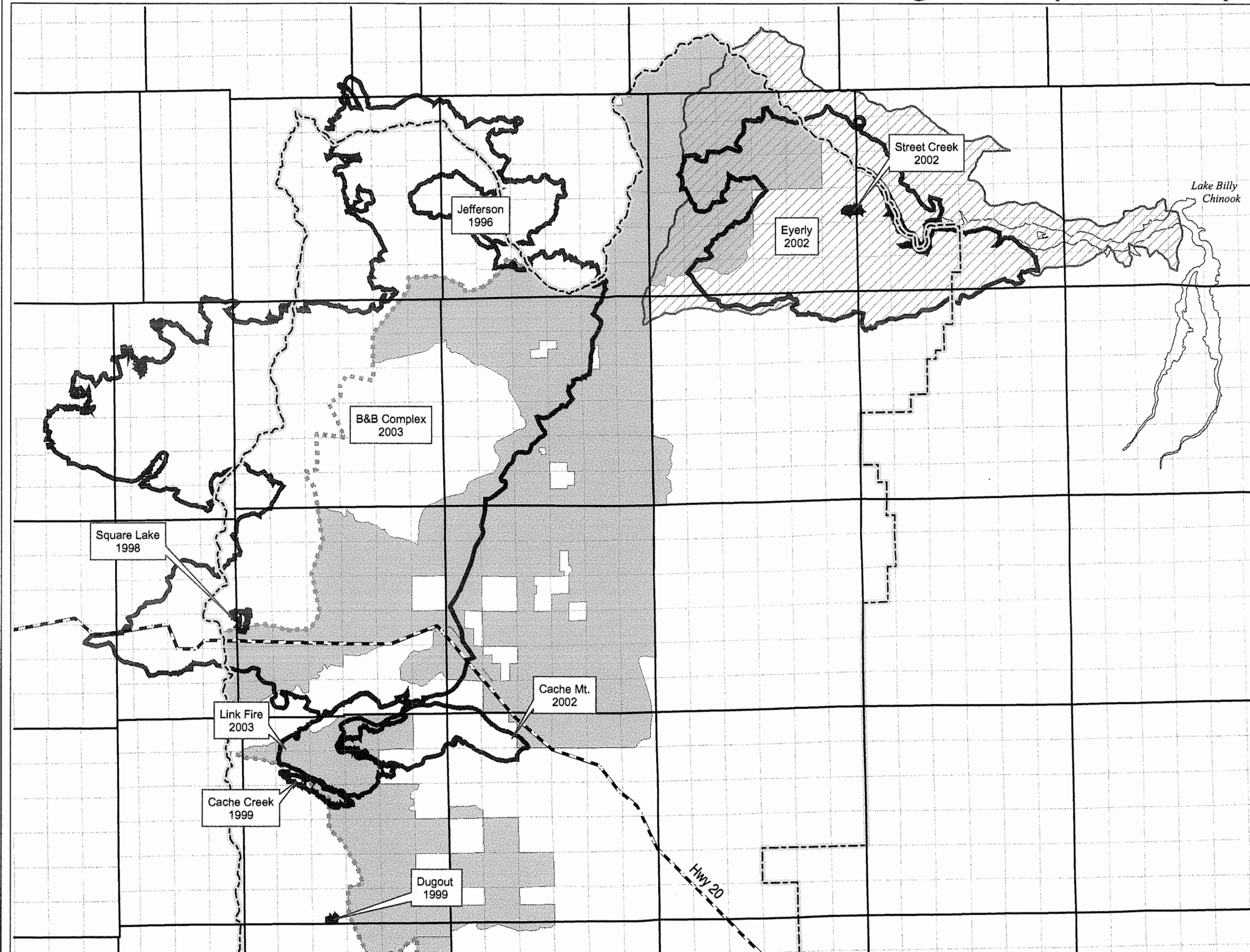
0 1 2 4 Miles

- Township and Range
- Section Lines
- Fire Boundaries
- Project Boundaries
- Wilderness Boundary
- 5th Field Watershed Boundaries
- Highway

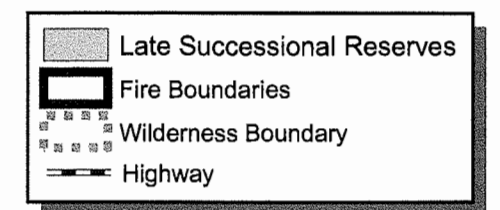
Eyerly Salvage FEIS

Metolius Late Successional Reserves with Recent Large Fires (1996-2003)

Map 10. Eyerly Salvage FEIS
Metolius Late Successional Reserves
with Recent Large Fires (1996-2003)



0 1 2 4 Miles



3.0 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

This chapter of the EIS describes both the existing conditions of and the environmental consequences that would affect the area and resources, based on the alternatives described in Chapter 2, Alternatives. For ease in presentation and comparison, the analysis discussions are separated into individual resource areas, such as soil quality, air quality, fish habitat, wildlife habitat, and botany. Although the anticipated environmental effects of alternatives were analyzed for each resource discipline, impact analyses (adverse and beneficial) emphasize those decisions that relate to the key issues and concerns identified in Chapter 1, Purpose and Need for Action. Some impacts are expressed in qualitative terms (e.g. wildlife habitat, scenic resources), others in quantitative terms (e.g. timber salvage, economic).

Effects descriptions under each resource area are divided into the following categories:

- Effects of the no-action alternative
- Effects unique to each action alternative

Effects and Commitments are defined as follows:

- **Effects** – Those adverse and beneficial direct effects:
 - Those which occur at the same time and in the same general location as the activity causing the effects.
 And, if applicable, those adverse and beneficial indirect effects:
 - Those which occur at a different time or different location than the activity to which the effects are related.
- **Cumulative Effects**– Those effects, which result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions.
- **Irreversible Commitments** – Those commitments that cannot be reversed, except in perhaps the extreme long-term.
- **Irretrievable Commitments** – Those commitments that are lost for a period of time.

Mitigation measures to be implemented for any timber salvage operations are addressed in Chapter 3, Section 3.13 Mitigation and Monitoring. By design, each alternative has built in mitigation in the form of standard and special contract clauses that would be added to the approval of any timber salvage sale. Effective mitigation avoids, minimizes, rectifies, reduces, or compensates for potential impacts. After mitigation is applied, any unavoidable adverse impacts to each resource area are addressed.

❖ 3.1 Changes Between Draft and Final EIS _____

The following changes were made between the Eyerly Draft and Final EIS. This list does not include minor grammatical corrections, editorial formatting, and clarification of data previously presented. The changes were driven by public comment and a comprehensive internal review.

1. A Past, Present, and Foreseeable Actions section is added
2. Cumulative effects analysis includes wildfires which occurred in the Summer 2003, which were not included in the Draft EIS.
3. Decision made to include the decommissioning of 3.8 miles of the 1170800 road segment following harvest activities with the selection of either action alternative.
4. Revised section analysis data in response to public comments and newly acquired information (Economics and Social; Fire and Fuels Accumulation).

❖ 3.2 Past, Present, and Foreseeable Actions _____

The activities listed address actions that occurred within or adjacent to the Eyerly project area.

Past Actions (Contributed to the Current Condition of the Eyerly Analysis area)

- Eyerly Fire suppression and rehab/BAER work (Summer 2002 – Spring 2003)
- Past timber harvest and associated road construction including regeneration harvests (late 1960's to 1990's)
- Prescribed fire and other fuels treatment (1970's to 1990's)
- Conifer reforestation associated with regeneration harvests (1980's to 1990's)
- Recreation activities including dispersed and developed camping, hunting, mushroom gathering, firewood cutting and ATV use (1960's to present).
- Large fire occurrence (1910 – 2003).
- Road maintenance (2002 – 2003)

Present Actions

- Continuing noxious weed control and monitoring (annually).
- Maintenance of roads and culverts in the fire area (annually).
- Recreation use within the area (annually).
- Continuation of Area Closure Order restricting off-road use of motor vehicles (annually).

Foreseeable Actions

- Long-term fire restoration and continuing BAER projects, reference Chapter 1 (2004 – 2006).
- Metolius Basin Forest Management Project (2004 – 2008).

❖ 3.1 Changes Between Draft and Final EIS

The following changes were made between the Eyerly Draft and Final EIS. This list does not include minor grammatical corrections, editorial formatting, and clarification of data previously presented. The changes were driven by public comment and a comprehensive internal review.

5. A Past, Present, and Foreseeable Actions section is added
6. Cumulative effects analysis includes wildfires which occurred in the Summer 2003, which were not included in the Draft EIS.
7. Decision made to include the decommissioning of 3.8 miles of the 1170800 road segment following harvest activities with the selection of either action alternative.
8. Revised section analysis data in response to public comments and newly acquired information (Economics and Social; Fire and Fuels Accumulation).

❖ 3.2 Past, Present, and Foreseeable Actions

The activities listed address actions that occurred within or adjacent to the Eyerly project area.

Past Actions (Contributed to the Current Condition of the Eyerly Analysis area)

- Eyerly Fire suppression and rehab/BAER work (Summer 2002 – Spring 2003)
- Past timber harvest and associated road construction including regeneration harvests (late 1960's to 1990's)
- Prescribed fire and other fuels treatment (1970's to 1990's)
- Conifer reforestation associated with regeneration harvests (1980's to 1990's)
- Recreation activities including dispersed and developed camping, hunting, mushroom gathering, firewood cutting and ATV use (1960's to present).
- Large fire occurrence (1910 – 2003).
- Road maintenance (2002 – 2003)

Present Actions

- Continuing noxious weed control and monitoring (annually).
- Maintenance of roads and culverts in the fire area (annually).
- Recreation use within the area (annually).
- Continuation of Area Closure Order restricting off-road use of motor vehicles (annually).

Foreseeable Actions

- Long-term fire restoration and continuing BAER projects, reference Chapter 1 (2004 – 2006).
- Metolius Basin Forest Management Project (2004 – 2008).

- Implementation of Road Management recommendations from the Eyerly Roads Analysis including 40.67 miles of road decommissioning (obliteration) and 22.49 miles of inactivation (closing) (2005 – 2007).

❖ 3.2.1 Eyerly Fire History

On the afternoon of July 9, 2002 a bolt of lightning ignited a fire on the north side of the Metolius arm of Lake Billy Chinook (LBC). Despite the effort of fire crews and helicopters carrying water, the fire grew rapidly in steep rugged terrain. It burned through areas comprised of a variety of vegetation, including cheatgrass, juniper, bitterbrush, ponderosa pine and Douglas fir trees. The maximum temperature recorded at the Colgate RAWS (Remote Automated Weather Station) on July 9th was 84°F. Over the next four days, temperatures steadily climbed and reached 108°F on July 13th. During the same 5-day period the relative humidity fell from 17% to 9%.

On July 11th the fire spotted to the south across the Metolius River. Here it continued to evade control and on the afternoon of July 12th, with temperatures at 106°F and relative humidity at 11%, the fire made a significant run to the east. This easterly run resulted in 18 residences, 19 outbuildings and 2 campgrounds being damaged.

Over the next several days, additional dozers and support from structural fire departments from across the state were employed. Firefighters were able to contain the eastern flanks; however, the rest of the fire continued burning west toward areas with higher fuel loadings, thicker canopy cover and steeper terrain. Dozers, supported by fire engines and hand crews started flanking the southern portion of the fire. Hotshot crews and heavy lift helicopters struggled to hold hand line and burn out as they flanked the north side of the fire from the river. Simultaneously, a taskforce of dozers started to construct a contingency fire line across the top of Green Ridge. Despite success on the flanks, the head of the Eyerly fire continued to burn intensely each afternoon on its westerly march. On July 22 the fire breached the dozer line on the top of Green Ridge and proceeded to back into the steep canyon formed by the Metolius River. The fire was contained at 23,573 acres the next day with the help of heavy rain and hail from the same thunderstorm that started the Cache Mountain Fire, twenty miles to the southwest.

❖ 3.3 Soil Quality (Key Issue 1)

❖ 3.3.1 Introduction

Issue: There is a potential for direct and cumulative effects from salvage operations on soil productivity. Soil productivity can be directly and indirectly affected by changes to physical, chemical and biotic elements of the soil resource as a result of natural and managed disturbance activities.

This section describes both the existing condition and the environmental consequences to the soils resource. It is based on the Eyerly Soils Report: Alternative Effects Analysis (Sussmann, 2003). The existing condition provides an overview of the landscape setting, soil characteristics in the area, the management direction, and the desired future conditions for the soils resource. This overview is followed by a detailed description of the affected environment of the soils resource as related to the:

- 1) **Physical Component** - Changes to the physical component of the soil primarily occur as compaction and displacement incurred by management activities involving machinery traffic over the native soil surface or the dedication of soil areas to roads. Compaction and displacement from past management activities, fire suppression operations and activities proposed under this EIS are quantified as the aerial extent of measured or predicted detrimental conditions within an activity area.
- 2) **Chemical and Biotic Components** - Changes to the chemical and biological components of the soil resource are primarily affected by the manipulation and removal of organic matter on site, but can also be altered by detrimental disturbance incurred by management activities. Effects to these components are tracked by describing changes in the composition and quantity of live and dead organic matter composition on site and calculating levels of detrimental disturbance levels across the project area or within activity units. Transformations of soil nutrients and biota as a result of the fire intensity and severity are summarized as a post-fire baseline to compare alternatives.

The environmental consequences of each alternative are later presented in terms of these components.

❖ 3.3.2 Existing Condition

Landscape Setting

The Eyerly Fire area covers approximately 23,134 acres on the east flank of Green Ridge and lies primarily within the Metolius, Spring, and Street Creek subwatersheds. Smaller portions of the Lower LBC Metolius, Lower Fly Creek, Metolius Horn and Big Canyon subwatersheds are also within the area. The Eyerly project area covers approximately 42,723 acres across these same watersheds and includes additional acres in the Prairie Farm and Scarp subwatersheds. The additional acres that comprise the project area were needed to consider effects beyond the fire perimeter for watershed analysis and transportation access.

Landtype classification in the Deschutes Soil Resource Inventory (SRI) describes the Green Ridge Physiographic Area as moderately dissected canyons draining relatively gentle east slopes of a Pliocene era, fault block scarp (Larsen, 1976). The topography of this physiographic area varies from gentle to moderately steep. The Eyerly Burned Area Emergency Rehabilitation team reported that within the fire perimeter, approximately 41% of the area had slopes of <15%, 29% had slopes of 16 to 30% and 30% had slopes exceeding 30% (David, 2002). Elevations range from 4,900 feet along the western crest of the Green Ridge scarp to 1,900 feet along the shores of Lake Billy Chinook on the northern and eastern boundaries of the project area. Aspects are generally easterly, with north and south aspects more pronounced along steeper canyon walls.

Primary geologic features comprising Green Ridge include Pliocene era basalts, ash flows and tuffs emitted from ancestral Cascades long since replaced by the existing Cascade subduction zone. Outcrops of tuffaceous and weathered ash materials from these older Cascades are exposed in the steep lower canyons of Street and Spring Creeks, while basaltic materials cap the majority of the subwatershed areas. A mantle of airfall volcanic ash from various sources comprises the surface portion of the regolith layer.

Soil Characteristics

Mapping: Soil surveys of the Eyerly project area have been completed by the Natural Resource Conservation Service and the U.S.D.A. Deschutes National Forest. Published surveys include the Soil Survey of the Upper Deschutes River Area (NRCS, 1992), the Warm Springs Survey (NRCS, 1999) and the Deschutes Soil Resource Inventory (SRI) (Larsen, 1976), respectively. The NRCS surveys are completed at a 1:24,000 scale and are correlated as Order 3 surveys. The SRI is completed at a 1:70,000 scale and is considered to be an Order 4 survey.

Soils within the area have developed under the influence of local geologic parent materials, topography, precipitation, and associated vegetative communities. Soil types within the fire perimeter are primarily comprised of moderately deep surface ash-fall over basaltic colluvium and residuum. The upper elevation, mixed conifer plant associations are dominated by deep well-drained soils with sandy loam surfaces; the middle elevation, Ponderosa pine associations are dominated by soils characterized by moderately deep to shallow sandy loams; and the lower elevation Juniper woodlands are dominated by shallow, well-drained soils. The inherent productivity of the soils throughout the fire area ranges from moderate to low, as measured by cubic foot site class in the SRI.

Sensitive soils: Soil Resource Inventory (SRI) map unit descriptions are used to identify sensitive soils under criteria listed in the Deschutes National Forest Land Resource Management Plan (LRMP), Appendix 14, Objective 5. Identification of fragile or sensitive soils addresses a concern expressed for post-fire salvage projects (Beschta 1995). Areas with sensitive soils have management limitations that need to be addressed during the planning of a vegetation management activity. Sensitive soil areas within Eyerly Project Area are included in *Table 3.3-1*.

Table 3.3-1. SRI mapped Sensitive Soils within Eyerly Project Area

Sensitive Soil Condition	Number of SRI Map Units in the Project Area	Acres within the Project Area	Percent of Project Area
Slopes greater than 30%: high erosion and displacement hazard	8	10,167	60%
Streams: bottomlands, natural draws, or drainage dissections	2	1,297	7.7%
High seasonal water table areas	2	298	1.8%
Compaction and Rutting: areas with high susceptibility	3*	1,656	9.8%
Low inherent productivity	3*	1,656	9.8%
Note: * Includes one SRI map unit and a component of that unit within two other SRI map unit complexes.			

Most of the sensitive soils identified within the Eyerly Project area have slopes exceeding 30% and are of a concern for their susceptibility to surface erosion and displacement. Approximately 10,167 acres, or 60% of the Project Area, are mapped by the SRI as having slopes greater than 30%, with another 1,104 acres mapped as a complex with the primary component having slopes exceeding 30%. The bottomland, wet depression areas and seasonal high water table map units (SRI units 8, 10 and 37) are found along stream course bottoms within the riparian corridors. SRI map unit 53 and the map unit 53 component of complexes TB and XL have a very low inherent productivity and are

considered to be sensitive to active management and unsuited for timber production. Map unit 53 comprises approximately 366 acres or 2% of the project area, while the map unit 53 component of complexes TB and XL comprise less than 30% of the total acres mapped as these two complexes within the project area.

Suitability: The Deschutes Forest Plan suitable lands database identifies areas considered to be suited for timber production using criteria affecting reforestation (FSH 2409.13). This database was developed to designate a planning level timber base area for the Deschutes Land Resource Management Plan (LRMP) and is broad scale in nature. Project level planning requires that lands proposed for harvest have their suitability verified based on the criteria outlined within the handbook (FSH 1909.12). Lands that do not meet these criteria are considered unsuitable or partially suitable for timber harvest due to regeneration difficulties or the potential for irreversible damage from management activities.

Units which were proposed for management activities during the Eyerly Salvage Project planning that are labeled as unsuited on the broad-scale Forest Plan data were assessed in the field for factors that affect or limit reforestation, including surface rock content and soil depth. These units include #'s 48,49,79,83-85,95,97-100,107-112,116,117,120 and 123. Existing natural regeneration densities and standing volume were also used as factors of productive capability to determine the landtype suitability within any proposed treatment areas. Based on field observations of the project silviculturalist, the units proposed for timber salvage and fuels treatments in the action alternatives meet the criteria for suitability that would allow them to be regenerated or resist irreversible damage. Proposed activity unit areas that included SRI map units 53 or TB were field verified to have deeper soils and the presence of regeneration and growth rates indicative of suitable lands.

Productivity: The Metolius Watershed Analysis (Deschutes National Forest, 1996) included the Metolius Horn and Scarp subwatersheds within its boundary and is the most recent record of analysis within any portion of the Eyerly project area. Trend and risk data included in the report identified a "red" trend rating for lowered soil quality from past activities within the Metolius Horn subwatershed. A moderate resiliency was identified for the soil resource against this trend due to the low natural soil productivity of many of the soils present, with a high risk to the ecosystem for the potential loss of forb and fungi diversity and late successional/old growth habitat. No activity units are proposed in the Metolius horn subwatershed. Although the soils within portions of the Street and Spring Creek subwatersheds are somewhat similar in composition to those in the Metolius Horn, the overall productivity within the bounds of suitable commercial forestland is slightly higher. All three subwatersheds have portions of the Metolius Roadless Area along their lower slopes that are comprised of lower productivity soil types considered unsuited for commercial forest production.

The productivity of the forestland soil resource can be measured as the Cubic Foot Site Class (Mean Annual Increment in cubic feet/year) or the Site Index (Mean 100 year height) of primary tree species located on sites considered to be undisturbed or in low disturbance conditions. Since cubic foot site class and site index numbers are means averaging multiple years of growth they cannot be used to reflect immediate changes in productivity on site but are valuable as a baseline soil productivity indicator reflective of potential production under natural conditions. These indices are also a reflection of the

resilience of a soil type to maintain productivity following disturbance from management activities or fire.

Volume and height indices for each soil type are included in the Deschutes SRI. A qualified descriptor of productivity has been assigned to the cubic foot site class for each soil type ranging from Very Low (site class 7) to High (Site class 4). Site classes 1, 2 or 3 have the highest cubic foot growth rates but are not found on the Deschutes National Forest. Soil types having site class 7 (Mean Annual Increment of less than 20 cubic feet/year) are considered unsuited for Forest Production and are included in the Deschutes LRMP Suitability [data] Layer as unsuited.

Soil productivity classes for the SRI units across the Eyerly project area total approximately 5,457 acres of high (32%), 6,648 acres of moderate (40%), 4,367 acres of low (26%) and 366 acres of very low (2%) productivity (Soil, GIS map data). In general, soils within the Eyerly project area on cooler and moister north and east aspects are less droughty and more productive. Soils at higher elevations are also more productive due to greater amounts of seasonal and annual precipitation.

Management Direction (LRMP Standards and Guidelines)

Soil Productivity: The Deschutes National Forest LRMP includes Standard and Guidelines for management of the soil resource intended to maintain or enhance long-term soil productivity (LRMP 4-70, SL-1, SL-3 and SL-4). Regional Standards and Guidelines (FSM 2500, R-6 supplement 2500-98-1) describe conditions detrimental to soil productivity and outlines Soil Quality Standards to limit the extent of these conditions to less than 20% of an activity area. Detrimental soil conditions are defined in the Soil Quality Standards as follows:

- Detrimental soil compaction in volcanic ash/pumice soils is an increase in soil bulk density of 20 percent or greater over the undisturbed level.
- Detrimental puddling occurs when the depth of ruts or imprints is six inches or greater.
- Detrimental displacement is the removal of more than 50 percent of the A horizon from an area greater than 100 square feet and at least 5 feet in width.
- Detrimental burn damage requires significant color change of the mineral soil surface to an oxidized reddish color, with the next one-half inch below blackened from organic matter charring as a result of heat conducted from the fire.
- Detrimental erosion requires visual evidence of surface loss over areas greater than 100 square feet, rills or gullies, and/or water quality degradation from sediment or nutrient enrichment.

The R6 Supplement also includes policy direction for designing and implementing management practices which maintain or improve soil and water quality. An emphasis is placed on protection over restoration within the Deschutes and Ochoco NF. Specifically, under 2520.3 – Policy, the narrative reads:

“When initiating new activities:

Design new activities that do not exceed detrimental soil conditions on more than 20 percent of an activity area. (This includes the permanent transportation system).

In areas where less than 20 percent detrimental soil conditions exist from prior activities, the cumulative detrimental effect of the current activity following project implementation and restoration must not exceed 20 percent.

In areas where more than 20 percent detrimental soil conditions exist from prior activities, the cumulative detrimental effects from project implementation and restoration must, at a minimum, not exceed the conditions prior to the planned activity and should move toward a net improvement in soil quality.”

Deschutes National Forest direction for interpreting and implementing this policy is outlined in the document “Final Forest Plan Interpretation: Standards and Guidelines – Forest-wide SL-3 and SL-4” formulated and finalized by the Forest Interdisciplinary Team on March 15, 1996 (Herrick, 96-01). The use of mitigation in order to comply with the R6 policy is defined by NEPA policy included in the Council of Environmental Quality 40 CFR 1508.02. This clause states that mitigation measures are specific actions that could be taken to minimize, avoid or eliminate potentially significant impacts on the resources that would be affected by the alternatives, or rectifying the impact by restoring the affected environment.

Effective Ground Cover: SL-6 in the Forest Plan states that effective ground cover should be met within the first two years after an activity is completed, and includes a range for each of four surface soil erosion potentials. Surface soil potentials for the SRI soil types included in the Eyerly project area and within the proposed activity units range from low to high. Effective ground cover is defined as including all living or dead herbaceous or woody materials and rock fragments greater than three-fourths of an inch in diameter in contact with the ground surface. It includes tree or shrub seedlings, grass, forbs litter, woody biomass, chips and so forth (LRMP, Table 4-30, footnote 3).

Desired Future Condition: The primary goal for managing the soil resource is the maintenance or enhancement of long-term site productivity. Region 6 Soil Quality Standards (FSM 2500, R-6 supplement 2500-98-1) define detrimental soil conditions that can reduce long-term site productivity. Desired future conditions for the soil resource include limited detrimental soil impacts across the landscape in order to maintain normal site functions associated with soil, plant and water interactions, and the maintenance of biomass on the soil surface after management activities to provide nutrient input and biotic habitat for the system. Desired conditions also entail the promotion of vegetative and organic litter cover on the soil surface to reduce erosion losses from overland flow events that might impair productivity of the soil resource.

Physical Component

Introduction: In order to describe the effects of the proposed management activities on the physical component of soil productivity, it is necessary to describe the existing condition in terms of the extent of detrimental soil conditions that exist on the landscape today. This section will describe the primary elements that have contributed to detrimental soil conditions in the area, which include past harvest history and the Eyerly Fire. The end of this section will present an overall summary of the detrimental soil conditions in the planning area.

Harvest History: Soil quality standards under the R6 Regional Supplement to the Forest Service Manual (FSM 2500, R6 Supplement 2500-98-1) apply to conditions that include compaction, displacement, puddling, burn damage and surface erosion. Impacts incurred from past timber harvest activities are primarily a result of ground-based machine harvest, yarding and fuels treatment operations. These impacts are most often expressed as compaction in areas of multiple machine passes or displacement in areas where machines have turned abruptly on loose mineral soil and/or sideslopes.

Timber harvest and fuels treatment systems can result in detrimental compaction over 15 to 30% of a unit area depending on topography, harvest prescriptions and volume removed per acre (Deschutes Monitoring Report, 1998). Monitoring has shown that bulk density increases of greater than 20% in soil types similar to those present in the Eyerly project occur after four or more passes of harvest and skidding machinery (Deschutes Monitoring Report, 1997). Although some natural recovery from compaction can occur through freeze thaw mechanisms, the soil resource in areas covered by skid trails and landings can remain detrimentally compacted for many years following operations. In general, the surface area dedicated to skid trails and landings comprises the large majority of compaction within an activity unit. Adjacent roads are included in activity area calculations and a portion of the soil resource between skid trails can be detrimentally compacted in areas of multiple machine passes from the harvest, yarding and/or fuels treatment operations.

The soil resource within the project area has been impacted primarily from past management activities associated with timber harvest and road construction dating from the 1960's. Harvest prescriptions from these activities combined with aerial photo interpretation from various flight line dates are helpful in assessing cumulative impacts to the soil resource from past activities at the subwatershed level. *Table 3.3-2* summarizes past harvest activity from 1960 to the present and road surface area within the primary subwatersheds of the project area using the harvest activity layer in Sisters District GIS database. A projected existing detrimental condition is included using an average of 25% detrimental acreage within past activity units and total road acreage present within the subwatersheds.

Table 3.3-2. Past Harvest Activity and Existing Detrimental Conditions within Primary Subwatersheds

Subwatershed (acres)	Acres w/past Harvest Activity (% of Sub)	Acres of roads (% of Sub)	Existing% of Sub in Detrimental Condition*	Alt.2 total	Alt.3 total
Metolius (13,545)	1,879 (14%)	53 (0.4%)	4%	4%	4%
Spring Ck (6,774)	4,228 (62%)	69 (1.0%)	17%	22%	20%
Street Ck (7,308)	3,588 (50%)	82 (1.1%)	13%	15%	14%
Notes: Detrimental acres were calculated as an average of 25% of past activity unit acreage plus and existing road acreage within each subwatershed. (Detrimental acreage within past activity units ranges from 10 to 30% depending on harvest prescriptions.) Alt.2 and Alt.3 totals are % of subwatershed in a detrimental condition after implementation					

The Street (50%) and Spring Creek (62%) subwatersheds have received the greatest amount of past harvest activity, while the Metolius Horn (14%) has had a smaller portion entered due to the steeper and less productive slopes on the northern end and a larger percentage of a roadless area within its boundaries. Early- and mid-20th Century harvest activities that occurred prior to assembled harvest records were primarily associated with private timberland and small mills located locally along Green Ridge (Claeyssens, personal communication). While evidence of these operations exists, the extent and impacts are not well documented.

Summary of Detrimental Soil Compaction: As pointed out above, field analysis of existing soil conditions within portions of the project area was completed during the fall field season following the fire. This information was collected for all silvicultural stands initially proposed as possible activity units and converted to units included in the Proposed Action and Alternative 3.

Field surveys utilized oriented, paced transects documenting the visual location and condition of points in order to tabulate the percentage of area currently in skid trails and landings. Probing of skid trails with a shovel to measure resistance to penetration showed that more than 90% of skid trail and landing surfaces were detrimentally compacted. As a result, a conversion from surface area committed to skid trails and landings to acres detrimentally compacted occurs on a one to one basis.

Appendix B, Table B-5 summarizes field measured detrimental conditions for each proposed activity unit. The majority of the units are a direct translation of a surveyed silvicultural stand number while others include portions of two or more stands. Documented past harvest activities from the GIS database and disturbance visible on aerial photographs were used to help refine the existing detrimental condition assessments in proposed activity units that are comprised of portions of multiple stands.

In general, the amount of area with detrimental compaction within proposed activity units is relatively low and currently meets the Regional 20% Standard for the allowable extent of detrimental conditions. *Table 3.3-3* is a summary of point data collected on transect surveys and converted to a percentage of surface area in skid trails and landings within the silvicultural stands and proposed activity units for action alternatives. The entire surface area in skid trails and landings is considered detrimentally compacted for this analysis.

Table 3.3-3. Existing Detrimental Compaction within proposed activity units

% activity area * in skid trails	0 to 5%	5 to 15%	15 to 20%	>20%
# of stands (%)	85 (31%)**	163 (59%)	14 (5%)	13 (5%)
Alt. 2 units (%)	48 (39%)	60 (48%)	13 (10%)	3 (2%)
Alt. 3 units (%)	34 (46%)	33 (45%)	7 (2%)	0
Notes: * Percentage ranges are the aerial extent of activity area considered detrimentally disturbed from compaction. ** Number of units with percent of total units in parenthesis				

The Eyerly Fire

Dozer and hand line construction: The construction of dozer and handlines during fire suppression activities has created detrimental post-fire soil conditions in the form of compaction and displacement within portions of the fire area. Approximately 84 miles of total dozer line in segments varying from 10 to 40 feet in width were constructed during fire suppression activities, equating to approximately 203 acres at an average width of 20 feet per line. These lines were observed to have variable conditions of compaction and displacement along their extent, generally averaging detrimental conditions from machine operations on 50% of their surface area. Rehabilitation of these areas during BAER operations constructed selectively located waterbars to dissipate overland flow energy but did not include actions to alleviate compacted conditions.

Handlines constructed during fire suppression efforts generally average 18 to 24 inches in width. These areas are devoid of organic cover and somewhat compacted from foot traffic egress during suppression and rehabilitation operations. Handlines throughout the fire area had waterbars installed during fire suppression rehabilitation operations, with variable amounts of re-contouring or replacement of surface organics.

Stand mortality classes: For vegetative and other resource analysis purposes, stands within the fire perimeter were placed into three post-fire silvicultural mortality classes using LANDSAT data and field verified fire intensities. *Fire Intensity* is generally mapped from the air as an initial framework for describing the extent and severity of a fire and is classified according to the extent, condition and consumption of crown foliage and small branches on trees and herbaceous ground vegetation. The three mortality classes include the Stand Replacement class, representing the high and moderate intensity data (>75% mortality, needles entirely consumed), the Mixed Mortality class, representing the low intensity data (25% to 75% mortality, needles of dead trees brown but present) and the Non-Lethal Mortality class, representing the under-burned and unburned intensity data (<25% mortality, primarily green needles).

Approximately 11,175 acres are classified as *Stand Replacement* as a result of the fire. These areas are primarily concentrated in the middle and lower elevation Ponderosa Pine plant association groups (PAG's) containing soils with moderate productivity and variable amounts of litter and duff accumulated prior to the fire. Although the fire advanced through the pine type very rapidly, the consumption of surface litter and duff was generally at or near 100%, and needle consumption on fire-killed trees was also nearly complete. Some stands along the periphery of the wind driven stand replacement areas or smaller blowouts did not have their needle component consumed and have since contributed needle fall to the ground.

White and gray ash was deposited on the surface in many of these stand replacement areas at depths up to 5 inches thick. Below ground charring indicative of significant heat pulses and consumption of soil organic matter is variable but not predominant in these areas. Large down wood on the surface or old stumps were generally consumed completely in these areas, leaving a reddish-orange discoloration of the mineral soil beneath them. These areas of mineral soil discoloration were not observed to have elevated levels of hydrophobicity and comprise approximately 4% of the high burn severity within the fire perimeter.

Stands classified as *Mixed mortality* are primarily located in the Mixed Conifer PAG's, many of which include a Douglas Fir and/or an Incense Cedar component. Litter and duff

levels prior to the fire were generally thicker and more extensive in the Mixed Conifer PAG's than in the ponderosa pine PAG's. Overall, these stands had approximately 1/3 of their area left in each mortality class following the fire. Lower fire intensity within these Mixed mortality stands produced less crown and bole scorch and variable needle consumption on the fire-killed trees. Slightly lower litter and duff consumption ranging from 50 to 80% also occurred in these areas and most of these stands have a significant needle fall component already on the soil surface following the fire. Ash accumulation was much less in these areas while some large down wood and stumps were not entirely consumed and only moderately charred.

Stands classified as *Non-Lethal* are also primarily located within the Mixed Conifer PAG's but had low tree mortality ranging from 5 to 25%. The fire effectively underburned through these stands, with little crown or bole scorch, variable consumption of surface litter and duff ranging from 20 to 50% and little ash left behind. Large down wood and stumps were charred lightly but remain relatively intact.

Fire Severity: Fire severity classes have been developed in order to describe the effects incurred on various resource values and conditions as a result of a wildfire. Initial mapping was completed by a Burned Area Emergency Rehabilitation (BAER) team in order to assess post-fire risks to public health and safety and aid in the development and implementation of emergency rehabilitation measures. Further refinement of this layer was done during the EIS analysis to more accurately describe these effects on the hydrologic response and productivity of the soil resource. *Table 3.3-4* compares the extent of the severity classes mapped by the BAER team with those generated during the analysis to reflect burn severity as it relates to hydrologic response, or the susceptibility to erosion, and the productivity of the soil resource.

Table 3.3-4. Burn Severity class within Eyerly Fire by GIS layer

Severity layer *	Severity Class acres		
	High	Moderate	Low
1) BAER 2500-8	32%	34%	34%
2) Hydrologic Burn Severity	73%	19%	8%
3) Soil Productivity	1%	65%	34%
Note: *The three severity analysis layers include: 1) the layer developed by the BAER team and summarized on the FS2500-8 report for the Eyerly fire; 2) the layer describing the hydrologic severity in terms of the loss of surface cover and associated susceptibility to surface erosion; and 3) the Soil Productivity layer which describes the level of detrimental burn damage to the soil resource.			

1) BAER 2500-8: Current direction and sideboards for Burned Area Emergency Rehabilitation (BAER) assessments of fire effects on soil and vegetative resources recommend the use of severity classes to describe the manner in which the intensity of the fire, described specifically as the heat released and flame lengths created during the combustion of fuels, has affected these resources above and below ground (BAER, website). A severity rating is derived from observations of post-fire conditions on the ground including soil, vegetative and topographic conditions that may affect watershed processes such as erosion, sediment delivery, peak storm flows or the productivity of the soil resource. The ratings included in the BAER manual speak primarily to soil resource characteristics such as litter and duff consumption, soil temperature, depth of ground char, presence and color of ash and woody debris consumption following the fire.

The determination of severity class by a BAER team is often integrated into a classification that best describes the overall post-fire effects of the burn on multiple resources. This integrated severity classification, however, can dilute or inaccurately describe the fire's effects on individual resource characteristics, or different characteristics of the same resource such as soil productivity and susceptibility to erosion. In order to more accurately describe the fire effects on the soil resource for this analysis, separate severity layers representative of the soil erosion/water runoff and soil productivity components were developed from further field observations for the Eyerly project area. The amount and extent of detrimentally burned soil as it relates to soil productivity and the surface area void or reduced of effective vegetative or organic litter ground cover as it relates to the hydrologic response of the soil during rainfall events were separately mapped and quantified for the analysis.

2) Hydrologic Severity: Erosion Susceptibility: The layer describing severity as it relates to increased susceptibility to erosion and water runoff relates directly to the stand mortality class layer and the associated loss of effective ground cover. Field reconnaissance determined that severity classes describing the watershed response conditions of erosion and water runoff could be derived from the three condition classes of the stand mortality layer. The mortality condition class data was used to populate a fire severity layer describing erosion/water runoff responses using a direct conversion of Stand Replacement acres to High severity, Mixed mortality to Moderate severity and Non-Lethal to Low severity. The resulting layer was used as the burn severity layer for predictions of erosion rates and sediment yields, as well as Evapotranspiration (ET) and peak storm flow models.

Further field measurements of detrimental burn damage, compaction, duff retention and needle fall coverage within approximately 275 silvicultural stands classified as having Stand Replacement or Mixed Severity mortality classes (Shank, 2003) were made to help verify the erosion susceptibility layer. Duff retention was limited throughout these areas, with only 12% of the sampled stands showing measurable duff retention. Post-fire needle fall had occurred in 63% of stands, generally covering 20 to 60% of the ground area, while the remaining stands will not have cover provided by needle cast. Stands with needle cover are primarily in the Mixed Mortality class and portions of the Stand Replacement mortality class that did not have all their needles consumed by the fire. Most of the needles fell to the ground during high wind events in November and December and, in many cases, provide the only organic material currently on the ground.

The near complete consumption of live vegetation, litter and duff on the soil surface is relatively contiguous throughout the Stand Replacement stand mortality class, with greater retention of all of these components within the Mixed and Non-lethal classes. Exposed mineral soil is estimated to range from 75 to 100% in the Stand Replacement mortality classes, 40 to 75% in the Mixed Mortality and 20 to 40% in the Non-Lethal stands that were essentially underburned by the fire event. Some soil types present below rock outcrops on the north facing slopes of Spring and Street Creek drainages have a considerable component of surface rock that reduces the amount of mineral soil exposed to around 70% within some areas of Stand Replacement mortality. Undisturbed, pre-fire cover conditions within the Mixed Conifer and Ponderosa Pine PAG's have an estimated 20% and 30% exposed mineral soil, respectively, levels which were used to compare calculated post-fire changes to rates of erosion losses.

3) Soil Severity: Productivity: Describing fire effects on soil productivity utilizes the detrimental burn conditions outlined in Regional Standards and Guidelines (FSM-2500, R6 Supplement 2500-98-1). Assessment of field conditions for this analysis found that areas classified as high severity by the BAER team over-estimated the amount of the soil resource considered detrimentally burned using these criteria. Mineral soil color change, below ground char and organic matter consumption associated with conditions that could affect a significant reduction in productivity are present under down logs and old stumps but are not contiguous across the mapped polygons analyzed. Field measurements from post-fire soil transect surveys show these conditions on an average of less than 4% of stand acreage. Only two surveyed stands have amounts meeting the detrimental burn damage criteria on greater than 8% of their area (Shank, 2003).

The return of vegetation within the fire perimeter also supports a lessened severity class describing effects on soil productivity for many acres initially classified as high severity by the BAER team. Native and seeded vegetation has returned extensively on soils that were originally classified as high severity (Suna, 2003) and even within areas of mineral soil discoloration underneath down wood consumed during the fire, where this re-growth was observed to be slightly reduced in size and number compared to adjacent areas (Dewey, personal communication). As a result, the high severity acres describing effects to soil productivity are 4% of the acres classified by BAER as high severity, which is the average amount of detrimental burn damage surveyed in the field within proposed activity units. The remaining high severity acres and all of the moderate severity acres classified by BAER were combined to represent moderate severity and the low BAER acres remained low severity for the soil productivity severity layer.

Post-Fire Erosion Control: BAER rehabilitation also included aerial seeding, contour felling, channel buffer felling and log erosion barriers on selected slopes to capture sediment and provide surface roughness to reduce overland flow energies. These projects covered approximately 2,433, 250, 100 and 120 acres, respectively, within the Spring and Street Creek subwatersheds. Contour felled trees were partially de-limbed in order to allow the bole to lie at or close to the surface and perpendicular to the slope. Channel buffer treatments felled trees within dry draws at a slight angle from the draw bottom up the slope. These trees have few or no limbs removed and generally do not lay completely flush with the soil surface. Log erosion barriers were completely de-limbed and recessed into the mineral soil, perpendicular to the slope. Monitoring of log erosion barriers was set up to qualitatively measure their effectiveness over time (Eyerly BAER, 2002).

Aerial seeding of sterile winter wheat and rye occurred on approximately 2,433 acres during October of 2002 at a recommended rate of 20 lbs/acre or approximately 5 and 15 pure live seeds/ft², respectively. Actual application rates were variable and averaged 19 lbs/acre and closer to 8 and 12 pl/ft² of the wheat and rye species (Pajutee, 2002). Sprouts of these seeds were first seen in late winter and have grown to appreciable size over extended portions of the seeded area during the spring and early summer months of 2003. Quantitative monitoring of sediment movement using silt fences installed on burned slopes with near or complete loss of litter and duff was implemented in order to measure the effectiveness of rehabilitation methods on seeded, unburned and burned slopes with log erosion barriers in reducing erosion. The lack of significant precipitation events to date has limited any movement of a quantifiable nature.

Summary of Detrimental Soil Conditions: *Appendix B, Table B-5* summarizes the existing detrimental conditions within proposed activity units.

Chemical and Biotic Components

In order to assess changes to the chemical and biotic components of the soil resource as a result of the fire, they must be defined as measurable entities capable of showing change. These components include the pool of nutrients contained within the soil matrix and soil organic matter along with bacterial and fungal microbial populations. Carbon, nitrogen, phosphorus and sulfur are also contained in above ground organics and vegetation within the forest system. Specific changes to on-site pools of carbon and nitrogen can alter the carbon to nitrogen ratio (C:N), which is important in describing effects of the fire on soil productivity and microbial activity since many microbial and plant growth processes are influenced by this ratio. This section will first describe the pre-fire nutrient pools and C:N ratios, and then describe the affect of the fires and the influence of retardant used on the fires on these parameters.

Pre-fire Nutrient site budgets and C:N ratios: Total nutrient site budgets of forested systems include above and below ground organic and mineral components that contain the primary nutrients in a variety of forms. Above ground vegetation, wood residues, litter and duff are estimated to contain approximately 54% total carbon, 15% total nitrogen, 4% total sulfur and <1% total phosphorus stored within an east-side forest system, as measured on long-term productivity plots on the Deschutes National Forest in a second growth, 50 to 70 year old Ponderosa Pine stand (Little and Shainsky, 1995).

Significant amounts of these nutrients are stored on site within the soil profile and were measured in Mazama ash soils beneath second-growth Ponderosa Pine stands to be 78 million grams/acre C (40% total C); 3,355 lbs/acre N (85% total N); and 8,926 lbs/acre P (99% total P). The soil profile in these forest systems contains lower concentrations of carbon, nitrogen and sulfur than the above ground organic components but stores a significant amount of the total budget of these nutrients, especially phosphorus, on site. The surface horizons in these soils contain up to 30% of total soil borne carbon and 25% of total soil borne nitrogen in these systems (Little and Shainsky, 1995).

Carbon to nitrogen ratios of a forested system can be calculated using amounts contained within the soil profile only or including live roots and the surface litter and duff. A functional site C:N ratio reflecting soil productivity utilizes carbon and nitrogen contained in the topmost mineral A1 and A2 surface horizons. A pre-fire ratio of soil-borne carbon and soil nitrogen is estimated to be approximately 30:1 in eastern Cascade systems (Busse, personal communication). Calculations utilizing amounts measured from the destructive sampling of plots within second growth ponderosa pine stands measured C:N ratios of 24:1 using amounts contained in the surface mineral horizons and 30:1 when live roots and surface litter and duff were included (Little and Shainsky, 1995). Soil biota, including bacterial and fungal populations, are likely present within the project area soils at levels similar to those measured in soils present in the Metolius Basin (Moldenke, 1998).

Fire induced losses of below ground nutrients: Changes in the chemical and biotic components as a result of the fire relate directly to the intensity and duration of heat generated during the event. The losses of nutrients contained in the soil profile are difficult to measure and likely quite variable across the fire area. The greatest losses

occurred in areas where mineral soil discoloration was observed under down logs or old stumps where extended durations of temperatures capable of volatilizing these nutrients occurred. Soils in these areas are likely to have had a measurable duration of temperatures in excess of 200 degrees Centigrade (C) capable of volatilizing nutrients in solution, as well as soil-borne organic matter and fungal and bacterial populations. As previously described, these areas comprise approximately 4% of the high severity acres mapped by the BAER team or approximately 296 acres within the fire perimeter and will likely have had temperature pulses and durations similar to those measured in soils on the forest during pile burning (Sheay, 1993).

Although the fire burned during a very dry mid-summer period when fuel moistures were quite low, the poor conductance characteristics of soils derived from ash and pumice, especially when soil moistures are below field capacity, likely kept temperatures within the soil profile well below 200 degrees C for the majority of the area. Hydrophobic soil properties indicative of hot burn temperatures were not observed to any measurable extent following the fire within the top few centimeters of the soil profile. While the characteristic nature of the older ash component present in these soils is slightly more conducive to heat transfer down through the profile than soils derived from younger and more pumiceous ash of Mazama, Blue Lake or Sand Mountain tephras located to the south, the depth and amount of below ground charring indicative of heat pulses was observed to be relatively minimal throughout the fire area.

Losses of soil-borne carbon and nitrogen from the fire are estimated to be similar to levels measured in soils derived from ash on other fires located on east-side forest landscapes within the region. Post-fire nitrogen levels measured in the A1 (topmost mineral) horizon of soils within the Entiat fires of 1970 were nearly 66% of natural pre-fire amounts. Losses of nitrogen at these rates could total as much as 160 lbs/ac N from the A1 horizon (Grier, 1975). Quantifying the loss of soil carbon is more difficult but could be as high as 10,000 lb/ac if 50% of the carbon contained in the A1 horizon was combusted.

Fire induced losses of above ground nutrients: The consumption of above ground vegetation, wood residues, litter and duff during the fire removed components of the nutrient pool that contain high concentrations of primary nutrients but a relatively low percentage of the total content of these nutrients on site. The loss of carbon contained in above ground vegetation and larger residues on the soil surface was calculated as an average of 100% of the coarse wood residues, 60% of the tree crown component and 20% of the tree bark component on site. Losses at these levels are calculated to be approximately 31% percent of total C and 11% of total N on site, and 59% of above ground C and 82% of above ground N on site. Fire losses at these consumption rates account for less than 1% total P and <3% of total S on site.

Nitrogen levels present in ash left behind on the soil surface in the Entiat fire were measured to be only 3% of that contained in pre-fire forest floor litter and duff, translating to a potential loss of 133 lbs/ac N from the consumption of litter and duff (Grier, 1975; Little and Shainsky, 1995). While the ash left behind on the soil surface contains small amounts of nitrogen, there are significant amounts of cations such as calcium, magnesium, potassium and sodium remaining behind in this material (Grier, 1975). Losses of carbon contained in litter and duff was nearly 100% of this component and could total approximately 7,140 lb/ac (Little and Shainsky, 1995).

Fire induced changes in C:N ratios: The consumption of soil-borne carbon and nitrogen contained in the A1 horizon by the fire could reduce the amounts of these nutrients considered for a functional C:N ratio by 50% for carbon and 33% for nitrogen. Since there was 20 to 30 times more carbon than nitrogen under pre-fire soil conditions, the total losses of each nutrient for calculating changes in C:N ratios are likely similar. Surface temperatures capable of volatilizing nutrients do not appear to have been extensive and the combustion of organic carbon likely occurred to a greater degree than the volatilization of nitrogen on these sites. Inferring changes to the soil-borne C:N ratio following the fire is difficult because nitrogen volatilizes at low temperatures and incompletely mineralizes to plant available ammonium at levels up to double that of those prior to the fire (Clark, 2001). The flush of available nitrogen following the fire will initially indicate a more active system in terms of nutrient availability reflective of a reduced C:N ratio for the first year, although the system will likely return to a soil C:N ratio similar to pre-fire levels within a few years. Although the ratio is not considered to have changed significantly, it is likely to have been lowered to some degree. Carbon to nitrogen ratios in the Hinman fire in Colorado were lowered to 16:1 in areas of heavy 1,000 hr fuel loading (Rumbaitis del-Rio, unpublished).

Fire induced losses of soil biota: The loss of fungal and microbial populations and inorganic forms of nutrients in soil solution occurred to varying degrees throughout the fire area and is also difficult to quantify. Studies at the Awbrey Hall fire on the Deschutes National Forest and the Mt. Lassen fire on the Lassen National Forest in California showed minimal short and long-term effects on bacterial populations and only short-term declines in fungal populations following wildfire (Busse, personal communication). Microbial populations in soils of the Eyerly fire have likely been only partially diminished from pre-fire levels in areas where ash production from the consumption of fuels was measurable but mineral soil discoloration did not occur. The return of mycorrhizal fungi in many areas of the fire during the spring of 2003, as well as herbaceous annuals and shrubs throughout the fire area during the spring and summer of 2003, indicates that fungal and bacterial populations are still present in the mineral soil following the fire.

Effective ground cover: Cover values immediately following the fire were quite low for the majority of soils located within stand replacement mortality. Re-sprouting of vegetation on site and aerial seeding of non-native grasses has returned cover to these areas during the first full growing season following the fire. Monitoring of the persistence and effectiveness of aerial seeded winter wheat and annual ryegrass during August of 2003 included visual estimates of cover in upland plots. Cover was recorded for seeded species, native species, other non-native species, bare soil and other occupants including rocks, shrub skeletons, and burnt snags. Three plots showed an average cover of 28%, 11%, 12%, 9%, 30%, and 9%, respectively for each of these categories. The three plots have an average total cover of 70% for herbaceous, organic woody and inorganic rock components on these sites (Suna, 2003).

Photo plots have also been established within the Eyerly fire showing oblique comparisons of seeded and unseeded areas. Visual observations informally show slightly lower levels of total cover in the unseeded areas, estimated to be within 20% of the seeded areas. Plots established in unseeded and seeded areas of the fire by research scientists include biomass measurements of herbaceous vegetation and can be roughly correlated to

aerial cover. Herbaceous biomass measured in control plots on the Lone Pine fire two years following the fire produced a mean of 1,500 kg/ha (Sexton, 1998).

Retardant Drops: Fire suppression activities also included the use of fire retardant dropped on fuels in front of advancing flames. Applied retardants coat the surfaces of ground fuels, suppressing their complete flammability and promoting charring or carbonization of woody fuels. A total of 57 loads or 148,109 gallons of Fire-Trol LCG-R (Chemonics Industries) and 2 loads or 6,002 gallons of Phos-Check HV-R (Solutia Inc.) were dropped from airtankers within the fire perimeter on six different days. Additionally, helicopter flights from two temporary batch stations at Fly Lake and the Eyerly Ranch property contributed 1,175 loads or 352,440 gallons of Phos-Chek 259-R retardant mixed from dry powder product. These drops were primarily associated with hot spots near containment lines throughout the fire area and occurred during a five day period from July 18-22.

Fire-Trol LCG-R and Phos-Check HV-R are both liquid concentrate forms of retardant mixed at a 4.75 and 3.6 to 1 ratio, respectively, with water. Fire-Trol LCG-R is unthickened and Phos-Check HV-R is thickened with Guar gum. Both are composed of ammonium salts, iron oxide used as a coloring agent and industry protected performance agents added to inhibit corrosion and spoilage, improve flow conditions and act as wetting agents. The Fire-Trol product contains yellow prussiates of soda (YPS), a corrosion inhibitor that contains sodium ferrocyanide shown to produce a weakly acidic, dissociable form of cyanide under exposure to ultra violet radiation (Little and Calfee, 2002). The Phos-Chek 259 R is a dry powder form of retardant mixed with water at a ratio of approximately 0.93 lbs/gal and is comprised of the same components as the liquid concentrate forms (CSIRO 2000).

Recommended application rates of fire retardant are 1.5 liters/square meter, although actual drop concentrations vary greatly depending on fuel loads and weather conditions at the time of flight. Using an average of 3,000 gallons per load at the recommended application rate gives an average of 1.87 acres covered per airtanker load and 0.18 acres covered per 300 gallon helicopter load. Assuming no overlap of drops, a maximum of (59 loads @ 1.87 acre/load) = 110.33 acres and (1,175 loads @ 0.18 acre/load) = 211 acres of the project area were covered by retardant from airtanker and helicopter drops, respectively.

Retardant transformations: *Heated retardant:* The actual amount of nutrient input into the soil system depends on any heat-initiated transformations of retardant components and any subsequent volatilization of these transformation products. When retardant is heated to temperatures up to 200 degrees C, ammonium salts of sulfate and phosphate are converted to sulfuric and phosphoric acids, producing sulfur dioxide, ammonia and oxides of nitrogen in their gaseous forms. Some of the sulfuric and phosphoric acids produced may be volatilized under temperatures capable of occurring under wild-land fire conditions. Under extreme fire temperatures exceeding 600 degrees C, ammonium salts of sulfate and phosphate would likely decompose to oxides of nitrogen, sulfur dioxide and P₂O₅, although most of the retardant would not have been exposed to such temperatures (CSIRO, 2000).

Retardant residues remaining following the fire likely contain some form of heat-modified products of the original retardant components previously listed. The performance additives may be oxidized or little affected, depending on the temperatures of the fire.

Although little information has been provided by the chemical companies or is available in the literature on oxidation mechanisms or the solubility and potential toxicities of performance additives or their products created by temperatures reached during wildfire, these compounds require high temperatures for complete decomposition and some of these retardant products are likely to be contained within ash left behind on the surface. Total ammonia concentrations measured in aqueous leachates of ash derived from combusted organics covered by Phos-Chek residues were significantly reduced from unheated retardant comparisons, while limited sub-lethal concentrations of dissociable and iron bound cyanide were measured in aqueous leachates of ash derived from combusted organics covered with Fire-Trol residues (Little, Calfee 2002).

Unheated retardant: Specific pathways for the three primary nutrient components are also outlined for unchanged or unheated retardant (CSIRO 2000). Pathways for unaltered performance agents are not well documented, although UV radiation has been shown to release lethal levels of cyanide from unaltered retardant containing YPS (Fire-Trol LCG-R) in streams or lakes. The guar gum thickener component is assumed to undergo oxidative decomposition and likely decomposes to carbon dioxide and water, while the iron oxide coloring agent would remain largely unaltered with negligible effects on soil processes (CSIRO 2000).

Nitrogen could be added to the system as ammonium from unheated retardant concentrations that could be greater than the rate at which growing vegetation can take it up. Much of this ammonium nitrogen would be converted to nitrates that are mobile within the soil profile and likely leached to the groundwater where concentrations would be diluted to some degree before resurfacing in a stream. The leaching of nitrates can also cause a slight acidification of the soil due to losses of base cations.

Phosphorus and sulfur in unaltered retardant are water-soluble and would likely enter the soil solution in the absence of large storm events capable of creating overland flows. Phosphorus is readily adsorbed onto mineral or organic sites while most soils have a very low capacity to retain sulfur, especially when it enters the soil together with phosphorus. Much of the sulfur entering the soil profile could be leached into groundwater as sulphate.

❖ 3.3.3 Soil Quality Environmental Consequences

Introduction

As stated earlier, the environmental consequences of the alternatives included in the Eyerly EIS are described as effects to the physical, chemical and biotic components of the soil resource. Changes to the physical component of the soil primarily occur as compaction and displacement incurred by management activities involving machinery traffic over the native soil surface or the dedication of soil areas to roads. Compaction and displacement from past management activities, fire suppression operations and activities proposed under this EIS is quantified as the aerial extent of measured or predicted detrimental conditions within an activity area.

Changes to the chemical and biotic components of the soil resource are primarily affected by the manipulation and removal of organic matter on site, but can also be altered by detrimental disturbance incurred by management activities. Effects to these components are tracked by describing changes in the composition and quantity of live and dead

organic matter composition on site, calculating levels of detrimental disturbance levels across the project area or within activity units, and summarizing transformations of soil nutrients and biota as a result of the fire intensity and severity.

Physical Component

Effects of Alternative 1 - No Action

Compaction and Displacement: The No Action alternative would incur no additional compaction or displacement to the soil resource beyond levels present following fire suppression efforts. Compaction levels within the project area would remain the same under this alternative since no ground-based salvage operations, road closures or subsoiling of compacted areas would occur. The majority of stands within the fire perimeter have levels of compaction well below the 20% Regional Standard and would continue to function as productive sites (Shank 2003).

Approximately 203 acres of dozer lines created during fire suppression activities were observed to have variable conditions of compaction and displacement along their extent, conservatively averaging detrimental conditions on 50% of their surface area. Suppression rehabilitation activities pulled organic litter and some tree boles back on to exposed surfaces and created waterbars at regular intervals to slow and dissipate overland flow energies. Compacted conditions from the dozer traffic will not be alleviated by mechanical means but would be slowly reduced by freeze thaw mechanisms when wetted soil conditions are exposed to temperature fluctuations during the colder months of the year. Areas of exposed mineral soil would accumulate organic litter from trees adjacent to the lines and from shrubs, forbs, grasses and seedlings that established on the lines in successive years. Productivity on these sites will be somewhat reduced when compared to undisturbed or burned conditions, although vegetation will gradually repopulate these lines over time. Over time, the risk of further impacts from machinery involved in a fire suppression effort would increase slightly as accumulations of downed trees and re-growth of herbaceous and conifer vegetation raises the potential for ignition and spread of wildfire.

Motorized access to this area, which is currently restricted to open roads, would not change under this alternative. Potential impacts to the physical component of the soil resource from motorized trespassing off of existing roads or onto Level II roads previously blocked by vegetation would increase slightly in the short-term from pre-fire conditions due to the consumption during the fire of visual and physical barriers to off-road traffic. This risk would be elevated until shrub re-growth and fallen trees provided visual and physical barriers to traffic off of roads or onto some Level II or previously closed roads.

Effective ground cover: Cover provided by herbaceous vegetation is expected to increase in both seeded and unseeded areas during the subsequent growing seasons following the fire as shrub and other species continue to grow in size and number. Although the mean above ground biomass of shrubs and herbaceous species measured in the control plots of the Lone Pine fire 5 years after the event had dropped approximately 23% to 1,095 kg/ha from 2 year measurements, additional cover was provided by snags that had fallen to the ground during this time period (Mallaby 2000). Effective cover

values are likely to be of sufficient levels to meet the requirements of SL-6 within two to three years of the fire event.

Erosion Risks: The physical component of the soil resource has elevated risks of erosion from water and wind mechanisms after the fire. Erosion risks following the fire include increased rates of upland soil movement from rill and sheet erosion and associated sediment yields to stream courses within a watershed. This risk is primarily associated with the loss of organic surface cover capable of reducing raindrop impacts and overland flow energies, or of trapping wind detached sediment before it can be transported offsite. Erosion rates and sediment yields to stream channels from storm events are predicted to increase in the immediate years following the loss of effective cover, but would steadily decrease after two to four years as a result of re-vegetation (Robichaud, 1999; and Radek, 2001). The loss of litter, duff and live vegetation elevates the risk of sheet and rill erosion during rainfall events across all of the burn severity classes within the fire perimeter until they return to a level capable of reducing rain drop impacts and slowing overland flow accumulations and energies to pre-fire levels.

Effective ground cover provided by these components is expected to return at steady successional rates observed on other fires across the Forest since the severity of the burn is not considered to have incurred detrimental damage extensive enough to limit vegetative re-establishment. Field observations during the spring and summer of 2003 have shown considerable re-growth of native herbaceous annuals and shrubs throughout the fire area, as well as rye and wheat species seeded on approximately 2,500 acres as part of BAER rehabilitation in the late summer of 2002 (Suna 2003). Since there would be no further planting of trees under this alternative the recovery of coniferous vegetation and the cover and litter that it provides would be slower when compared to acres proposed for harvest under the action alternatives. The return of total herbaceous and coniferous cover, however, is expected to occur at similar rates when compared to the action alternatives (Malaby 2000).

Erosion risks associated with dozer lines will be slightly elevated over the next few years until vegetation returns to levels capable of reducing raindrop impact energies on exposed mineral soil. The current roughness of the lines provided by gouges in mineral soil, rocks exposed on the surface and some woody organics not scraped off by the dozers would function to slow overland flow energies and limit erosion of exposed mineral soil during 2 year recurrence interval rainfall events and annual snowmelts. Water bars constructed during post-fire BAER work would also function to dissipate overland flows before they accumulate large volumes capable of moving sediment. Rain on snow, or 100 year recurrence interval rain events are likely to produce overland flow intensities capable of eroding sections of these lines until they became fully re-vegetated over time.

Handlines constructed during fire suppression activities have had waterbars constructed to reduce overland flow energies and dissipate accumulated flows off of their tread. These lines currently have slightly elevated levels of compaction from foot traffic during suppression and mop up activities and minimal organic cover from post-fire needle cast. Rehabilitated lines are likely to accumulate vegetative cover over the next few years at slightly reduced rates when compared to adjacent acres within the burn perimeter that have less compaction and fresh ash on the surface.

Predicted erosion rates: Erosion rates following the fire for the three burn severity classes across the fire area were calculated using a model entitled “Guidelines for Computing Quantified Soil Erosion Hazard and On-site Erosion” (Anderson, 1989). Calculations used to predict erosion rates and annual losses for this analysis generalize the soil types across the burned area using an average soil profile depth of 20 to 40 inches, ashy sandy loam surface textures (medium texture) and a rapid permeability class.

Table 3.3-5 summarizes predictions for pre and post-fire erosion rates from upland locations with representative post-fire vegetative cover for a year in which a 2-year, 30-minute or 100-year, 30-minute storm occurred. Calculations of erosion rates and hazards are contained within the Eyerly EIS Soil Report: Alternative Effects Analysis and Appendix AA (Sussmann 2003).

Table 3.3-5. Predicted pre and post-fire annual upland erosion losses by storm type

Storm type *	First year predicted annual erosion losses in tons/acre (% increase) **			
	Unburned ***	Low severity	Moderate severity	High severity
2 yr 30min.	0.047	0.156 (232%)	0.469 (898%)	0.938 (1,896%)
100 yr 30 min.	0.54	1.87 (246%)	5.78 (970%)	10.78 (1,896%)

Notes:

* Precipitation amounts for 2yr 30 minute and 100yr 30 minute recurrence interval storm types for the analysis area are 0.258 inches and 0.826 inches, respectively (Miller, et al. NOAA Atlas 2). Annual losses are predicted for a year in which a storm of this magnitude occurred.

** Post-fire erosion losses for low, moderate and high burn severities are for first year conditions without significant (<20%) return of vegetative cover. Percent increases over unburned conditions are included in parenthesis.

*** Predicted annual erosion loss values for unburned conditions assume an average of 80% aerial cover capable of intercepting raindrops, 45 to 74% of which is considered to be effective ground cover. Average ground and standing aerial cover capable of intercepting raindrop impacts for high, moderate and low burn severities were 20, 30 and 50%, respectively.

Predicted increases in first year, post-fire upland erosion rates for both recurrence interval storm types for the low, moderate and high burn severity classes are approximately 3, 10 and 20 times greater, respectively, than the predicted rate under pre-fire cover conditions. These predicted increases correlate reasonably well with research of post-fire sediment production from lower intensity storms (Potts et al. 1985; Noble, Lundeen 1971) and higher intensity storms (Robichaud 1999, 2000; Radek 2000) during the first year following a significant, cover-reducing fire event. Total sediment captured by traps for these studies ranged from 1.5 to 11.60 tons/acre on various slope grades, with larger amounts primarily associated with high precipitation events exceeding an inch within a 24-hour period. The amount of sediment trapped in silt fences placed on slopes with various BAER erosion control treatments in the year since the Eyerly fire has been under 0.1 tons/acre, which is significantly less than the modeled or measured levels primarily because no high intensity rain storm events have actually occurred on site.

Effects of Surface Erosion: Natural Resource Conservation Service (NRCS) T-values define annual allowable soil loss tolerances in order to maintain sustainable *soil productivity*. T-values for the soil map units within the Eyerly fire perimeter range from 3 to 5 tons/acre/year for the majority of soil map units before productivity would be

negatively affected. A low value of 1 ton/acre/year is assigned to the Fremkle, Henkle and Bakeoven series, which are very shallow to bedrock. Predicted overland erosion rates for a 2yr recurrence interval storm are within these allowable losses for all map units under current cover conditions following the fire.

Rates predicted for the moderate and high burn severity classes under a 100yr recurrence interval storm currently exceed the allowable loss for all map units. These rates under a large storm event would continue to exceed allowable losses until organic litter and live vegetation returned to provide approximately 40% to 60% effective ground cover. The re-growth of herbaceous vegetation already observed during the spring and summer of 2003 indicates that the return of vegetative cover within the fire perimeter would likely occur at post-fire rates observed within other fires located on the forest of similar extent and severity. Vegetative conditions which would reduce the erosion loss below allowable T-values for a 100yr storm type will likely return over the majority of acreage within three to five years. Additional cover would be provided as snags begin to fall over the next decade.

Sediment yields from subwatersheds following the Eyerly fire correspond directly to changes in erosion rates associated with the loss of surface cover and the extent of the three burn severity classes. The total amounts of sediment produced by sheet and rill erosion during a 2yr or 100yr 30 minute recurrence interval storm event were calculated on a per acre basis for the entire subwatershed areas under this analysis using erosion models (Eyerly EIS Soil Report, Sussmann, 2003). Sediment actually delivered to the stream courses from upland sheet and rill erosion is generally recognized as a percentage of the total produced within a subwatershed by a storm event, the majority of which is derived from areas adjacent to, and extending up to 480 ft from, actual stream channels (PSWHA I & Tower Fire Report).

The percentage of sediment delivered to stream channels for this analysis is estimated to be 30, 20 and 10% of sediment produced within delivery buffers located 0 to 160, 160 to 320 and 320 to 480 feet, respectively, from the channel. An additional 1% of the total sediment produced within the subwatershed outside these delivery buffers was also tallied as contributed sediment to streams. Calculations used to estimate increases in first year sediment yield to the primary intermittent and perennial stream courses in the project area include the adjustment of annual per acre losses by the percent delivery rates contributed by each buffer width. *Table 3.3-6* summarizes predicted changes in annual sediment yields between pre-fire and first-year, post-fire conditions for a year in which a 2yr 30 minute recurrence interval storm occurred.

Table 3.3-6. Predicted First Year Changes in sediment yields to stream courses by subwatershed

Sub_Wshed	Metolius 6th	L. Fly Ck	Spring	Street	Metolius 5th	Met. Horn	L.LBC Met	Big Canyon	Prairie Farm	Scarp
temporary % increase * of sediment yield	420%	432%	1614%	935%	767%	7%	438%	109%	0%	0%
Note: * Predicted post-fire sediment yields are for first year vegetative cover conditions.										

Predicted first year amounts of sediment delivered to stream channels range from 4 to 11% of the predicted total sediment produced in each subwatershed from a storm event.

Predicted post-fire sediment yields to streams under first year effective ground cover conditions, range from 4 to 16 times the predicted pre-fire yields within the primary subwatersheds of the project area. Predicted increases in sediment yield are expected to decline over time as vegetative re-growth reduces raindrop impacts and overland flow energies.

Erosion risks associated with wind have increased following the loss of cover throughout the Eyerly fire area. NRCS wind erodibility groups indicate the susceptibility of soil to wind erosion, with those assigned to group 1, 2 or 3 the most susceptible to this mechanism. The majority of the soil surface following the fire is comprised of a mixture of ash from the fire and mineral sandy loams from previous volcanic depositions. Ash material is included in erodibility group 2 and mineral sandy loams are included in erodibility group 3.

Dust devils comprised of surface soil material were observed frequently during the late summer and early fall months following the fire. Indications of this loss are apparent in some areas on the ground where the roots of bunch grasses and the edges of rock fragments on the surface have been exposed by this scouring mechanism. Much of the ash and finer mineral soil that is lifted by this mechanism is likely deposited near or within the perimeter of the project area. Total losses of ash and soil material from this process are not expected to exceed allowable T-values or significantly reduce the productivity of these soils. The risk and rate of soil loss from this mechanism would decrease steadily over time as fine and coarse organics accumulate on the soil surface and vegetative re-growth continues to increase ground cover in subsequent years.

Effects of Alternatives 2 and 3

Alternative 2, the proposed action, and Alternative 3 would have a variety of Direct, Indirect and Cumulative effects on the soil resource. Direct effects are related to alterations of the physical component of the soil by machine traffic utilized for harvest and yarding operations. Cumulative effects are primarily a result of proposed activities occurring in areas where previous activities have incurred detrimental impacts to the soil resource.

Physical Component

Compaction and Displacement: Skid trails, landings and areas of four or more machinery passes on bare soil within the proposed ground-based units would be considered detrimentally compacted following these activities. Detrimental compaction requires bulk density increases of 20% or greater over natural, undisturbed levels in ash and pumice soils (FSM 2500, R6 Supplement). Levels exceeding this limit have been measured in ash soils on skid trails and landings or areas of four or more passes by ground-based tracked and rubber tired machinery used for harvest operations of this type (Deschutes Soils Monitoring). Detrimental displacement requires the removal of greater than 50% of the mineral A horizon over an area of 100 square feet or greater (FSM 2500, R6 Supplement). Displacement of soil occurs primarily when ground-based machinery pivots quickly in loose mineral soil, especially on sloped areas.

Direct effects of detrimentally compacted soils include increases in soil strength capable of limiting the establishment, density and growth of conifer and other herbaceous roots (Gomez, 2000), reducing mycorrhizal microbial populations integral to nutrient availability and uptake (Moldenke, 1998), and altering infiltration rates of water as a result of changes in soil porosity (Froehlich, 1989). Activity areas in which the detrimental soil conditions exceeded 20% of their area may have lowered site productivity as a result of these altered soil functions. The level of this reduction is not entirely clear and may be offset to varying degrees by the inherent productivity and physical elements of the site. Some research has shown an improvement in seedling height and growth rates as a result of compaction in sandy loam soils (Gomez, 2000).

Direct effects of displacement include the loss of surface mineral soil that contains soil borne carbon, nitrogen and other nutrients from the displaced area. Although these nutrients are not moved off of the site, the soil exposed is generally subsurface A/C or C horizon material that contains less organic matter and may limit vegetative re-growth from seed sources. Although past monitoring of harvest activities has found that detrimental displacement occurs infrequently within harvest activity units (Deschutes Soil Monitoring), the current post-fire conditions of exposed mineral soil, limited slash on the soil surface and moderate slopes does increase the risk of this disturbance within unit areas proposed for ground-based logging and cable yarding operations. Detrimental displacement would be expected to occur over less than 5% of the unit areas during the implementation of proposed activities, while smaller areas of displaced soil are likely to occur throughout the unit areas.

Detrimental conditions measured in the field for similar harvest operations on the forest (Deschutes Soil Monitoring, 1994-2001) were used to predict the aerial extent of detrimental soil conditions incurred by harvest and fuels treatment activities proposed under this FEIS. Field measurements of existing detrimental conditions and predicted, post-harvest conditions for Alternatives 2 and 3 are summarized in *Appendix B, Table B-5*.

Fire Suppression: The effects of compaction and displacement on dozer lines created during suppression activities would be the same as described under Alternative 1 except for a 1 mile section that would be used as a temporary road to access skyline units. This section would be subsoiled following the implementation of harvest and fuels treatment activities.

Effective ground cover: The effect of proposed salvage operations on cover values would be two fold. The use of ground-based machinery would disturb established vegetation on implemented skid trails and landings, the extent of which, combined with off trail, out and back passes of an excavator, could be cover approximately 20% of an activity area. At the same time, the felling and yarding of material would move organic woody branches and smaller boles to the ground on these areas. Effective cover values would not be expected to change significantly as a result of these two effects, with small short-term reductions possible.

Disturbance resulting from these operations would not be expected to slow the growth of vegetation established on the site or prevent disturbed vegetation from returning. Cover values of shrubs (PUTR = 25%) and biomass production (herbaceous species = 387 kg/ha) on salvaged areas in the Lone Pine fire after five years were not statistically different than un-salvaged controls and had additional cover provided by planted and naturally

regenerated conifers (Mallaby, 2000). Field observations of cover within salvaged units of the McKay and Pringle fires on the Bend Ft. Rock district also show significant cover provided by shrubs and other herbaceous vegetation. Based on information from these studies and field observations, effective cover values on acres proposed for treatment are likely to be of sufficient levels to meet the requirements of SL-6 within two years following implementation of activities.

Logging Systems: Table 3.3-7 contains a summary of the unit acres by logging system for the subwatersheds in which treatments are proposed under the action alternatives.

Table 3.3-7. Alternative Logging System Unit Acres by Subwatershed

Logging System	Metolius 6th		Street Ck		Spring Ck		Lower Fly Ck	
	Alt. 2	Alt. 3	Alt. 2	Alt. 3	Alt. 2	Alt. 3	Alt. 2	Alt. 3
Ground	868	679	898	448	1,597	836	219	165
Cable	116	68	98	6	66	7	9	0
Skyline	64	0	238	96	161	132	0	0
Helicopter	38	87	30	19	339	156	0	0
Skyline-TRC*	27	24	0	0	78	170	0	0
Total Harvest	1113	858	1264	569	2,241	1301	228	165

*Skyline-TRC are skyline yarding units with temporary road construction

Ground-based Harvest Systems: Salvage of trees within the proposed harvest units will have direct effects to the physical component of the soil resource. Unit acres proposed for ground-based harvest and yarding have slopes under 30%. Ground-based operations are likely to utilize boom-mounted machinery to cut and accumulate trees, and grapple rubber tired skidders or tracked forwarders to move the material to landings for processing and/or loading. Past monitoring of harvest units has shown that 15 to 30% of a unit can be detrimentally compacted by ground-based harvest systems depending on the spacing of skid trails, trees per acre removed and the soil conditions at the time of harvest (Deschutes Soil Monitoring, 1995).

Estimations of detrimental conditions within ground-based units following proposed harvest activities account for the moderate volumes (5 to 10 MMBF/acre) proposed for removal and the mitigated fuels treatments necessary to process activity fuels predicted to occur from yarding and de-limbing operations. Ground-based logging systems within Stand Replacement salvage units are expected to incur detrimental compaction on 15 to 20% of their unit area from felling, yarding and processing activities. Approximately 10 to 15% of these unit areas would be committed to skid trails and landings in order to harvest and yard material, with an additional 5% of the unit areas possibly incurring detrimental conditions from harvest and fuels treatment traffic between skid trails.

Actual spacing of skid trails would be variable across the units, dependent primarily on the topography and the distribution of the trees intended for harvest within the unit. Based on an average disturbed width of 12 feet, parallel skid trail spacing of 100 feet would commit 11% of a ground-based activity unit to a detrimental condition. Skid trail patterns are generally more dendritic due to topography and landing locations and are likely to average closer to 75 foot spacing or 14% of the unit in some cases. Forest averages for landings within the activity units removing the 5 to 10 MMBF/acre volumes proposed in this salvage are approximately one landing (100 ft. by 100 ft.) for 10 acres of harvest acreage or 2% of the activity area.

Skid trail spacing of greater than 75 feet would also entail the off-trail travel of machine harvesters to reach material more than 20 feet from the trail. The physical impacts incurred by the off-trail machine traffic is generally measured to be detrimental on areas where multiple passes have occurred over soil that is not frozen greater than 6 inches in depth or is devoid of sufficiently firm snow cover to mitigate ground pressures. Off-trail traffic of feller bunchers would be limited to single or out and back passes, although these trips may cross previously impacted soil and incur detrimental compaction in some areas. Off-trail travel of harvest traffic without sufficient snow or frozen ground conditions are expected to incur detrimental physical impacts on up to 5% of the unit area between skid trails in units with skid trail spacing of 75 feet or greater. No off-trail traffic of machinery utilized for fuels piling would occur in these units.

Cable, Skyline and Helicopter Systems: Units with cable, skyline and helicopter harvest systems are expected to incur lower levels of detrimental conditions than those estimated for units utilizing ground-based felling and yarding machinery. Units in which these yarding operations are proposed have slopes exceeding 30%. Estimated detrimental disturbance levels following the implementation of proposed activities are 5% for helicopter yarding and up to 10% for cable or skyline yarding. Trees in these units would be hand-felled and de-limbed or topped within the unit before yarding. Cable yarding would incur some gouging since the front end of material would not be suspended off the ground and would have the surface mineral soil mixed with subsurface material in many areas. Total disturbance from this yarding system would be higher than in units utilizing skyline yarding. Skyline units would yard material with one-end log suspension using small mobile yarders. Skyline corridors would be expected to have some mixing of mineral soil but generally less gouging than cable yarded corridors.

Landings required for Helicopter and Skyline units would be cover a maximum of approximately 49 acres or 5% of the 971 unit acres proposed under alternative 2. Material yarded to these landings would have tops and limbs removed within the units and generally hot loaded onto trucks in order to keep the landing sizes at a minimum. Approximately 15 acres of landings associated with Skyline units requiring temporary road construction, as well as helicopter landings, would be subsoiled where possible if needs for using these areas were not necessary for an extended period of time.

Temporary roads: A maximum of 3.0 miles of temporary road would be constructed under Alternative 2 to access ridgelines above skyline units and provide station points for mobile yarders. Approximately 1 mile of temporary road would occur on fire perimeter dozer line. Alternative 3 would require approximately 1.4 miles of temporary road construction. The temporary road construction would disturb approximately 7.2 acres and 3.4 acres under Alternatives 2 and 3, respectively, and would include the loss of surface vegetation that has returned since the fire and the temporary detrimental compaction of the soil resource. Temporary roads would be subsoiled where possible or have their surface features obliterated and blocked following proposed management activities where rocks within the profile precluded subsoiling operations. These areas would be expected to recover vegetative cover over the next few years following subsoiling, with recovery slightly slower in any areas where subsoiling could not relieve compaction.

Fuels treatments: Fuels treatments under the action alternatives would also directly affect the physical component of the soil resource. Proposed piling and burn treatments to reduce slash levels created from the harvest activities include the use of grapple machinery to pile from existing skid trails and hand lopping and piling between skid trails in activity units with slopes less than 30%. Underburns, handpiling or lop and scatter methods would occur in units employing skyline or helicopter yarding systems.

Slash piled within the units would be burned following a period of curing. The burning of slash piles has the potential to volatilize nutrients and soil organisms contained in the soil beneath them. Temperatures exceeding 200 degrees C have been measured 2-5 cm below the soil surface for greater than 4 hours during active pile burns, while soil pH levels were shown to increase for 0-2.5 cm and 2.5-10 cm soil horizons following these burns (Sheay, 1993). Measured soil nitrogen concentrations in these horizons were not reduced, apparently due to the downward distillation of organic nitrogen from the burn piles and the possible oxidation of nitrogen from roots in the top horizons. Few studies have monitored the long-term recovery of soil underneath pile burns.

Pile burning often discolors the mineral soil below them due to the oxidation of iron. This reflects temperatures in excess of 300 degrees C, a level far exceeding volatilization temperatures for some nutrients and organic matter, and one capable of leaving these areas depleted in these components for a number of years. Depending on the amount of slash generated from the harvest operations, the amount of area affected by pile burning would vary from unit to unit but is likely to average less than 5% of the unit areas, with the majority of that occurring on skid trails and landings within a unit.

Summary: Effects to the soil resource under the alternatives are similar in scope but smaller in scale for Alternative 3 in comparison to Alternative 2 for the physical components. The amount of disturbance would be reduced due to fewer acres proposed for salvage activities (2,893), altered unit boundaries located further from intermittent stream channels and often above the closest road to the stream channel, and changes in logging systems for some units. Overall detrimental disturbance in the form of compaction within the sediment delivery zone would be lower under this alternative, reducing the risk of erosion and lowering predicted sediment delivery to stream channels by up to 3% when compared to alternative 2.

Detrimental acres following activities proposed under Alternatives 2 and 3 are summarized by subwatershed in the following table. The greatest difference in predicted detrimental conditions from the proposed activities of each alternative occurs in the Spring Creek subwatershed, with Alternative 3 being 3% less than Alternative 2.

Table 3.3-8. Alternatives 2 and 3 Predicted Detrimental Acres from proposed harvest activities

Activity	6 th Field Subwatershed Harvest and predicted detrimental acres							
	Metolius 6th		Street Ck		Spring Ck		Lower Fly Ck	
Total Subwatershed Acres	13,545		7,308		6,774		8,466	
Existing % Sub-shed detrimental	4%		13%		17%		---	
	Alt 2	Alt 3	Alt 2	Alt 3	Alt 2	Alt 3	Alt 2	Alt 3
Proposed Harvest Acres	1,112	858	1,264	570	2,240	1,300	228	165
% Sub_shed proposed Harvest	8%	6%	17%	8%	33%	19%	3%	2%
% Sub_shed Ground Harvest	7%	5%	12%	6%	24%	12%	3%	2%
Detr. acres Ground Harvest*	180	136	179	89	319	167	44	33
Detr. acres from other Harvest Systems **	24	26	37	14	64	36	1	1
Additional % Sub_shed detrimental. ***	2%	1%	3%	1%	5%	3%	<1%	<1%
Detr. Ac. Within 480ft ****	49	30	58	20	128	34	6	2

Notes:

* Detrimental acres are calculated as 20% of the proposed Ground-based Harvest unit acres utilizing machine feller-bunchers and skidders or forwarders.

** Detrimental acres from other Harvest Systems are calculated as a maximum amount of 10% of unit acreage on Cable, Skyline, and Helicopter units.

*** % Sub_shed detrimental summarizes additional acres predicted to be detrimental from the prescribed harvest, fuels and subsoiling treatments.

**** Detrimental acres within 480 ft buffer are calculated to be 20% of the unit acres that are within 480 ft of an ephemeral, intermittent or perennial stream reach. No proposed unit acres are within 160 ft of these reaches. These unit acres are likely to have less than 20% detrimental disturbance due to mitigations ensuring hand felling and the pulling of line within the buffer boundaries for units proposed for ground-based, helicopter or skyline prescriptions.

The primary differences between the action alternatives regarding effects to the physical component of the soil resource include a reduction of total proposed harvest activity acres by 2,048 acres under Alternative 3. Alternative 3 reduces proposed activity unit acres within the 480 ft sediment delivery buffers within the Street and Spring Creek subwatersheds by nearly 132 acres when compared to Alternative 2. It also changes additional activity unit acres from skyline to helicopter yarding that would reduce the amount of temporary road construction necessary to implement the proposed harvest. Temporary roads constructed for alternative 3 would cover 1.4 miles or approximately 3.4 acres. A complete summary of the existing and predicted detrimental conditions for proposed activity units are included in *Appendix B, Table B-5* and summarized in *Table 3.3-8*.

Alternative 3 would require an estimated 69 fewer acres to be subsoiled in order to meet Standard and Guidelines for the soil resource. Proposed activity units 1-3, 5, 8, 14, 16, 21, 22, 25, 28, 41-43, 45-50, 53, 58-67, 69, 70, 73, 74, 78, 80-84, 86, 89, 91, 97-99, 101, 108, 112-115, 123, 124, and 126, with areas ranging in size from 3 to 221 acres, are predicted to exceed the 20 percent limit in detrimental soil conditions following the mechanical treatments proposed with this project.

Table 3.3-9. Summary of Alt. 2 and Alt. 3 Existing and predicted Detrimental Disturbance and predicted acres to be subsoiled within proposed activity units

% of area* in skid trails or landings w/in unit	Percent Detrimental Condition Class				Acres predicted for subsoiling
	0 to 5%	5 to 15%	15 to 20%	>20%	
# of Alt. 2 units currently in condition class (%)	48 (39%)**	60 (48%)	13 (11%)	3 (2%)	--
# of Alt. 3 units currently in condition class (%)	34 (46%)	33 (45%)	7 (9%)	0	--
Predicted Alt. 2 units after harvest and fuels activities (%)	1 (1%)	40 (32%)	29 (23%)	56 (44%)	116 ac
Predicted Alt. 2 units after subsoiling	1 (1%)	40 (32%)	85 (67%)		
Predicted Alt. 3 units after harvest and fuels activities (%)	0	27 (37%)	15 (21%)	31 (42%)	47 ac
Predicted Alt. 3 units after subsoiling	0	27 (37%)	46 (63%)		
Notes:					
* Percentage ranges are the aerial extent of activity area considered detrimentally disturbed from compaction.					
** Number of units with percent of total units in parenthesis					

Erosion Risks: Erosion risks under Alternative 3 would be slightly lower than Alternative 2 due to a fewer number of proposed activity acres on which physical disturbance of surface vegetation and the compaction of soil would occur. Existing levels of disturbance from past harvest activities and roads are summarized within the primary 6th field subwatersheds (*Table 3.3-2*). Under Alternative 2, Street and Spring Creek subwatersheds would see the greatest amount of additional compaction from proposed activities, approximately 2% and 5% of their respective areas, with varying levels of disturbance of established vegetation within 17% and 33% of these subwatershed areas. This compares to compaction disturbance under Alternative 3 of 1% and 3% of Street and Spring Creek Subwatersheds, respectively, with disturbance of established vegetation occurring within up to 8% and 19% of their subwatershed areas (*Table 3.3-8*).

Any skid trails and landings that were not subsoiled within proposed activity units would remain susceptible to erosive overland flows capable of moving sediment. Although vegetation would be slower to return on compacted areas that were not subsoiled, effective cover is likely to return on areas within units between skid trails at a rate similar to unsalvaged areas (Malaby, 2000). Salvaged units within the McKay and Pringle fires on the Bend/Ft. Rock district are observed to have significant cover values provided by ceanothus shrubs and numerous perennials five years after salvage activities occurred. Proposed activity unit areas would also have an immediate contribution of woody material to the ground from harvest activities, which would provide additional surface roughness and effective cover capable of reducing overland flow energies and raindrop impacts.

Sediment yields: Predicted changes to sediment yields in each 6th field subwatershed following salvage activities are found in *Table 3.3-17* of Chapter 3 and in the Eyerly Hydrology specialist report (McCown, 2003). Estimates for changes in predicted sediment yields to stream channels under alternatives 2 and 3 assume detrimental disturbance in the form of skid trails of 20% of the proposed activity unit acreage within the 480 ft sediment transport zone. Predicted increases are lower for alternative 3 than alternative 2 due to the reduction in proposed activity units within the sediment delivery zone. Changes are reported as relative percent increases from existing conditions and between alternatives

because of the difficulty in measuring and interpreting actual sedimentation levels (McCown, 2002).

The predicted increases in sediment delivery for the action alternatives relate to the exposure and compaction of mineral soil on skid trails that may alter the volume and/or energies of storm flows. Skid trails within the sediment delivery zone would be prioritized for subsoiling to return soil strength to pre-impact levels, effectively returning hydrologic function to these areas and reducing the effects of compacted disturbance on overland flow energies, effective vegetative cover and sediment movement. In addition, changes in erosion risks on disturbed areas are also offset to some degree by the surface roughness provided by activity fuels generated on the soil surface (Shakesby, et. al., 1996).

Sensitive soils: Sensitive soils in the project area were summarized previously in this chapter in Table 3.3-1. Those identified within activity units proposed under Alternatives 2 and 3 primarily have slopes exceeding 30% and are of a concern for their susceptibility to erosion and displacement. All proposed activity units with slopes exceeding 30% are proposed for hand-felling and skyline, cable or helicopter yarding to minimize disturbance from proposed activities. A few proposed ground-based harvest and yarding activity units include portions of SRI map units having slopes exceeding 30% (*Appendix B, Table B-5*). These unit areas were field checked and found to have the majority of slopes below 30% on the ground. Any individual areas exceeding 30% in ground-based units would be prioritized as wildlife leave areas. All bottomland and wet depression areas (units 8, 10 and 37) are encompassed within riparian buffer areas (RHCA and Riparian reserves) and do not include any activity unit acres. Proposed activity units 48, 79, 83-85, 100, 101, 106, 107, 116, 117 and 123 are mapped with low productivity SRI map units 50 or TB. These areas were also field checked and found to have sufficient depths of mineral soil to be classified as moderately deep and are not considered to have unsuited productivity as a result of shallow soils or limited regeneration potential.

Cumulative Effects

Compaction and Displacement: Assessing the cumulative effects from activities proposed under this EIS includes consideration of past harvest management actions and reasonably foreseeable future actions that would cause changes to the levels of detrimental soil disturbance within an activity unit. Proposed units with existing levels of detrimental compaction above 10% have been identified and are likely to exceed the 20% Standard after harvest and fuels treatment activities were completed (*Appendix B, Table B-5*). Each of the action alternatives would utilize subsoiling as a mitigation measure to, at a minimum, rectify areas of detrimental compaction exceeding 20% to ensure compliance with Standards and Guidelines discussed previously under Management Direction in the soils section of this chapter.

Additional Fuels Treatments: Standing, non-merchantable material ranging from 6 to 12" dbh in excess of recommended fuel loadings may be machine felled during harvest operations and possibly removed as part of a purchaser option in the sale contract. Material not removed or felled during commercial operations would be felled and piled by machinery operating from existing skid trails. Material out of reach from skid trails would

be hand-felled to the lead and accumulated from the skid trails or lopped and hand-piled or scattered between trails.

Detrimental disturbance levels associated with the physical component of the soil resource are likely to be maintained near or at post-harvest activity levels as a result of mitigations restricting machine traffic to designated skid trails. Lop and scatter or handpiling methods would not create additional physical compaction impacts to the soil resource in activity units where this occurred. Although some additional detrimental soil disturbance would occur underneath burn piles, the majority of piles would be located on existing areas of detrimental impact such as skid trails and landings. Piles off of trails could cover up to 5% of the unit area.

Subsoiling: Both action alternatives would have a portion of compacted soil areas conditioned utilizing a winged subsoiler following proposed management activities. This would occur within units having greater than 20% of their surface area in detrimental compaction following proposed activities and in units with portions of their boundary within the sediment delivery zone. Predicted unit acres requiring subsoiling to meet Standards and Guidelines are 116 acres for Alternative 2 and 47 acres for Alternative 3. Additional acres prioritized for subsoiling within the sediment delivery zone could total up to 162 acres in Alternative 2 and 54 acres in Alternative 3. Unit specific estimates are included in *Appendix B Table B-5*.

Subsoiling directly fractures compacted soil particles and increases macro pore space within the soil profile, both of which contribute to increased water infiltration and enhanced vegetative root development (Craig, 2000). Bulk density cores taken before and after subsoiling operations have measured reductions to or below natural levels from compacted readings as high as 30% above natural levels. Soil conditions following subsoiling can be much fluffed in nature but are observed to return to natural bulk density levels after a year or two of physical settling and moisture percolation through the soil profile (Deschutes Soil Monitoring, 1995). Subsoiled areas are considered to have their soil strength restored to pre-impact conditions, allowing for the recovery of organic and biotic components over time (Moldenke, 1998).

Foreseeable future actions: No current or foreseeable activities are proposed within the aquatic and riparian ecosystems. Portions of the riparian reserves were aerial seeded by BAER treatments following the fire, along with some diversity planting of native tree and shrub species. Vegetative cover has already returned within the riparian buffer areas that will not be further disturbed under this action. (See Appendix E, Responding to Recommendations of Beschta et al, 1995). Riparian protection buffers under Alternative 3 have been extended to 320 feet along the primary forks of Street and Spring Creeks to reduce the amount of disturbance within sediment delivery zones capable of sourcing sediment to intermittent or perennial stream channels.

The Eyerly IDT completed a roads analysis during the EIS process and has made recommendations for the closure and/or decommissioning of 32 miles of roads within the burn area. Priority conditions for closure were identified as those roads considered to be direct conduits to stream channels for storm flows and sediment that are located within or immediately adjacent to intermittent or perennial stream channels. This reasonably foreseeable action will help reduce the potential for surface erosion and sediment delivery into stream channels within the project area.

Road Mitigations: The recommended closure of roads under the Roads Analysis includes the 1190-800 system that would be partially utilized for implementing proposed harvest and fuels treatment activities under the action alternatives. The closure and decommissioning of road 800 and a number of spurs would be implemented under the action alternatives to mitigate effects of sedimentation from the use of portions of this road for access and hauling. Removing the hydrologic connectivity of this road from the adjacent intermittent stream channel would reduce sediment and storm flow inputs into the Spring Creek subwatershed.

Chemical and Biotic Components

Effects of Alternative 1 - No Action

The chemical component of the soil resource includes nutrients contained in above ground biomass, soil organic matter and the soil matrix. Effects to these components relate directly to the amounts of surface and soil-borne organics that were consumed or volatilized as a result of heat produced by the fire. Although temperatures approaching 200 degrees C at the soil surface are not uncommon in wildfire events, temperatures produced throughout the majority of the fire area were relatively short-lived and likely less than this level. Less than 1% of the soil resource within the fire perimeter is estimated to have had extended durations of elevated temperatures capable of volatilizing significant amounts of nitrogen and other soil nutrients, primarily in areas where mineral soil is discolored underneath consumed down logs and residual stumps (*Table 3.3-4*).

The volatilization of nitrogen and other nutrients in the soil by heat-induced processes are not easily quantified but are estimated for this analysis. The largest and most quantifiable nutrient losses from the fire are those contained within above ground biomass consumed by the fire. Measured and estimated losses or transformations of nutrients as a result of the fire, as well as post-fire inputs into the system are discussed under Long-term Site Productivity and summarized in *Table 3.3-7* for this Alternative.

Carbon to Nitrogen (C:N) ratios: The ratio of soil-borne carbon and nitrogen within a forested system is functional for reflecting the relative amount and type of microbial populations associated with the cycling and plant uptake of nutrients. The consumption of soil-borne carbon within the top mineral soil horizons occurred to a greater extent in Stand Replacement mortality areas and is estimated to be 20% of residual pre-fire amounts for this analysis. C:N ratios following the fire are likely to have been lowered within Stand Replacement mortality areas of the project area due to the greater consumption of soil borne carbon and the conversion of organic nitrogen to available inorganic ammonium nitrogen during the fire (Clark, 2001). C:N ratios have been measured to be 16 to 20:1 in the post-fire environment (Hibbard, unpublished data; Rumbaitis del-Rio, unpublished data), down from pre-fire levels of 25 to 30:1 in east-side forests (Busse, personal communication; Little and Shainsky, 1995). Lower C:N ratios are generally favorable to microbial activities associated with cycling nutrients into plant available forms while higher ratios tend to tie up microbial populations in the decomposition of wood residues (Busse, personal communication).

C:N ratios under the no action alternative would slowly rise toward pre-fire levels as vegetative re-growth produced a photosynthesized source of carbon contained in plant

litter and root biomass. The fixation of atmospheric nitrogen associated with ceanothus (snowbrush) and purshia (bitterbrush) species would also begin to input nitrogen to the soil surface as litter and root biomass as these plants grow larger each year. Atmospheric deposition of nitrogen would continue to occur at pre-fire levels in subsequent years and be the primary input of this nutrient into the system over the next few years. C:N ratios over the next few decades are not expected to be altered enough to affect microbial populations or associated nutrient cycling processes in these areas. This alternative would have the largest accumulations of coarse wood on the soil surface after ten years, levels that would continue to increase over the next few decades. Raising the available lignin sources on these sites to levels predicted by fuels models may be capable of slowing microbial activities associated with nutrient cycling and plant uptake by tying up significant portions of the microbial population.

Soil Biota: Effects to the biotic component of the soil resource relate directly to the heat induced mortality of soil biota and indirectly to changes in the C:N ratio on site.

Laboratory measurements of soil samples collected at the Awbrey Hall and Mt. Lassen fire sites showed minimal short and long-term effects on bacterial populations and only short-term declines in fungal populations following wildfire (Busse, personal communication). Microbial recovery is likely to occur over time as populations respond to vegetative root growth and available hosts. The recovery of microbial populations would continue under this alternative as additional carbon produced by new plant growth and contributed by fallen trees as coarse woody debris provided habitat and a source of material for respiration processes.

Fungal populations are also likely to rebound in years subsequent to the fire. Morel mushrooms returned during the spring of 2003 at variable levels throughout the mixed conifer and wetter ponderosa pine PAG's within the fire perimeter. Populations of these species are difficult to measure since the mycelium are relatively ubiquitous and are generally associated with live vegetative roots. Recovery of these species may also occur from dormant spore accumulations, stashes of truffles by small mammals and the ability to morph into a saprophytic stage until live host roots return to the site (Smith, unpublished). Ectomycorrhizal fungi are integral to the uptake of nutrients and water by plant roots in ash and pumice soils. Any changes in these components are likely to affect the vegetative uptake of available nutrients and general herbaceous recovery from losses incurred during the fire.

Surface organics and soil borne carbon: The majority of the fire area has had significant consumption of surface organics and live vegetation, especially within the Stand Replacement mortality class. The post-fire return of surface litter and duff and soil-borne carbon is directly related to the presence of vegetation to provide these components to the soil resource. Unconsumed needles from burned trees have already accumulated on the soil surface throughout the Mixed mortality and portions of the Stand Replacement mortality class areas. The post-fire return of annual and perennial vegetative species is expected to continue to occur at natural post-fire rates under this alternative, contributing fine-sized organic material on the soil surface and within the mineral soil rooting horizons. Substantial amounts of these species have sprouted and grown during the spring and summer of 2003 and are expected to continue to re-populate as pioneer species in the post-fire line of vegetative succession. The establishment of these species will provide a photosynthesized source of soil carbon and nutrients in the years following the fire. Soil functions such as moisture retention, microbial nutrient breakdown and translocation, and

surface stabilization will recover to varying degrees as these species carry out their life cycles and are incorporated into the mineral soil.

Additional organics and nutrient cycling will be provided by the re-growth of ceanothus, chinkapin, and manzanita shrub species that have already resprouted during the warm late summer/early fall of 2002 and the current 2003 growing season throughout the fire area. These species will likely thrive over subsequent years in the absence of planted conifers and provide additional organic input to the soil surface and mineral soil. Bitterbrush throughout the moderate and high severity burn classes was nearly completely consumed and will likely re-establish slowly over the next decade since it does not re-sprout very well (Riegel, personal communication). Natural re-establishment of this species would be from residual seeds in the soil not consumed by the fire, subsequent seed caches made in the fire area by small mammals or those transported by the wind from unburned areas adjacent to the fire. There are occasional small islands or individual bitterbrush plants within the fire perimeter that did survive that should provide some seed source in the next few years.

The rate at which conifer seedlings and their associated organic litter inputs would return to the site would be reduced when compared to the action alternatives since no replanting would occur beyond the 500 acres of diversity planting already implemented during the spring of 2003. Rates of natural regeneration within the Ponderosa pine and Mixed Conifer PAG's have been predicted (Volland, 1988) and are summarized in the silviculture report (Schantz, 2003). Conifer seeds produced the year of the fire had not matured at the time of the burn and the survival of seed caches from small mammals is not known at this time. Natural regeneration under unsalvaged conditions within Ponderosa pine areas of the Lone Pine fire was relatively extensive (Sexton, 1998; Malaby, 2000) and is likely to occur at similar rates on these sites.

Coarse Woody Debris: Coarse woody debris on the soil surface primarily functions to help retain moisture on the soil surface and provide microbial habitat on site. Coarse woody debris does not appear to make a significant contribution to N and P cycling in arid east-side conifer forests (Prescott, 2002). The majority of nutrients contained in the biomass of a tree that are available for rapid decomposition and input into the soil system are contained in the crowns and small branches which were already consumed on the majority of trees remaining within Stand Replacement mortality areas. A variable amount of coarse wood remains on the soil surface within the Mixed and Non-lethal stand mortality classes and very little of this component remains on the ground within the Stand Replacement mortality class areas. Despite variable charring from the fire, coarse wood remaining on site should function normally as microbial habitat and as a source of wood for decomposition (Graham et al. 1994).

Coarse woody debris on the surface under the No Action alternative would initially be deficit in fulfilling productivity roles associated with microbial processes until snags begin to fall to the ground from windthrow events. Research has shown a direct relationship between the amount of active ectomycorrhizal root tips and the level of coarse woody debris on site, with an optimal coarse woody debris level for ectomycorrhizal activity in a ponderosa pine/Arizona fescue association of 7 to 14 tons per acre (Graham et al. 1994). Although wind throw has already occurred in a few areas within the fire perimeter it is fairly limited in extent. Snag fall rates from the Lone Pine fire measured 50% of snags over 14" and 90% of snags between 3 and 14" on the ground in 10 years, indicating that standing dead would contribute a steady supply of down wood over the next two decades.

Total levels of coarse wood on the ground could range up to 30 or 40 tons per acre within 10 to 20 years, depending on the timing and intensity of wind events over that period.

Long-term site productivity: The effects of the consumption of biomass and any associated nutrients on long-term site productivity are difficult to quantify over time. Calculating a ratio of the estimated amount of each nutrient consumed by the fire with the estimated amount of each nutrient that would re-enter the system annually gives an indication of the extent to which the fire impacted the nutrient components of site productivity.

Table 3.3-10 summarizes estimated above-ground nutrient losses from the Eyerly Fire within Stand Replacement mortality classes. Annual post-fire input of carbon and nitrogen from photosynthesis, as well as atmospheric deposition of nitrogen and sulfur are included. The period of time to replenish carbon to pre-fire levels refers to amounts stored in above-ground components only. The table data is augmented by narrative discussions on the losses of soil-borne nutrients incurred by the fire and subsequent replenishment pathways for each nutrient. The effects of the No Action alternative on nutrient availability and replenishment as they relate to long-term site productivity are considered to be minimal. The mechanisms and extent of nutrient loss and input described here are applicable for all three alternatives under this analysis.

Table 3.3-10. Estimated Nutrient Export/Input Ratios

Nutrient	Pre-fire amounts	Amount lost *	Annual input	Ratio	Replenishment**
Carbon	46 tons/acre	27 tons/acre	.24 tons/acre***	112:1	100+ years
Nitrogen	504 lbs/acre	412 lbs/acre	15 lbs/acre	27:1	30 years
Phosphorus	57 lbs/acre	44 lbs/acre	Unknown****	(--)	--
Sulfur		6 lbs/acre	1.4 lbs/acre	4:1	5 years

Notes:

* Amount lost was calculated based on the combustion of the entire vegetative and organic component associated with herbaceous shrubs, wood residues, and surface litter and duff, as well as 60% combustion in weight of the crowns of trees and 20% in weight of the bark component. Site budgets of the primary nutrients contained in the crown, bark, litter and duff, wood residues and shrubs of a fully stocked Ponderosa Pine forest were used as a basis for estimating this loss (Little and Shainsky, 1995).

** Replenishment refers to the time involved to return individual nutrients contained in above ground biomass only to pre-fire levels.

*** The annual input of photosynthesized carbon into a fully stocked forestland system (Busse, 1994; Little and Shainsky, 1995). Annual input of a post-fire, shrub/grass/forb dominated community is estimated to be at or above these rates when fully stocked (Busse, personal communication). Movement of carbon contained in standing trees to the ground would occur as fire killed trees rotted and were wind thrown over the next twenty years.

**** The annual input level of phosphorus is difficult to measure in forestland systems since most of it comes from the weathering of parent material and soil in place. Measured concentrations of this nutrient in the soil profile are relatively high and contain upwards of 98% of the total P stored on site (Little and Shainsky, 1995). Levels present after the fire would be sufficient to support the growth of forest vegetation on site. Inputs would occur over the course of a rotation that would most likely replenish the amounts lost from the fire.

Carbon: The loss of carbon from the fire was primarily through the consumption of live vegetation, litter, duff and coarse woody debris on the soil surface. Losses of carbon are greater within the Stand Replacement areas and also include the consumption of needles and small branches in the standing trees that provide regular input of fine organics to the soil. Total losses of soil borne carbon are difficult to measure but could be approximately 9 tons/acre in soils containing 3 to 4% organic carbon.

The No Action alternative would not remove any additional carbon from the sites. Carbon levels would be replenished by photosynthetic processes that create new biomass contained in roots and vegetation. The annual input of photosynthesized carbon into a fully stocked forestland system has been measured at 0.24 tons/acre (Busse 1994; Little, Shainsky 1995). The annual photosynthetic input of carbon within a post-fire shrub/grass/forb dominated community would gradually return to this rate over the next few years as the site becomes fully re-vegetated. Observed shrub and herbaceous re-growth already occurring on site will contribute carbon through photosynthetic mechanisms at rates comparable to a mature forest community over the next decade (Busse, personal communication).

Nitrogen: Total nitrogen on some sites may have been reduced by up to 500 lbs/acre through the consumption of organic material and volatilization of some inorganic forms of nitrogen (M. Busse, personal communication; Grier 1975). Quantifying the amount of soil borne nitrogen consumed is very difficult. Many organic forms of nitrogen are converted to inorganic, ammonium forms of nitrogen during and after fire, much of which are available for plant uptake in the immediate years following the event. This flush of plant available nitrogen following fire events has been widely observed and measured by research (Clark 2001, Deluca 2000).

Nitrogen replenishment in forestland plant associations occurs through symbiotic-N fixation by bacteria and actinomycetes in the nodules associated with the roots of *Ceanothus* (snowbrush) and *Purshia tridentata* (bitterbrush). These fixation rates have been measured locally to be 15 to 20 lbs/acre/year and 0 to 2 lbs/acre/year, respectively, while atmospheric deposition of nitrogen has been measured at rates of 1 to 10 pounds/acre/year (Busse, personal communication). The return of *Ceanothus* and other herbaceous vegetation during the spring and summer of 2003 indicates that there is plant available nitrogen following the fire. The re-growth of N-fixing species will begin to contribute nitrogen within the soil profile at these fixation rates after the needs of the individual plants are met, a delay likely to take up to ten or more years (Busse, personal communication). Atmospheric deposition is likely to be the primary input of nitrogen into the system until that time.

Phosphorus: The amount of phosphorus removed from the system during the fire primarily comes from the combustion of shrubs and tree crown components. Total losses from the combustion of surface organics and live vegetation are a very small percentage of the total phosphorus contained in the system because over 98% of this nutrient is stored within the soil profile. Losses of phosphorus from volatilization within the soil profile are difficult to quantify but are likely to have occurred to a greater degree under down logs where a longer duration of higher temperatures were sustained during the fire.

Phosphorus replenishment into the soil system is very slow because it is derived from the weathering processes of soil minerals. The soils within the Eyerly area are relatively low in phosphorus but are not considered to be phosphorus deficient. Levels have been

measured at 50 ppm in the mineral soil A (surface) horizons of Mazama pumice and ash located in the Long-Term Productivity Plots on the Deschutes National Forest (Busse, personal communication), and 6,400 to 10,000 pounds/acre in a complete profile of similar soil (Little and Shainsky, 1995). Levels of phosphorus following the fire would not be considered to be deficient for vegetative growth.

Sulfur: As with phosphorus, the amounts of sulfur lost from the combustion of organics during the wildfire are relatively small since a very small percentage of the site budget of sulfur is contained in the vegetative component. Losses of this nutrient are primarily from the volatilization of soil organics and nutrients in solution under down logs where high temperatures were sustained for an extended period of time.

The amount of atmospheric input of sulfur into the terrestrial environment varies throughout the world according to concentrations and rainfall. Gaseous forms of sulfur in the atmosphere can be deposited in rainfall or by dry fallout. Estimates of sulfur input into soils of the United States range from 20 pounds/acre/year, as measured in an Indiana soil, to as much as much as 200 pound/acre/year closer to industrial point sources (Barber, 1984). Estimates for the local area are less than this given the absence of a significant industrial source upwind of the Deschutes and Jefferson county areas. Estimated input of oxides of sulfur from local and mobile sources is 1,324 tons/year for Deschutes county or approximately 1.4 lbs/acre/year (L.Caulkin, personal communication).

Exchangeable bases (potassium, sodium, calcium and magnesium) : Exchangeable bases are likely to be readily available within the mineral soil following the wildfire event. The volatilization temperatures of the primary exchangeable bases are above 700 degrees C and all four of these nutrients are readily released from the combustion of above-ground biomass (Agee, 1993). Ash produced from the combustion of organics is variable in depth throughout the fire and primarily consists of cations like Ca (calcium), Mg (magnesium), K (potassium) and Na (sodium) originally associated with the more readily volatilized anions containing phosphorous and nitrogen.

The volcanic ash soils present in the fire area have moderate cation exchange capacities and are capable of adsorbing cations of nutrients contained in the ash of the wildfire and subsequently leached into the soil solution. Soil nutrient samples in Jeffrey Pine forests in the eastern Sierra following fire have documented short-term increases in exchangeable bases (Blank, 1998). The No Action alternative would have no additional short-term effect on these levels and would provide the greatest amount and extent of post-fire coarse wood containing these nutrients for long-term input to the mineral soil.

Retardant Applications: Based on airtanker and helicopter records from Eyerly fire suppression activities and retardant concentrations, a total of 96,399 lbs nitrogen, 26,670 lbs phosphorous and 93,828 lbs sulfur were applied within or near the fire perimeter from retardant drops. The input of nutrients from retardant applied at recommended rates of 1.5 liters/square meter (CSIRO, 2000) would be an estimated 337 kg/ha (300lbs/acre) of nitrogen, 94 kg/ha (83 lbs/acre) of phosphorous and 328 kg/ha (292 lbs/acre) of sulfur over a maximum of 321 acres, assuming no overlap of drops. Concentrations are likely to be lower than this on the soil surface since the retardant would have come to rest on the crowns of trees, herbaceous understory vegetation and organic residues of all fuel classes on the ground. Much of what was applied was likely heated or eventually combusted,

depending on the fire behavior or persistence at the time. Some drops may have occurred away from the fire edge and may not have been heated or burned over.

Effects of Retardant Residues: The effects of retardant chemicals on soil chemistry and water resources depends on their heat induced transformations from the fire, soil characteristics such as organic matter content and cation exchange capacity (CEC), and leaching pathways involved in the system. The majority of retardant dropped within the project area was likely heated to some degree by the fire and altered as described in the retardant transformation discussion included in the existing condition section of this chapter. Soil organic matter is generally below 4% in this area and the CEC of these soils is moderate. The permeability of the soils is moderately rapid and somewhat conducive to leaching mechanisms into subsurface flows that reappear at the surface along the intermittent channels of Street and Spring Creek. The amount and extent of effects described here are applicable for all three alternatives under this analysis.

Protocol for retardant application during wildfire suppression recommends that retardant not be applied within 300 ft of surface waters, which appears to have been adhered to during this fire (Metzger, personal communication). The vast majority of retardant was likely applied to upland locations far enough from channels where a very low percentage could contribute to stream concentrations. Although no retardant drops occurred directly into surface waters, there is the possibility that some retardant drop occurred within or near dry ephemeral draws and upper portions of intermittent reaches of Street and Spring Creeks where residues could be diluted into seasonal surface flows.

Initial movement of individual nutrients and compounds contained in retardant residues in their heated or unheated forms is primarily determined by the timing and duration of precipitation events capable of dissolving retardant residues or delivering soil particles covered with retardant residue to stream flows following the fire. The proximity of retardant to stream courses would determine whether residues dissolved in concentrated precipitation or present on mineral soil particles would be transported to channel courses or infiltrated into the soil profile. Very little precipitation occurred in the three months following the fire and fall rains and winter snows during the 2002/2003 precipitation season were below average. Rain events capable of producing significant overland flow and delivering sediment to streams did not occur in the year following the fire.

Primary potential inputs from retardant residues include ammonium nitrogen and yellow prussiate of soda (YPS) from the Fire-Trol product, both of which can be toxic to fish. Ammonium concentrations in stream flows have been measured to be 0.4 to 50 mg/L from direct applications of retardant to surface waters and 0.01 to 0.8 mg/L from surface runoff emanating from adjacent upland soils applied with retardant (Boivin and Bailor, 1996). Although it is possible that some ammonium nitrogen entered the stream channel surface water system via dilution of retardant residues or direct transport of soil particles, it is likely to have been at very low concentrations since very little precipitation occurred in the first four months following the fire. Diluted ammonium was more likely to have percolated into soil solution where it could be utilized by plants re-sprouting on site.

Further movement of other individual nutrients through the soil profile are likely as follows: Residual amounts of sulfuric and phosphoric acids from the retardant not volatilized during the fire are likely to have combined with cations produced by partial combustion of ground and vegetative fuels and then percolated into the soil matrix. Products derived from phosphates that reach the soil matrix are readily adsorbed and fixed to mineral and organic exchange sites in these soils. Products derived from sulfates are

more likely to be leached into the groundwater and would follow a similar dilution pathway as nitrates. Residual ammonium nitrogen not taken up by plant roots would be nitrified into nitrate products susceptible to leaching through the soil profile and into groundwater. Inputs of nitrates into the groundwater system would decrease over subsequent growing seasons as vegetative uptake of available nitrogen on site increased toward pre-fire levels (CSIRO, 2000).

Although less mobile within the soil profile than ammonium nitrogen, significant precipitation can dissolve and transport the yellow prussiate of soda (YPS) component within Fire-Trol products into surface waters. YPS contains sodium ferrocyanide, which can release free cyanide under exposure to UV radiation while in solution. The risk of creating levels toxic to fish through this mechanism has been shown to decrease significantly after retardant residues are exposed to sunlight for 45 days or more before being dissolved into solution (Little, Calfee 2002). Since no significant rains occurred within the first two months following the fire it is unlikely that this product could be produced through this mechanism and the risk to fish is no longer present within the system.

Effects of Alternatives 2 and 3

Alternative 2, the proposed action, and Alternative 3 would have a variety of Direct, Indirect and Cumulative effects on the chemical and biotic components of the soil resource. Direct effects are related to changes to the chemical component from the removal or treatment of vegetative material during harvest and fuels treatment activities. Indirect effects are related to changes in the biotic and chemical components integral to soil productivity as a result of physical alterations to the soil resource. Cumulative effects are primarily a result of proposed activities occurring in areas where previous activities have incurred detrimental impacts to the soil resource.

Carbon to Nitrogen (C:N) ratios: The primary input of nutrients to the soil borne C:N ratio on site would come from fine litter and root biomass generated by the re-growth of vegetation. Although proposed activities would disturb some of the vegetation re-established since the fire, the overall return of this source of organic litter would be expected to be similar when compared to unsalvage areas within five years (Malaby, 2000). Planted conifers within proposed activity units would contribute additional litter fall in the immediate years following their establishment. Activity units would also have slash in the form of branches and tops that were not piled or burned contributed to the soil surface capable of contributing some carbon as decomposable soil wood to the soil borne C:N ratio. The rate at which soil C:N ratios move toward pre-fire levels would be similar for all three alternatives.

Soil Biota: Proposed activities would directly affect soil biota as a result of compaction of the soil profile and disturbance of the surface organic and mineral soil horizon. Documented effects to soil biota in compacted areas include changes in amounts and ratios of fungal and bacterial populations (Moldenke, 1998). Detrimental disturbance would occur over 20% of the area within a ground-based unit, primarily as skid trails and landing areas, leaving 80% of the area in a condition of acceptable productivity and condition for microbial recovery under undisturbed post-fire conditions described for

Alternative 1. Although fungal populations are likely to have been reduced to some degree in compacted areas, skid trails and landings that were subsoiled have been shown to have fungal and bacterial ratios and species composition return toward pre-impact levels (Moldenke, 1998).

The proposed harvest activities could remove up to 65% of currently standing, merchantable bolewood from proposed activity units under Alternative 2. Despite this removal the recovery of microbial populations directly related to vegetative hosts, fine organic litter and coarse woody debris under the Alternatives 2 and 3 is likely to occur at similar rates compared to Alternative 1. Roots associated with live and dead vegetation would be present at similar levels between alternatives to provide biomass for microbial respiration and host-sites for mycorrhizal relationships. Large snags and downed logs would be left on site at levels meeting the Metolius LSRA Standard and Guidelines for coarse woody debris and snag retention for each Plant Association Group (PAG). These levels range from 25 tons/acre in the Mixed Conifer wet PAG to 8 tons/acre in Ponderosa pine dry PAG (FEIS p.45-46). Unmerchantable standing trees and broken branches from felled and yarded boles would provide additional amounts of coarse wood within salvaged areas. As a result, levels of coarse wood on these sites are likely to meet or exceed recommended levels for soil productivity associated with mycorrhizal root-tip levels (Graham 1994; Brown et al, 2003) and the role of this material in providing functional microbial habitat would be retained on these sites.

The recovery of microbial populations within proposed activity units would be expected to occur at similar rates between the action alternatives due to the similarity of the level of disturbance within activity units. Although detrimental disturbance incurred under the action alternatives may slightly reduce or alter the composition of microbial populations in some unit areas when compared to Alternative 1, the extent of detrimental compaction is limited to 20% of a unit area and portions of the compaction incurred by proposed activities would be rectified through subsoiling in various units. The recovery and function of microbial populations in activity units would be maintained at levels sufficient to support productivity of the site in non-compacted areas covering 80% of the unit areas.

Surface organics and soil borne carbon: The post-harvest return of surface litter and duff, and soil-borne carbon is directly related to the presence of vegetation to provide these components to the soil resource. The proposed removal of material from activity units would disturb and remove existing vegetation on areas committed to skid trails and landings, ranging from 13 to 16% of the unit area. Vegetation between skid trails could be crushed or uprooted in areas where feller-bunchers traveled to shear and accumulate material, but this would occur on generally less than 10% of the area. The recovery of trampled vegetation and the re-growth of herbaceous vegetation capable of providing surface litter on these sites are expected to be delayed only slightly when compared to non-salvaged areas and Alternative 1 (Malaby 2000). Substantial amounts of annual and perennial vegetative species have sprouted and grown during the spring and summer of 2003 and are expected to continue to increase litter production in the post-fire line of vegetative succession.

Additional litter input would be contributed to the soil surface in proposed activity units from planted conifers following harvest and fuels treatment activities. The establishment of these species will provide a slightly larger amount of photosynthesized carbon and other nutrients contained in fine-sized organic material to the soil surface in the next few years under the action alternatives compared to Alternative 1, depending primarily on the rate and density of naturally regenerated conifers in unsalvaged areas. Soil functions such

as moisture retention, microbial breakdown and translocation of nutrients, and surface stabilization would recover at similar rates between alternatives as vegetative growth is cycled and incorporated into the mineral soil.

Coarse woody debris: As previously mentioned, coarse woody debris in proposed activity units within the LSR would be left on site at levels meeting the Metolius LSRA Standard and Guidelines for each Plant Association Group (FEIS Chapter 2, Table 2.8-6). These levels range from 25 tons/acre in the Mixed Conifer wet PAG to 8 tons/acre in Ponderosa pine dry PAG and would be primarily standing snags >10" dbh (FEIS Chapter 2, Table 2.9-1). A minimum of 120 lineal feet per acre of coarse woody material greater than or equal to 16 inches in diameter and at least 16 feet in length would be left on the soil surface within all units covered by matrix and eastside screen allocations. Large coarse wood already on the ground in all treatment areas would not be removed during proposed harvest and fuels treatment activities (FEIS, p.37). Additional levels of coarse wood in activity units would be contributed from unmerchantable standing trees and broken branches and tops from felled and yarded boles that were not piled and burned. Predicted levels of these fuels between 3 and 12" in diameter range from 3 to 6 tons per acre within units following proposed activities.

As a result, levels of coarse wood on all treatment sites are likely to exceed recommended levels for soil productivity, which research indicates to be at or above 7 tons/acre in Douglas fir/Ponderosa pine forests (Graham, 1994; Brown, et al, 2003). The role of coarse wood in providing functional microbial habitat and moisture retention on site is expected to be maintained on these sites, with sufficient levels of mycorrhizal root tip interactions for adequate soil productivity. Nutrient cycling associated with biotic and woody decay processes would also be maintained with the predicted levels of coarse woody debris left on site.

Long-term Site Productivity: The effects of the removal of biomass on long-term site productivity relates to the relative amount and function of the nutrients lost from the site. The analysis calculates the amount of each nutrient removed and the percentage remaining on site following proposed activities to describe the level of impact to the budget of each nutrient on site. For comparison to existing conditions under Alternative 1, areas of Stand Replacement mortality were calculated to have had approximately 59% of above ground carbon and 82% of above ground nitrogen stored in live vegetation and organic residues consumed by the fire.

Alternative 2: Table 3.3-11 compares the budgets of the primary nutrients as a result of the proposed harvest removal of approximately 50 to 65% of remaining commercial bolewood and the treatment of activity and non-merchantable fuels within the areas of Stand Replacement mortality for Alternative 2. Assumptions used for calculating changes in nutrient budgets are included in footnotes to the table. These activities would remove approximately 25% and 12%, respectively, of pre-fire, above-ground site budgets of carbon and nitrogen, and approximately 60% of the carbon and 75% of the nitrogen remaining in above-ground biomass on site following the fire. The material removed would consist primarily of commercial tree boles, and branches and tops that were piled and burned. Harvest and fuels treatments would leave behind activity fuels in the 10 and 100 hr size class and a relatively large amount of 100 hr fuels contained in the 3 to 12" non-merchantable material in these activity areas. Amounts of nutrients remaining on site

are likely to be greater than figures in the table since the majority of the non-merchantable trees in the 3 to 12" size class would not immediately be harvested or burned.

Table 3.3-11. Alternative 2 nutrient removal from proposed harvest within Stand Replacement activity units

Estimated Above Ground Nutrient Levels Per Activity					Environmental Inputs	Estimated Nutrient Export/Import Ratios	
Nutrient	Post-fire amounts onsite	Amount lost from ground harvest*	Amount lost from Skyline or Helicopter harvest **	Amount lost from fuels ***	Annual input	Ratio**** with fuels removed	Ratio without fuels removed
carbon	19 tons/acre	11.4 tons/acre	9.7 tons/acre	1.87 tons/acre	.24 tons/acre*****	55:1	40:1
nitrogen	82 lbs/acre	61.1 lbs/acre	35.5 lbs/acre	29.3 lbs/acre	15 lbs/acre	4:1	2:1
phosphorus	13 lbs/acre	8.8 lbs/acre	5.7 lbs/acre	3.6 lbs/acre	Unknown*****	(--)	--
sulfur	~10 lbs/acre	~6 lbs/acre	~3 lbs/acre	~2 lbs/acre	1.4 lbs/acre	4:1	1.4:1

Notes:

* Maximum amounts lost from ground based harvest operations utilizing whole tree yarding fuels treatments. Amounts lost on acres proposed for salvage are based on the physical removal of 50-65% of merchantable trees from units within Stand Replacement areas. Totals calculated include 65% of the nutrient budget contained in bolewood, plus 35% of the crown by weight (5% considered to break off during yarding) and 70% of the bark by weight, contained in the same amount of bolewood. Site budgets of the primary nutrients contained in the crown, bolewood and bark of a fully stocked, live Ponderosa Pine forest have been measured to be 22 T/acre C, 172 lb/acre N, 25 lb/acre P and approximately 10 lb/acre S (Little and Shainsky, 1995).

** Maximum amounts lost from Skyline, Helicopter and Cable units in which tops and limbs would be removed before yarding. Amounts lost on acres proposed for salvage are based on the physical removal of 50-65% of merchantable trees from units within Stand Replacement areas. Totals calculated include 65% of the nutrient budget contained in bolewood, plus 70% of the bark by weight contained in the same amount of bolewood. Site budgets of the primary nutrients contained in the standing bolewood and bark of a fully stocked Ponderosa Pine forest have been measured to be 15 T/acre C, 60 lb/acre N, 10 lbs/acre P and approximately 5 lbs/acre S (Little and Shainsky, 1995).

*** Maximum amounts lost from the burning of piled slash generated from harvest and yarding operations. An estimated 40% of Crown biomass remains following the fire and totals are calculated based on the removal of 65% of merchantable trees.

**** Ratios reflect the amount of each nutrient removed from proposed activities compared to the annual input of each nutrient. The amount of time taken to replenish each nutrient to pre-activity levels can be surmised from this ratio.

***** The annual input of photosynthesized carbon into a fully stocked forestland system (Busse, 1994; Little and Shainsky, 1995). Annual input of a post-fire, shrub/grass/forb dominated community is estimated to be at or above these rates when fully stocked. Movement of carbon contained in standing trees to the ground would occur as fire killed trees rotted and were wind thrown over the next ten years.

***** The annual input level of phosphorus is difficult to measure in forestland systems since most of it comes from the weathering of parent material and soil in place. Measured concentrations of this nutrient in the soil profile are relatively high and contain upwards of 98% of the total P stored on site (Little and Shainsky, 1995). Levels present after the fire would be sufficient to support the growth of forest vegetation on site. Inputs would occur over the course of a rotation that would most likely replenish the amounts lost from the fire.

Alternative 3: Table 3.3-12 compares the budgets of the primary nutrients as a result of proposed harvest removal of 30-50% of commercial bolewood remaining on site and the treatment of activity and non-merchantable fuels on site under Alternative 3. Alternative 3 would remove approximately 20% and 9%, respectively, of above-ground, pre-fire site budgets for carbon and nitrogen. This alternative would remove slightly lower

percentages of these nutrients remaining following the fire when compared to Alternative 2, approximately 47% of the carbon and 57% of the nitrogen, respectively. Amounts of nutrients remaining on site are likely to be greater than figures in the table since the majority of the non-merchantable trees in the 3 to 12" size class would not immediately be harvested or burned.

Table 3.3-12. Alternative 3 nutrient removal and input ratios from proposed harvest activities within units

Estimated Above Ground Nutrient Levels Per Activity					Environmental Inputs	Estimated Nutrient Export/Import Ratios	
Nutrient	Post-fire amounts onsite	Amount lost ground harvest*	Amount lost other harvest **	Amount lost fuels ***	Annual input	Ratio**** with fuels removed	Ratio w/out fuels removed
carbon	19 tons/acre	9.03 tons/acre	7.77 tons/acre	1.42 tons/acre	0.24 tons/acre*****	37:1	32:1
nitrogen	82 lbs/acre	47 lbs/acre	27.3 lbs/acre	22.5 lbs/acre	15 lbs/acre	3:1	1.8:1
phosphorus	13 lbs/acre	6.83 lbs/acre	4.37 lbs/acre	2.83 lbs/acre	Unknown*****	(--)	--
sulfur	~10 lbs/acre	~5 lbs/acre	~2.5 lbs/acre	~1.5 lbs/acre	1.4 lbs/acre	3.6:1	1.8:1

Note: Footnotes are listed under Table 3.3-11

Proposed activities under Alternative 3 would leave approximately 10% more standing 1000 hr and 100 hr fuels on site than under Alternative 2 and approximately 60% less than Alternative 1. The action alternatives would also move a portion of the remaining above ground storage pool to the soil surface, primarily as a result of breakage during operations and the removal of tops and limbs prior to Skyline and Helicopter yarding. Various amounts of this slash would be piled and burned within each unit in order to reach recommended fuel loadings of the 10 and 100hr size classes ranging from 5 to 15 tons/acre. Predicted fuels levels following proposed harvest and yarding activities under the action alternatives range from 20 to 30% of the pre-fire above ground biomass, although the 1 and 10 hr fuel classes were mostly consumed within the stand Replacement mortality areas and would not be well represented (Metzger, 2003). Differences between alternatives in amounts of finer organic material in the 1 and 10hr fuels classes moved to the soil surface would be negligible as they relate to the productivity of these sites.

The effects on long-term productivity from the removal and treatment of bolewood and fuels on site are expected to be minimal for the action alternatives. Coarse woody debris does not appear to make a significant contribution to N and P cycling in arid east-side conifer forests (Prescott, 2002; Busse, 1994). The majority of nutrients contained in the biomass of a tree that are available for rapid decomposition and input into the soil system are contained in the crowns and small branches which were already consumed on the majority of trees proposed for removal. Although the removal of bolewood reduces the amount of above-ground site nutrients remaining after the fire, the percentage of total site nutrients lost, especially available soil nutrients, is relatively low (Little and Shainsky, 1995). The primary replenishment mechanisms for available nutrients on these sites are photosynthetic and atmospheric deposition processes that do not utilize bolewood as a storage mechanism before utilization by plants (*Table 3.3-12*).

The action alternatives also provide for level of snags and coarse wood within each plant association following salvage activities that are in accordance with site productivity recommendations associated with their role as hosts for mycorrhizal fungal activity (Graham, 1994). Coarse wood levels within activity units would exceed those recommended for mycorrhizal root tip abundance associated with productivity for the Ponderosa pine and Mixed Conifer PAG's and contribute to long-term productivity needs.

Soil Nutrients: The chemical pathways and input rates of the primary nutrients described under Alternative 1 are applicable for Alternative 2 and 3. The current soil-borne levels of nutrients on site have not been significantly altered or reduced by the fire and are capable of supporting vegetative growth over the next few years. The organic biomass produced in this time period is the primary input of nutrients to the above-ground budget of nutrients in the short-term and this growth of vegetation is not likely to be significantly different between alternatives after three to five years (Malaby, 2000). Herbaceous and coniferous vegetation on these sites would produce seasonal inputs of organic litter that would contribute to nutrient budgets in the mineral and organic soil horizons in subsequent years.

Planting of the stand replacement acres proposed for salvage would jump start the return of fine organic litter inputs from trees over Alternative 1 by a number of years, depending on the rate and density of natural regeneration that occurs on unsalvaged areas over the next few years. Carbon contained in needles of planted seedlings would also increase this component contribution to soil borne locations within the proposed activity units. Although the removal of tree boles would reduce the amount of above-ground carbon and nitrogen on site, there would still be substantial amounts present within the remaining snags, down wood and non-merchantable size classes and the primary replenishment mechanism of these nutrients is through photosynthesized vegetative growth.

Although compaction of the soil resource can physically reduce or inhibit biotic populations within the soil profile, these indirect effects are likely to be localized to areas committed to landings and skid trails and should not be detrimental to overall populations and site productivity if limited to less than 20% of the activity area.

Summary: The action alternatives differ slightly in the amount of nutrients removed from proposed activity acres. Silvicultural prescriptions remove less merchantable material under Alternative 3 in order to further address wildlife snag and down wood requirements under the DECAID model (Hennings, 2003). *Table 3.3-13* compares the above ground nutrient budgets within a Ponderosa Pine plant association under stand replacement post-fire conditions for the three alternatives. Post-fire calculations for Alternative 1 are based on the consumption of all above ground shrubs, coarse wood and forest floor litter during the fire, as well as 60% of the tree crowns and 20% of the tree bark. Additional losses calculated for Alternatives 2 and 3 assume the removal of 50 to 65% of merchantable trees in Alternative 2 and 30 to 50% under Alternative 3.

Table 3.3-13. Above ground Site Budgets of primary nutrients by alternative

Site Budget		Above Ground* Site Budget by Alternative		
Primary Nutrient	Pre-fire Site Budget total	Alt. 1 Post-fire total (1 st year)	Alt. 2** post-treatment total	Alt. 3 post-treatment total
carbon	46 tons/acre	19 tons/acre	7.6 tons/acre	10 tons/acre
nitrogen	504 lbs/acre	82 lbs/acre	21 lbs/acre	35 lbs/acre
phosphorus	57 lbs/acre	13 lbs/acre	4.2 lbs/acre	6.2 lbs/acre
Residue C:N ratio	283:1	same	same	same
Soil C:N ratio	26:1	(16 to 20):1	same	same
Notes: * Above Ground Site Budget for alternative comparison includes nutrients contained only in tree components such as crown, bolewood and bark . ** Alt. 2 and Alt. 3 above ground site budgets are based on the removal of 65% and 50%, respectively, of merchantable trees within ground-based, whole tree yarded activity units.				

The fire was calculated to have consumed approximately 59% of the carbon, 82% of the nitrogen and 77% of the phosphorus, respectively, contained in above ground vegetation prior to the fire. Ground-based activity units in Alternative 2 are calculated to remove an additional 25% of the carbon, 12% of the nitrogen and 15% of the phosphorus contained in the pre-fire, above ground nutrient budgets, while those proposed in Alternative 3 are calculated to remove 20% of the carbon, 9% of the nitrogen and 12% of the phosphorus contained in these same budgets.

Retardant Applications: Application amounts and the pathways of nutrients contained in retardant residues described for Alternative 1 are applicable for the action alternatives under this analysis. The effects of proposed activities on residue contributions to the soil profile or stream channels are directly related to the disturbance of mineral soil within activity areas where residue remained. Short-term increases in sediment delivery identified for Alternatives 2 and 3 indicate a slightly elevated risk of carrying soil particles with ammonium nitrogen or other nutrients on them into the stream channel system. Total concentrations of these nutrients are likely to be very low as a result of this pathway, especially since the higher flows necessary to deliver sediment would further dilute their concentrations.

The effects of retardant chemicals on soil chemistry and water resources depends on their heat induced transformations from the fire, soil characteristics such as organic matter content and Cation Exchange Capacity (CEC), and leaching pathways involved in the system. Proposed activities are not likely to change any of these components enough to affect change to the transformation or movement of these residues. Since the likelihood of soil disturbance occurring directly over areas where retardant residues remain is relatively low and the over all permeability of the soils in the area is moderately rapid, additional movement and concentration of nutrients contained in these residues as a result of proposed activities is very low. The residues will also have weathered two complete winter precipitation seasons capable of diluting or moving nutrients before any proposed activities disturbed these sites.

Cumulative Effects

Cumulative effects to the soil resource as a result of the implementation of proposed activities in areas of existing disturbance are summarized in the Existing Condition section of the soils resource report and *Table B-5 of Appendix B*. Units with 10% or more of their area in a detrimental condition from past activities are expected to incur additional detrimental impacts in excess of 20% of the unit area before subsoiling operations occurred.

No reasonably foreseeable activities are proposed within the Eyerly Project area following the proposed activities under this FEIS. Fuels reduction proposals on Green Ridge and future under-burning within and around activity units included in the Eyerly FEIS were recommended during the development of the Eyerly proposed action but were not analyzed under the EIS. Underburn treatments possibly implemented under future NEPA decisions could utilize activity units for portions of their area and would have limited affects to the soil resource if associated Burn Plans include proper mitigations for the protection of soil characteristics. It is possible that these underburns would treat portions of the project area not designated as harvest activity units by using existing roads or skid trails as unit boundaries in order to reduce the construction of lines for containment of the burn. These methods would be expected to reduce disturbance of the surface soil attributable to underburn operations. District priorities are likely to move to other areas following the B&B Complex fire and landscape planning in the South Trout Project area.

❖ 3.4 Water Quality (Key Issue 2)

❖ 3.4.1 Introduction

Issue: The proposed activities have the potential to affect water quality parameters such as sediment production and channel stability. Water quality and quantity within the Eyerly Project Area have been affected by past management practices and the Eyerly Fire.

This section describes both the existing condition and the environmental consequences in relation to water quality and quantity. It is based on the Eyerly Salvage Hydrology Report: (McCown 2004) and also relies on information presented in the Soils Report (Sussmann 2004).

The existing condition provides a hydrologic overview of the planning area and the management direction as related to the water quality. This overview is followed by a detailed description of the affected environment in relation to hydrologic elements such as streamflow; sedimentation; channel conditions; water temperature; and water chemistry effects. The environmental consequences section follows the existing condition section and presents the environmental effects in terms of the hydrologic elements listed above.

❖ 3.4.2 Existing Condition

Hydrologic Overview

The Eyerly Fire Salvage Analysis Area lies within the Upper Deschutes River Sub-Basin. The analysis area is primarily located within National Forest Service (NFS) lands north of Forest Road (FR) 1170, south and west of the Metolius River, and east of FR 1149. It is in the Lower Metolius watershed, which include the subwatersheds (SWS) listed in *Table 3.4-1*.

The Eyerly Fire affected some portions of all these subwatersheds; however, salvage is only proposed in portions of Lower Fly Creek, Spring Creek, Street, Metolius Horn, and Metolius SWSs. Slivers of Prairie Farm, Big Canyon, and Scarp subwatersheds are within the analysis area but would be unaffected by the proposed salvage.

Table 3.4-1. Acres by subwatershed within the Eyerly Salvage Analysis Area

SWS Name	SWS Acres	NF acres in SWS	Acres in Project Area Boundary	Acres burned
Lower Fly Creek	8,466	7,144	2,149	2,141
Spring Creek	6,774	6,774	6,774	6,149
Street	7,308	7,308	7,308	4,874
Metolius Horn	31,658	7,378	418	195
Metolius	13,545	8,981	13,545	7,449
Lower LBC Metolius	11,785	1,005	11,785	2,215
Total	79,536	38590	41,979	23,023

Management Direction

Clean Water Act: Beneficial uses and the associated water quality parameters as defined by the State of Oregon for the Metolius River and its subwatersheds are shown in *Table 3.4-2*. Parameters that there may be a risk of affecting with the proposed actions in the Eyerly Salvage analysis area are temperature, turbidity, and total dissolved solids in the rivers and pH and chlorophyll *a* in Lake Billy Chinook Reservoir.

Table 3.4-2. Beneficial uses, associated water quality parameters: Deschutes River Basin (ODEQ 2003).

Beneficial Use	Associated Water Quality Parameter
Public Domestic Water Supply	Turbidity, Chlorophyll <i>a</i>
Private Domestic Water Supply	Turbidity, Chlorophyll <i>a</i>
Industrial Water Supply	Turbidity, Chlorophyll <i>a</i>
Irrigation	None
Livestock Watering	None
Anadromous Fish Passage	Biological Criteria, Dissolved Oxygen, pH, Sedimentation, Temperature, Total Dissolved Gas, Toxics, Turbidity
Salmonid Fish Rearing	Dissolved Oxygen, Sedimentation, Temperature
Salmonid Fish Spawning	Same as Salmonid Fish Rearing
Resident Fish and Aquatic Life	Same as Anadromous Fish Passage
Wildlife and Hunting	None
Fishing	Aquatic Weeds or Algae, Chlorophyll <i>a</i> , Nutrients
Boating	None
Water Contact Recreation	Aquatic Weeds or Algae, Bacteria, Chlorophyll <i>a</i> , Nutrients, pH
Aesthetic Quality	Aquatic Weeds or Algae, Chlorophyll <i>a</i> , Nutrients, Turbidity

The State is required by the Clean Water Act (CWA), Section 303(d), to identify water quality impaired streams. Lake Billy Chinook reservoir is the only waterbody listed in the Eyerly Salvage analysis area listed on Oregon's 2002 303(d) list. It is listed for pH and chlorophyll *a* exceedances (ODEQ 2002).

Total Maximum Daily Loads and Water Quality Management Plans: The Deschutes National Forest relies on current laws, management plans, and Best Management Practices

(BMPs) to provide the basis for improving water quality in the forested landscape. All federal land management activities must follow standards and guidelines (S&Gs) listed in the Deschutes National Forest Plan, as amended by the Northwest Forest Plan (NWFP) (USDA Forest Service and USDI Bureau of Land Management 1994), INFISH (USDA Forest Service 1995a), and BMPs (USDA Forest Service 1998a). NWFP and INFISH provide management direction in the form of Riparian Reserves (RRs) and interim Riparian Habitat Conservation Areas (RHCAs), and S&Gs for Key Watersheds. The National Forest lands in the Eyerly Salvage analysis fall under NWFP and INFISH direction.

The Clean Water Act requires States to develop Total Maximum Daily Load allocations and Water Quality Management Plans in basins where waterbodies are listed as water quality impaired, that is, do not meet State Water Quality Standards. The Upper Deschutes River Sub-Basin Total Maximum Daily Load (TMDL) and Water Quality Management Plan (WQMP) is scheduled for completion in 2006 and covers all the subwatersheds in the Eyerly Salvage analysis area. The TMDL and WQMP document establishes water quality goals for water bodies and lays out steps toward meeting them by establishing numeric goals for allowable levels of pollution (loads) by sub-basin within the larger basin. The Confederate Tribes of the Warm Spring Reservation (CTWSR) and Portland General Electric (PGE) developed a Water Quality Management and Monitoring Plan (WQMMP) for the Pelton Round Butter Project (i.e. LBC Reservoir) as a requirement of the relicensing of the dam (CTWW and PGE 2002). A Memorandum of Understanding (MOU), signed May 2002, between Oregon Department of Environmental Quality and the USDA Forest Service, designates the Forest Service as the management agency for the State on National Forest Service lands. To meet CWA responsibilities defined in the MOU, the Forest Service is responsible for developing a Water Quality Restoration Plan (WQRP). The Upper Deschutes Basin WQRP is under development and scheduled for completion in 2004.

Standards for parameters of concern (ODEQ 2003): The Eyerly Hydrology Report details the standards for parameters of concern and exceptions established within the State of Oregon (OAR 340-041, December 2003) and Confederated Tribes of Warm Springs Reservation to accomplish the goals of the Clean Water Act. Activities proposed within the project area would meet quality standards for surface water temperature, turbidity, total dissolved solids, pH, and chlorophyll *a* through application of site specific BMPs, monitoring, and evaluation. In addition, activities would not lead to downstream water quality limitations.

Streamflow

The Metolius River is a spring dominated system and precipitation inputs are stored and released slowly resulting in a generally flat hydrograph (small range between high and low flows). Average monthly flow ranges from 1348 cfs (cubic feet per second) in October to 1631 cfs in June. Streamflow in the analysis area is generally dominated by snowmelt with peaks in the spring and low flow in August and September. Most streams in the project area drain into the west side of Lake Billy Chinook (LBC) reservoir. A few intermittent or ephemeral streams in the Metolius subwatershed drain into the lower 6 miles of the Metolius River above LBC reservoir (*Table 3.4-3*). Fly Creek and its upper tributaries, Prairie Creek and Six Creek, are perennial and are fed by springs during the low flow period. The lower sections of Spring Creek (river mile 0 to 0.25) and Street Creek (river mile 0 to 1.6) are perennial and fed by springs in the low flow period, while the upper sections are intermittent and flow only part of the year or during wet years. The Metolius subwatershed consists of many intermittent and ephemeral face drainages that feed into the lower Metolius River from both the west (USFS land) and east sides (Warm Springs Tribal land). The intermittent flow regime in these side drainages is due to high infiltration rates, short channel lengths, steep terrain, and low annual precipitation.

Table 3.4-3. Flow regime and channel type of named streams in the Eyerly Salvage analysis area

SWS Name	Stream	Flow Regime		Stream Type*
		Perennial	Intermittent	
Lower Fly Creek	Fly Creek	Between Prairie Farm Creek and Six Creek; lower 500 ft	X	C3, B3, C3, B2/A2
Spring Creek	Spring Ck.	Lower ¼ mile	X	B3
Street	Street Ck.	Lower 1.6 miles	X	B3
Metolius Horn	Metolius R.	X		B/C
Metolius	Metolius R.	X		B/C
Metolius	Bean Creek		X	B/A
Lower LBC Metolius	Lake Billy Chinook Reservoir	X		N/A
Notes: * Approximate stream type from top to bottom (Rosgen 1996) ▪ A – Entrenched; Low width/depth ratio; Low sinuosity; Slope range 0.04 - 0.099; Channel material: bedrock - o A2 – Channel material: boulders - o A3 – Channel material: cobble ▪ B – Moderately entrenched; Moderate width/depth ratio; Moderate sinuosity; Slope range 0.02 – 0.04; Channel material: bedrock - o B3 – Channel material: cobble ▪ C - Slightly entrenched; Mod. to High width/depth; Mod. to High sinuosity; Slope range .001 – 0.02; Channel material: bedrock - o C3 – Channel material: cobble				

The relationship between the loss of vegetation (timber harvest and fire) and increases in water yield are well established (USDA 1976; Helvey 1980). The reduction in tree density (i.e. canopy cover) results in a reduction in the amount of transpiration and canopy interception of rainfall/snowfall, thereby, increasing the amount of the precipitation available for runoff as streamflow. The majority of the increase in water yield occurs during spring runoff (King 1989). In addition, studies have shown that snow-water-

equivalent and the snow melt rates are higher in open areas (both burned and natural) than in forested areas (McCaughy and Farnes 2001; Skidmore et al. 1994). As leaf-area-index recovers, water yield declines. Studies in Colorado have shown that full vegetative-hydrologic recovery after logging occurs approximately 80 years after harvest (Troendle and King 1985; USDA 1976).

Although numerous studies have evaluated the effects of created openings on water yield, the results are highly variable (Scherer 2000, Stednick 1995, Fowler et al. 1987, Troendle and King 1985). A compilation of results from scientific literature on the effects of created openings on water yield indicates “highly variable changes in: peak flow (ranging from no change to 66% increase), peak-flow timing (ranging from no change to 18 day advancement), water yield (ranging from no change to 111% increase), and low flow (ranging from no change to 37% increase)” (Scherer 2000). The amount and duration of the water yield increase following timber harvest activities can vary according to the size and the amount of canopy removed; while following a wildfire, the burn size and burn severity¹ may affect the water yield increase. Studies have shown increases in water yield following fires ranging from 7 % (Farnes 2000) to 52 % (Helvey 1980), partially depending on the amount of the watershed burned.

Climate primarily determines the magnitude of peak flows (Dunne and Leopold 1978); however, land use practices such as timber harvest have been shown to increase peak flows in some cases (Troendle and Kaufmann 1987). In addition, studies have shown that roads can increase high flows but results are variable (King and Tennyson 1984, Wemple et al. 1996, Harr et al. 1975). Roads can alter surface hydrology through several mechanisms including interception of subsurface runoff (through compaction), concentrating surface runoff, and extending channel networks which increases watershed efficiency. Past harvest or fire suppression equipment can also cause compaction and associated hydrologic impacts (usually in skid trails, bulldozer lines, and landings). However, compaction in skid trails is considerable less than roads and compaction in bulldozer lines is even less than skid trails because there are fewer passes by heavy equipment.

Watersheds exhibit great natural variability in flow, and can accommodate some increase in peak flows without damage to stream channels and aquatic organisms. However, shifts in the frequency of channel-forming flows will result in physical adjustment of the channel such as increases in channel width, depth, erosion, and sediment deposition. Hydrologic risk, generally related to channel erosion, should then be evaluated based on specific watershed characteristics such as precipitation, infiltration, and channel stability.

Streamflow Analysis: A study found that after wildfires, water yields were most affected by basal area loss (trees killed by fire) and the greater the loss, the greater the increase in water yield (Potts et al. 1985). The Eyerly Fire and past timber management activities have removed significant vegetation within the Metolius, Street and Spring Creek subwatersheds, which as a result has altered sedimentation and most likely water yield in

¹ All burn analyses in the hydrology report uses the union_bsevs_p coverage which is based on stand burn severity. The term “stand burn severity” is used to indicate the mortality levels on the stand. These classes were developed by the Sisters District silviculturist based on field verification of the “burn severities” originally determined by vegetation flights, landsat interpretation, and BAER reconnaissance. The stand burn severity classes are: stand replacing (> 75% stand mortality), mixed severity (between 25% and 74% stand mortality), and non-lethal (< 24% stand mortality). For this analysis, the stand burn severity layer is also an accurate base fire severity layer for describing post-fire watershed response of evapotranspiration and soil erosion. This layer represents the burn effect on soil because the amount and extent of organic litter and duff consumption was often directly related to the stand characteristics following the fire (refer to Soils Report). In this report the fire effect will be described by burn severity classes: high (stand replacing mortality), moderate (mixed mortality), low (non-lethal), and unburned.

these subwatersheds. Predicting changes to streamflow following a fire is difficult and no one model depicts all components (i.e. water yield, peakflow, low flow, days of high flow); therefore, various models were used to describe the changed condition.

Changes in evapotranspiration (ET) due to the loss of vegetation following the Eyerly Fire, past harvest, and road building were estimated using the equivalent clear-cut area (ECA) model. The procedure to determine the ET index accounts for harvest method, stand burn severity¹, roads, vegetative recovery rates, and subwatershed area for the Eyerly Salvage analysis area. The ET index is only a surrogate for evapotranspiration because it does not include variables such as climate, wind and vegetation type (refer to Hydrology Specialist Report for a more detailed description of the model). The model predicted reductions in the ET index ranging from 37 to 69 after the Eyerly Fire (*Table 3.4-4*).

Changes to vegetative opening in the rain-on-snow zone were evaluated because an increase in openings could increase snow accumulation and melting, and possibly peak flows. Twenty percent of the Eyerly burn area falls within the rain-on-snow zone (3500 to 5000 ft). None of Lower Lake Billy Chinook (LBC) Metolius subwatershed and less than 2% of Lower Fly Creek and Metolius Horn subwatersheds are within the rain-on-snow zone. Although 20 percent of the Eyerly burn perimeter is within the rain-on-snow zone (i.e. the upper 1000 ft), less than 10 percent of the high burn severity¹ within the rain-on-snow zone occurred within any one subwatershed. Therefore, the risk of increased peak flows from rain-on-snow events has changed very little since the Eyerly Fire.

Based on personal observation and professional judgement, the Forest hydrologist predicted a 20% increase in peak flows following the fire in the Eyerly Burned Area Emergency Response (BAER) report (Wilcox et al. 2002). It is difficult to model peak flows; however, it is possible to model stormflows based on average rainfall intensities. A geospatial model called, “The modified rational GIS flow model 1.0”, developed by URS Greiner Woodward Clyde and modified by M. Parenti & Associates (2003), was used to predict the percent change in stormflow (not including a rain-on-snow event) from a 1-hour rainstorm event in the subwatersheds most affected by the fire. The inputs to the model were rainfall intensity, soil hydrologic group, vegetative cover, burn severity, drainage area, stream miles, and slope (refer to the Hydrology Specialist Report for a more detailed description of the model).

Predicted increases in stormflow from a from a one-hour rain storm event in the first year following the fire ranged from 50 to 90% in Street and Spring Creek subwatersheds (*Table 3.4-4*). Metolius subwatershed was not modeled for stormflow increase using the geo-spatial model because it is comprised of face drainages rather than one outlet. Although the change in evapotranspiration in the Metolius SWS is similar to Street SWS, the increase in stormflow would be less because drainages in the Metolius SWS are short and steep with very porous soils allowing water to infiltrate and be stored for late season flow. The overall stormflow effects would decrease as vegetation recovers.

Table 3.4-4. Reduction in the evapotranspiration index (scale 1 – 100) and increase in streamflow (after a one hour rainstorm) by subwatershed (SWS) following the Eyerly Fire.

SWS	Total Acres	% of SWS burned	ET Index Pre-Fire	ET index Post-Fire	Reduction in ET index	% Increase storm flow
Spring Creek	6,774	91	18	87	69	90
Street	7,308	67	26	68	42	50
Metolius	13,545	55	9	46	37	N/A

The compiled results from the models suggest that water yield and stormflows will greatly increase in the watersheds most affected by the fire. Peak flows could also greatly increase depending on the type of event (i.e. storm or melt) that triggers them. It is likely that some intermittent reaches may become perennial until vegetation reestablishes and evapotranspiration returns to pre-fire conditions. Increases in peak flows and/or stormflows could increase channel erosion in some streams; however, this depends on many watershed variables and will be discussed in the Channel Network and Condition section.

Sedimentation

The amount of sediment transported to or eroded within a stream channel can affect the beneficial uses of water, and is frequently used as a measure of overall water quality. If sediment loads increase above the stream's ability to transport it, then the stream may become shallower, wider, and less stable than pre-deposition conditions and may cause harm to aquatic resources. The major causes of sedimentation in the Eyerly Salvage area are wildfire effects, roads, and timber harvest.

Wildfire: Wildfires have the potential to impact sedimentation by reducing soil aggregate stability, reducing permeability, increasing runoff and erosion, and reducing organic matter/nutrient status. These combined effects can cause runoff to increase, which can increase soil erosion, especially on steeper slopes that burned with a high burn severity. Burn severity describes the effects of the fire on the soil hydrologic function (amount of surface litter, erodibility, infiltration rate, runoff response) and productivity. Salvage logging may increase erosion potential in some situations; however, it decreases over time as the soil surface is revegetated and the soil aggregate stability is reestablished. The recovery of shrub and other herbaceous vegetation within activity units is not likely to be inhibited significantly in the short-term following harvest activities and would be expected to provide cover capable of reducing raindrop impacts at levels similar to areas left unsalvaged within 3 to 4 years (Chou et al. 1994).

Although the risk of sheet and rill erosion was elevated after the fire due to the loss of live vegetative cover and the consumption of litter and duff on the soil surface (*Table 3.4-5*), this risk has been significantly reduced because ground vegetation in the Eyerly Fire area has partially reestablished, and ground cover in burn areas is estimated to be 60 to 100 % (field observations, Spring 2004, C. McCown). In less than 2 years after the fire there has been considerable regrowth of native herbaceous annuals, shrubs, grasses, and non-native seeded species, both within and outside of seeded areas (monitoring data from Fall 2003 by Suna). Other studies have shown this same rapid reestablishment (2-6 years) of ground vegetation following fires and have also shown a subsequent reduction in sediment yields (Robichaud 1999; and Radek 2001; Hauer and Spencer 1998)

Also, other surface roughness capable of reducing erosion exists, such as needle fall, down wood, and rock. According to field data from the Fall 2002, post-fire needle fall occurred in 63% of stands, generally covering 20 to 60% of the ground area. This occurred primarily in stands in the moderate burn severity class and some stands in the high burn severity class that did not have all their needles consumed by the fire. In addition, soil types present on the steep north facing slopes of Street and Spring Creek subwatersheds have a considerable component of surface rock that reduces the amount of

mineral soil exposed on these slopes. The needle cover and rock reduce the erosive effects of rainfall in the burn area.

Table 3.4-5. Eyerly Fire percent burn severity and percent riparian area affected.

SWS	% SWS acres burned	% of SWS acres burned by severity class			% RHCA/RR affected by fire		
		Low	Moderate	High	Low	Moderate	High
Lower Fly Creek	25	0	5	20	<1	1	22
Spring Creek	91	1	10	80	1	13	79
Street	67	8	15	44	7	20	37
Metolius Horn	<1	0	0	0	0	0	<1
Metolius	55	8	11	36	12	10	31
Lower LBC Metolius	19	0	7	15	0	4	25

Due to low percent of hydrophobic soil conditions and abundant surface roughness (i.e. BAER projects, rocky slopes, needle cast, down wood, and other unburned or partial burned vegetation), severe soil erosion, under normal precipitation events, is not expected from the vast majority of hill-slopes in the burn area. Sedimentation modeling, using erosion rates predicted by the soil scientist (Soils Specialist Report 2004, used Anderson model 1989) and a sediment delivery model based on the distance from the disturbance to the nearest stream channel (USDA Forest Service 2001; Leven 1971), predicted a 9 to 16 fold increase sedimentation in Street and Spring Creek subwatershed for the first year following the Eyerly Fire. The modeled estimates are reasonable, based on erosion rates in the literature, if a high intensity rainstorm occurs within 3 years after the Eyerly Fire (Helvey 1980; Debano *et al.* 1998; Sirucek 1987). These models assumed that at least a 30-minute intensity rainstorm occurred, which has not yet happened in the Eyerly analysis area since the fire (2 years). Preliminary monitoring of silt fences in high burn severity slopes between 40 and 49% in Street and Spring Creek SWS show that erosion in the burn area has been significantly less than predicted. Less than 0.1 ton per acre of sediment was eroded from these areas during the first year following the Eyerly Fire. The Hayman Fire area, which experienced nine rainfall or snowmelt events that produced erosion in the first 15 months following the fire, produced approximately 300 times more sediment per acre than the Eyerly Fire area. Monitoring of soil erosion in the Eyerly Fire will continue in the burn areas, in burn areas with erosion control treatment, and in unburned areas over the next 1 to 2 years. Reference the Hydrology Specialist Report for a detailed discussion of the computation of quantified soil erosion.

Roads: In managed forested areas, the main source of direct sediment is from roads associated with timber harvest (Helvey and Fowler 1979). As mentioned earlier, roads, skid trails, landings and firelines can alter surface hydrology and increase natural rates of erosion. Roads reduce infiltration, reduce vegetative cover in streamside areas, and accelerate erosion and sedimentation into streams (Megahan 1983). Skid trails have the same effects as roads but at a lesser degree. Compaction of the road or trail surface can increase erosion by causing overland flow. It could also increase bank erosion by altering the timing and magnitude of peak flows.

A large portion of the Eyerly project area (6707 acres) lies within the Metolius Roadless area. Although no activities are proposed in this area.. The roaded portion of the analysis

area contains 87 miles of open road (Levels 2 and 3) and 59 miles of closed (Level 1) roads. Considerable road decommissioning (42 miles) and road closure (23 miles) is proposed in the Eyerly Project Area Roads Analysis (USDA Forest Service 2003); environmental analysis for implementing the proposed road work has not yet been scheduled. The effects of the existing roads and the proposed road management actions are evaluated in this section of the EIS (*Table 3.4-6*) and discussed under cumulative effects.

Table 3.4-6. Road management activity by maintenance level proposed in the Eyerly Roads Analysis

Maintenance Level	Existing Road Miles	Proposed Road Miles Decommissioned	Proposed Road Miles for Closure	Road Miles After Proposed Action
Level 1 - Custodial Care (Closed)	58.9	32.8 *	0	26.1
Level 2 – High Clearance Vehicles	81.3	9.2	22.5	49.6
Level 3 – Suitable for passenger Cars	6.0	0	0	6.0
Total	146.2	42.0 *	22.5	181.7
Note: * Includes 1.3 miles of Road 1170890 identified by IDT between Draft and Final EIS. All other calculations reflect original recommendations documented in the Eyerly Roads Analysis document (Pers. Comm. Horgen 2004).				

Road Densities: High total road densities are an indication of the need to further examine the road network. Road densities for subwatersheds associated with the Eyerly Salvage analysis area range from 0.2 to 4.9 mi/mi² (*Table 3.4-7*)². Many of these road densities are considered a high risk to the aquatic system according to the document, “Determining Risk of Cumulative Watershed Effects Resulting from Multiple Activities” (4.6 mi/mi² for subwatersheds with slopes less than 30%; and > 3.6 for subwatersheds with slopes greater than 30%) (USDA Forest Service 1993). After proposed decommissioning, road density in Spring Creek SWS will be reduced to 3.1 mi/mi² and to 4.0 mi/mi² in Street SWS, but will not significantly change in the other subwatersheds.

Table 3.4-7. Road densities in subwatersheds affected by the Eyerly Salvage

SWS Name (bold denotes primary SWS in Analysis Area)	Road Density (mi/mi ²)	Road Density after proposed changes (mi/mi ²)	Change in road density (mi/mi ²)	Percent of SWS within Eyerly project area boundary
Lower Fly Creek	2.5	2.4	0.1	25.3
Spring Creek	4.7	3.1	1.6	100
Street	4.9	4.0	0.9	100.0
Metolius Horn	2.9	2.9	0	1.3
Metolius	1.4	1.4	0	100
Lower LBC Metolius	0.2	0.1	0.1	100

² These values include non-USFS roads.

Road Stream Crossings and Location: Road-stream intersections and location of roads are critical factors in determining aquatic risk from roads. Abundant stream crossings or unstable crossings increase the direct impact to the stream and the risk of sedimentation by road failures at culvert. In addition, roads in the valley bottoms have the most direct effect on streams and riparian areas by accelerating erosion, reducing streamside shade, decreasing floodplain area, and increasing the number of stream crossings.

Analysis of road-stream intersections in the Eyerly Salvage analysis area indicates that there are approximately 304 stream crossings, but only 7 of those cross fish-bearing streams (Table 3.4-8); In addition, the BAER team repaired or replaced all of the culverts that they determined were a risk to the aquatic resources during the winter following the fire (Wilcox et al, 2002; personal comm., Wasniewski, 2003).

Table 3.4-8. Road-stream crossings within the Eyerly Salvage analysis area

SWS	Fish-bearing (Class 1&2)	Perennial non-fish (Class 3)	Intermittent (Class 4)	Total by SWS
Lower Fly Creek	4	0	8	12
Spring Creek	0	0	47	47
Street	2		67	69
Metolius Horn		55	83	138
Metolius	1		33	34
Lower LBC Metolius	0	0	4	4
TOTAL by Class	7	0	242	304

Most of the slopes in the subwatersheds are less than 30%, except slopes in Metolius subwatershed. Analysis of road position has shown that most of the roads are ridge-top or mid-slope roads. Approximately 40 miles of road are adjacent to streams and very few miles are adjacent to fish-bearing streams. The ratio of riparian road miles to stream miles is 1.04 and will be reduced after the proposed roads are decommissioned (Table 3.4-9). A total of approximately 8 miles of road within riparian areas are proposed for decommissioning in the Roads Analysis and are planned as a reasonably foreseeable action.

Table 3.4-9. Riparian area road and stream miles by subwatershed (SWS)

SWS	*Road miles within riparian area	*Total riparian road mi / stream mi.	**Road miles proposed for decommissioning within riparian
Lower Fly Creek	4.10	0.22	0.07
Spring Creek	8.44	0.33	4.20
Street	6.57	0.24	1.67
Metolius Horn	13.80	0.15	0.00
Metolius	4.10	0.07	1.90
Lower LBC Metolius	0.35	0.03	0.00
TOTAL**	37.36	1.04	7.84

Notes: * Calculated for entire SWS (including road/stream occurrences outside of Eyerly Project area).
 ** Road work proposed in the Eyerly Roads Analysis will be evaluated and documented separate from the salvage EIS; however, proposed road work will be discussed in this document to better understand cumulative effects.

During fire suppression operations, a total 84 miles of bulldozer line, at a width ranging from 10 to 40 ft, were constructed around the fire perimeter. The dozer line was rehabilitated by building waterbars on moderate and steep slopes and covering the trail with debris. For the most part, the bulldozer line follows the ridgeline and crosses intermittent and ephemeral headwater tributaries in the Street, Spring Creek, and Lower Fly Creek subwatersheds 19 times. Soil compaction is not as severe in bulldozers lines because the bulldozer usually makes only one pass. In the short-term, the bulldozer line may contribute sediment to the stream while it is flowing at some stream crossings.

Past Timber Harvest: Tree falling is not usually considered a major cause of increased sediment; however, methods for removing harvested timber (such as tractor and cable yarding) can cause erosion, gouging of slopes, and alteration of soil characteristics and permeability. Compacted surfaces such as roads, skid trails or landings, can alter hydrology by intercepting surface runoff, concentrating surface runoff, and extending channel networks which increases watershed efficiency. All of these mechanisms have the potential to increase erosion. Field reconnaissance of stands previously harvested was conducted to determine the amount of area in detrimental condition due to compaction primarily from skid trails and landings. Only stands likely to be harvested in the Eyerly Salvage were evaluated. Only three units have greater than 20% of their area in detrimental condition due to compaction (refer to Soils Report), and most are less than 15%. No subwatershed has greater than 20% of its area in detrimental soil condition (Table 3.4-10).

Table 3.4-10. Acres in each subwatershed previously harvested or in roaded condition and percent of each subwatershed currently compacted (assuming that 25% of the harvested area was compacted).

SWS	Total SWS Acres	Total Acres harvested or roaded	% of SWS compacted
Spring Creek	6,774	4,228	17
Street	7,308	3670	13
Metolius	13,545	1932	4

Summary: Although sedimentation as a result of the Eyerly Fire, was predicted to significantly increase in all the subwatershed in the Eyerly Salvage analysis area given a large rainstorm event, very little erosion has been observed. However, the risk of an increase in sedimentation would exist, albeit at lessening degrees, until vegetation reestablished, slopes stabilize, and peak flows return to pre-fire magnitudes. Currently road densities are considered a high risk to the aquatic ecosystem in two of the subwatersheds in the Eyerly Salvage analysis area; however, none will have road densities in the high risk category after the road decommissioning proposed in the Eyerly Roads Analysis. In addition, most of these roads are mid-slope or ridge-top and all the road-stream crossings that were at risk of failing after the Eyerly Fire have been rehabilitated. Soil compaction from roads, skid trails and landings is less than 20% in Spring Creek, Street and Metolius subwatersheds. Therefore, the impact of roads and skid trails on the sediment regime in the Eyerly analysis area is moderate and should be reduced in the near future with the implementation of proposed road management activities.

Channel Network and Condition

The drainages in the Eyerly salvage analysis area are on the eastern side of Green Ridge (4800 ft) and flow west to east to the Metolius River and Lake Billy Chinook Reservoir (1900 ft). Green Ridge is a fault block scarp and drainages on the east side and are moderately dissected canyons draining relatively gentle east slopes of Pliocene era (refer to Soils Report). There is no evidence of contemporary landslide activity within the project area, and the closest evidence of debris flow, caused by the 1996 event, is on the steep (slopes > 50%), west side of Green Ridge (approximately 2 miles from the project area) in two ephemeral draws. The 1996 rain-on-snow event also appears to have caused increased bank and bed erosion in the lower, perennial section of Street Creek, but the other streams seem relatively unaffected.

Riparian Condition: Riparian vegetation is important for many aspects of stream health including providing: a sediment filter zone, a source for in-stream large wood recruitment, bank strength and roughness, and shade for reducing water temperatures. Riparian vegetation within moderate or high burn severity areas has either been completely or partially denuded (*Table 3.4-5*). Approximately 24% of RHCA/RRs within the subwatersheds affected by the Eyerly Fire was completely denuded (stand replacing fire) and is more susceptible to erosion. Also, the loss of tree canopy will reduce stream shade and possibly affect stream temperatures (further discussed in Stream Temperature section of EIS). Although, approximately 93% of the riparian area in Spring Creek was burned and 64% in Street Creek it was the interpretation of the BAER team botanist that the riparian shrub component was still viable and would begin to reestablish rapidly in the more moist intermittent and perennial reaches (Riley 2003, per. comm.). Vegetation reestablishment in the higher severity burns, especially along dry ephemeral channels, may take slightly longer, making these draws more susceptible to channel erosion and debris torrents during high flow events.

Although vegetated riparian buffers trap more sediment than unvegetated buffers, the buffers in the Eyerly Salvage project area are still beneficial. The burned riparian buffers still provide a linear distance between any activity and a waterbody; thus reducing sedimentation from activities. Also, field observations in the Fall of 2003 and Spring of 2004 indicated that ground cover in the fire area, especially in the seeded areas, is returning rapidly (Suna 2003; personal observation, McCown 2004). Approximately 5000 riparian plant seedlings are scheduled to be planted in the RHCA/RRs of Street and Spring Creeks in spring of 2004.

Channel Condition: The risk of increased channel erosion and/or changes to channel morphology following the Eyerly Fire depends on increases in stream power (i.e. increased high flows); however, it also depends on the amount and type of riparian vegetation burned, abundance of in-stream wood, type of bed and bank substrate, and density and location of roads and skid trails. For the subwatersheds that were mostly burned, streamflow is expected to increase, by as much as 90 % during a one hour rainstorm. Stream channels with minimal bank erosion and substantial bank vegetation have a more inherent ability to accommodate changes in flows; whereas, unstable channels do not. In general, streambanks are less stable due to the reduction in root strength and bank roughness. Over the next 10 years, standing dead trees in riparian areas will fall into channels and provide in-stream sediment storage. Downed wood may help strength banks in some areas; however, it may cause more erosion in other areas. A detailed discussion of subwatershed and channel condition is in the hydro specialist report.

Summary: Street Creek has the highest risk for changes in morphology for the following reasons:

- 1) predicted increases in water yields and/or peak flows;
- 2) predicted increases in sedimentation;
- 3) significant bank instability (probably from the 1996 rain-on-snow event); and
- 4) high road density.

Although, Spring and Metolius subwatersheds are at risk for increases in water yield and/or peak flow and sedimentation, there is less risk of channel morphology changes because Spring Creek is fairly well armoured and very little of the Metolius subwatershed is roaded and less of it burned. The predicted increase in sedimentation is high in these subwatersheds; however, reestablished natural and seeded ground vegetation and existing and future down wood will help buffer the sedimentation effects. The other subwatersheds were burned very little or not at all by the Eyerly Fire and are not at risk for increased water yield and associated changes in channel morphology.

Water Temperature

Minimal water quality data has been collected in the Eyerly Salvage analysis area because there is very little perennial water and/or fish-bearing water. Most water quality data is collected in Lake Billy Chinook Reservoir as a requirement for operation of the dam. Prior to the Eyerly Fire, water temperature in the analysis area did not exceed the water temperature standards that existed at that time, and as a result, no streams were listed on the 303(d) list for temperature. Following fires, researchers have shown marked increases in water temperatures (Tiedemann et al, 1979). The Eyerly fire burned 67 % of the riparian area within Street Creek and 91% within Spring Creek (*Table 3.4-5*). This reduction in stream shade is likely to cause an increase in stream temperatures until riparian vegetation can reestablish. Planting of approximately 5000 riparian seedlings is planned in the Spring 2004 to accelerate the revegetation process.

Water Chemistry

pH: State standards for pH (OAR 340-041-0021) as well as the applicable Tribal standard, are exceeded in Lake Billy Chinook reservoir. Hydrogen ion concentration falls outside the range of acceptability (6.5 – 8.5 pH). In the case of Lake Billy Chinook Reservoir, the following exception applies: “Waters impounded by dams existing on January 1, 1996, which have pHs that exceed the criteria shall not be considered in violation of the standard if the Department determines that the exceedance would not occur without the impoundment and that all practicable measures have been taken to bring the pH in the impounded waters into compliance with the criteria” (ODEQ 2003).

According to monitoring data reported in the Pelton Round Butte Project Water Quality Management and Monitoring Plan (WQMMP), high pH values in the reservoirs are limited to the surface waters (CTWSR and PGE 2002a). In the deeper water, pH remains within the standard at all times. These exceedances are the result of high levels of photosynthetic activity promoted by the high concentration of nutrients, principally phosphorus, in the waters above the Pelton Round Butte Dam. The phosphorus enters the reservoir in the tributary streams and appears to be largely of natural origin. Of the tributaries, the Metolius River has the lowest pH, not exceeding a pH of 8.3. No nutrients

are contributed to the water by the reservoir. Reservoir discharge data collected from 1994 through 2001 indicate that pH, maximum pH in particular, is higher in tributary inflows to Lake Billy Chinook than in water released at the re-regulating dam. Based on this data, it appears that there is no measurable increase in pH through the reservoir area and that the reservoir is reducing the pH of the inflow (CTWSR, PGE 2002a). As part of the WQMMP, CTWSR and PGE are proposing a Selective Water Withdrawal facility to improve water quality and surface currents in LBC reservoir (CTWSR and PGE 2002). ODEQ is reasonably assured that operation of the Project will comply with the pH standard provided that CTWSR and PGE meet monitoring, maintenance, and policy conditions outlined in the Findings document (ODEQ 2002b).

Chlorophyll a: Additionally nuisance phytoplankton growth within Lake Billy Chinook reservoir exceeds the applicable State of Oregon chlorophyll *a* Standard (OAR 340-041-0019) during the summer months. An increased concentration of chlorophyll *a* accumulates in the reservoir during the summer resulting from an input of nutrients from the tributary rivers and natural processes of seasonal stratification in the reservoirs. The high concentration of phosphorus in the Metolius River is natural due phosphorus in the basaltic bedrock of the basin. Blooms of blue-green algae in Lake Billy Chinook are the result of excess phosphorus and relatively low nitrogen. The artificial impoundments created by the dams provide a suitable environment for this high level of primary production to take place (CTWSR and PGE 2002).

The trigger concentration of 15 ug/L Chlorophyll *a* of the state's nuisance phytoplankton growth standard has led to Lake Billy Chinook reservoir being placed on the CWA 2002 303(d) list. CTWSR and PGE have conducted extensive studies describing present reservoir water quality; assessed impacts on beneficial uses; assessed probable cause of the trigger exceedance and beneficial use impact; and developed a proposed control strategy for attaining compliance where technically and economically practicable (2002). These actions are consistent with an action process lined-out in the standard. ODEQ concurs with the PGE and CTWSR's position that while the trigger value is exceeded in the reservoirs during the summers, beneficial uses of the dam impoundments are not adversely affected by nuisance phytoplankton growth. In addition, the Selective Water Withdrawal facility should help reduce phytoplankton growth in the reservoir. ODEQ is reasonably assured that operation of the Project will comply with the nuisance phytoplankton growth standard provided that CTWSR and PGE meet monitoring, maintenance, and policy conditions outlined in the Findings document (ODEQ 2002b).

Nutrients

Existing Data: Nutrient monitoring by the Deschutes National Forest in the Upper Metolius River began in 1996 and is ongoing. Although the Metolius River within the Eyerly fire area has not been monitored, the results from the Upper Metolius monitoring give an indication of pre-fire nutrient concentrations in the Lower Metolius.

Water quality monitoring results from the 1996-2003 in the Upper Metolius River show that orthophosphorus levels continue to be high in the Metolius basin, ranging from 0.05 to 0.08 mg/L (USDA Forest Service 2004). Although no standards are established for phosphorus, MacDonald et al. (1991) suggests streams entering lakes or reservoirs should not exceed 0.05 mg PO₄-P/L. High phosphorus concentration is natural in the Metolius basin due to the interaction of phosphorus rich volcanic rock and ground water (CTWSR and PGE 2002). Chitwood (1997) found natural amounts as high as 2.3 mg/L total phosphorus discharging from the Metolius River springs. Once these waters enter the

reservoir concentrations drop to 0.03 to 0.06 mg/L (Johnson 1985), within the range suggested by MacDonald and others (1991).

Nitrate data was collected at Link Creek, Lake Creek, and at five Metolius River sampling sites between 1996 and 2003 (USDA Forest Service 2004). Levels were below the 0.1 mg/L reporting level at all sites except for the Metolius River springs, where levels averaged 0.108 mg/L. There are no national standards for nitrate concentrations but a concentration < 0.3 mg/L would likely prevent eutrophication (MacDonald et al. 1991). Results indicate that the Metolius River is still nitrogen limited. It appears that nitrogen decreases downstream as algae and bacteria absorb it (Codder and Riehle 2001).

Wildfire: Fire may induce sudden changes in water chemistry. When a fire burns through down fuels there is an oxidation of many elements that then become available for leaching and/or aerial deposition into running or standing surface water. Also, nutrients can be transported into streams, ionically attached to soil sediments that are more erodible after a fire. The low burn severity sites have virtually no effect on the soil's physical or chemical properties.

Some fire retardant chemicals used during fire suppression may affect water quality and can be toxic to aquatic animals if transported (NWCG 2001). During fire suppression efforts at the Eyerly Fire, 148,109 gallons of Fire-Trol LCG-R, 6,002 gallons of Phos-Check HV-R, and 352,440 gallons of Phos-Chek 259 R were dropped on the fire. All are composed of ammonium salts, iron oxide as a coloring agent and industry protected performance agents. Fire-Trol also contains sodium ferrocyanide shown to produce a weakly acidic, dissociable form of cyanide when exposed to ultra violet radiation (refer to Soil Quality section).

Assuming recommended application rates and no overlap in drops, approximately 300 acres within the burn area were covered by retardant (refer to Soils Report). No retardant drops landed in streams or immediately adjacent to streams. There was a spill of Phos-Check in Street Creek that resulted in a fish take (refer to Fish Specialist Report). Nutrients (i.e. Phosphorus, Nitrogen, and Sulfur) from both the burned (depending on heat transformation) and unburned retardant could reach the stream by the same processes that transport nutrients from the burned soil and biomass. Ferrocyanide (in Fire-Trol) could also reach the stream by the same process but may not transform, depending on exposure to ultra violet radiation. A study showed that aqueous leachates of ash derived from combusted organics covered with Fire-Trol residues contained limited sub-lethal concentrations of dissociable iron bound cyanide (Little and Calfee 2002).

Within the Eyerly Fire area, the primary nutrients of concern, in relationship to timber harvest and fire activities, are phosphorus and nitrogen. In the Eyerly Fire area the primary concern with any nutrient increase in the streams, is a potential for increasing the nutrient levels in the Metolius River and ultimately, Lake Billy Chinook Reservoir, which could lead to increased algae growth in the reservoir. The effect of nutrients on pH and chlorophyll a, 303(d) listed parameters in LBC reservoir, were specifically addressed in the Water Quality Management and Monitoring Plan for the Pelton Round Butte Project. (Water Chemistry/PH or Chlorophyll a section), and the effect of nutrients on their levels (CTWSR and PGE 2002).

During the burning process, some nutrients in the grass and duff are released into the atmosphere; however, most remain in the ash and are rapidly reabsorbed into the topsoil (DeByle 1981). Studies have shown that water chemistry is most often altered during the

first few storms following fire and typically returns to pre-burn levels within one to two years (Spencer and Hauer 1991; Debanco et al. 1998). Nutrients can remain ionically attached to soil particles until utilized by newly established vegetation after a fire. Before vegetation reestablishes, nutrient leaching could occur but the risk is significantly reduced significantly in soils with high cation exchange capacity and moderately well drained soil permeability characteristics. The majority of the soils in the proposed units fit this description.

During spring runoff in mid-April of 2003, small algal blooms were seen in the intermittent sections of Street and Spring Creek, which were assumed to be associated with nutrients in the ash or fire retardant that were deposited in the channel or leached into the groundwater and resurfaced in the springs (McCown and Sussmann field data). Most of the ash in the channel and channel margins was flushed out during the first few high flows. However, there is the potential for increased nutrient levels during significant storm events when upland burn areas are being eroded and sediment transported to the stream.

Street Creek is most likely to experience a few nutrient spikes during the first 1 to 2 years following the fire because 1.6 miles are perennial and 64 % of the RHCAs/RRs along this stream are in moderate or high burn severity classes. Streamflow from Street Creek accounts for approximately 1%³ of the flow into Lake Billy Chinook (LBC) reservoir. Because of the dilution effect when Street Creek flows into the Metolius arm of Lake Billy Chinook reservoir, any increased nutrient level would probably not be measurable above the natural background variation.

❖ 3.4.3 Water - Environmental Consequences

Streamflow

Effects of Alternative 1 - No Action

The effects of the Eyerly Fire itself would continue to have the greatest influence on hydrology and streamflows within the analysis area. As discussed in the existing conditions streamflow section, the ECA and the modified rational GIS flow model were used to model evapotranspiration and stormflow changes in the subwatersheds most affected by the Eyerly fire (*Table 3.4-4*). The ET index was predicted to decrease between 37 and 69 and stormflow was predicted to increase 50 to 90 percent in the first year following the Eyerly Fire. Under Alternative 1, there is no direct funding or plans to replant burned acres. Recovery of evapotranspiration processes and precipitation interception in the long-term would be more rapid under Alternatives 2 and 3 because planting would restore conifer cover more quickly than “No Action” under Alternative 1. Accordingly, streamflows would take longer to return to pre-fire levels in Alternative 1.

Soil compaction caused by logging equipment, skid trails, and temporary roads, decreases infiltration of water into the soil and the water holding capacity of the soil. Lowering infiltration rates reduces soil water content and aquifer recharge, while increasing surface runoff. Under the “No Action” Alternative no land-use activities are proposed; therefore,

³ Streamflow calculations for ungauged streams were estimated using regional equations for 2-year discharges (Harris and Hubbard 1983). Two-year discharges in ungauged streams in the Metolius SWS (flows directly into the Metolius River, not LBC reservoir) were compared to the bankfull discharge in the Metolius River to estimate the percent flow contribution from the Eyerly analysis area to the mainstem Metolius River. Bankfull discharge (1.5 year discharge) for the Metolius River was estimated using gauging data. The percent flow contribution estimate from the Eyerly analysis area is on the high end because it is only estimating flow contribution during high flow. During low flow the flow contribution from the Eyerly analysis area would be less. Values were converted to acre – feet per year to determine input into LBC reservoir.

soil compaction would maintain the status quo. Road decommissioning, primarily riparian roads, proposed in the Action Alternatives (3.8 miles) would not occur as a result of the Eyerly Salvage R.O.D. However, this decommissioning and addition road decommissioning and closure is proposed in the Eyerly Roads Analysis and could occur as part of a future Environmental Analysis.

Effects of Alternatives 2 and 3

The action alternatives would have a negligible effect on streamflow because no live trees would be removed and soil compaction is not at a magnitude that would significantly effect streamflow. Although some precipitation adheres to dead trees and returns to the atmosphere, harvest would not measurably reduce interception or evaporation. Under the action alternatives, units that were harvested would be replanted with conifers. Recovery of evapotranspiration processes and precipitation interception in the long-term would be more rapid under action alternatives than under “No Action” because planting would restore conifer cover more quickly. Likewise, recovery of evapotranspiration, interception and streamflows would be more rapid under Alternative 2 than 3 because more acres would be replanted and infiltration on 3.8 miles of road would be improved.

In both action alternatives detrimental soil condition (which includes compaction) would increase (*Table 3.4-11*); however, it would remain within the guidelines of the Forest Plan. Most units would remain under the 20% detrimental soil condition threshold; however some units would use subsoiling after harvest to bring the soil condition in compliance (refer to Soils Specialist Report). Subsoiling would only be necessary on approximately 116 acres. No compaction over the threshold would occur within 480 feet of the streams (*Appendix B, Table B-5*).

Table 3.4-11. Increase in detrimental soil acres from proposed harvest for each subwatershed

Subwatersheds	Alt. 2 –Increase in detrimental acres	Alt. 3 –Increase in detrimental acres
Lower Fly Creek	0	0
Spring Creek	244	105
Street	183	121
Metolius	47	23
Total	474	249

Design elements and mitigations such as using existing skid trails and landings where possible, implementing wide skid trail spacing, subsoiling, and constructing water bars would help reduce the effects of soil compaction in the salvage areas in Alternatives 2 and 3. Approximately 3.8 miles of mostly riparian road would be decommissioned under Alternative 2 or 3 after harvest, which would help mitigate compaction effects in Spring Creek. Although decommissioning these roads would not occur under the “No Action” alternative in this EIS, it would still be a future foreseeable project for this alternative based on the Eyerly Roads Analysis recommendations. Also, areas where hazard trees would be removed would be accessed from the road so as not to increase compaction. If hazard trees are in RHCAs/RRs then they will be hand felled and left, thereby, not increasing soil compaction and erosion in these areas. Planting 2 year old conifers would help “jump start” evapotranspiration recovery.

The amount of dead wood available for slowing runoff would rapidly increase beyond pre-fire conditions. Only 21% of the burn area is proposed for harvest and a specified amount of downed wood and snags (in accordance with the Northwest Forest Plan) within this area would be left. In addition, none of the logs that were contour felled would be removed by the proposed activities. More than 80% of the post-fire downed wood would be unaffected and would meet Northwest Forest Plan standards for downed wood in all units.

Also, upland timber harvest and fuels treatments would reduce future wildfire severity in some stands. As a result, the risk of changes to evapotranspiration and potentially peak flow given a reburn would be less in Alternative 2 than under Alternative 1.

Sedimentation

Effects of Alternative 1 - No Action

The effects of the Eyerly Fire itself would continue to have the greatest influence on sedimentation within the analysis area. Water yield and soil erosion within the burned area is predicted to increase following the Eyerly Fire due to consumption of vegetation and much of the ground cover that protected the soil, especially within the areas that burned at high intensities (Beschta, 1995). Modeling the reduction in basal area resulting from the fire shows that the evapotranspiration index has been significantly reduced (37 to 69) and that stormflow is predicted to increase (50 to 90%) (*Table 3.4-7*). Already unstable channels will be most affected by increases in high flows (refer to section 3.4.3 Existing Condition, Channel Network and Condition) and will continue to erode until vegetation has recovered. Although sedimentation has not significantly increased in the two years after the fire, the risk of increases in sedimentation (albeit less than originally predicted in Hydrology Specialist Report) will continue until vegetation reestablishes, slopes stabilize, and peak flow magnitudes return to pre-fire ranges.

In Alternative 1, there are no salvage-related plans or funding to replant burned acres; however, recovery of soil stability would occur at the same rate as the Action Alternatives because shrubs, grasses, and down wood, capable of trapping sediment, would help stabilize soils regardless of planting. In addition, any re-growth or needle-fall that has occurred would not be mechanically destroyed. In the short-term return of fine woody material would be slightly slower than within treatment areas because harvest activity would break branches of the dead trees. The erosive effects of an increase in high flows would continue longer in Alternative 1 than in Alternatives 2 and 3 because recovery of tree stands and associated evapotranspiration and precipitation interception would occur at natural rates.

Under the “No Action” Alternative, no land-use activities are proposed; therefore, soil compaction would maintain the status quo. Residual effects of past harvest activities would gradually decrease; however, areas where soil has been lost or compacted may not achieve noticeable improvements within many years or decades. Sedimentation effects of roads would continue. Road decommissioning, primarily riparian roads, proposed in the Action Alternatives (3.8 miles) would not occur as a result of the Eyerly Salvage R.O.D.; however, this and additional road decommissioning and closure is proposed in the Eyerly Roads Analysis and could occur under a future Environmental Analysis.

Effects of Alternative 2

Activities that disturb the soil have the potential to accelerate soil erosion, thus increasing sedimentation because a percentage of that sediment is delivered to the streams.

Activities which would cause ground disturbance and could increase sediment production in the short-term include: salvage of dead trees, hazard tree removal, planting of trees, temporary road construction, road decommissioning, subsoiling, and prescribed burning of activity fuels (Beschta 1995). Mitigation to limit the amount of sediment increase is listed throughout *Chapter 2, Project Design Elements*. Some of the BMP's recommended for implementation under the Action Alternatives include no-treatment riparian buffers, designated logging systems, and subsoiling of primary skid trails and landings. Activities which would reduce overall sediment yields in the long-term include road decommissioning and revegetation.

Salvage of dead trees and hazard trees is proposed on 4845 acres, 1263 acres of which is on slopes greater than 30% and would be harvested by helicopter or skyline logging systems (*Table 3.4-12*). Likewise, skyline units are generally restricted to slopes greater than 30% to prevent gouging the ground by not adequately partially or fully suspending the logs. Aerial methods of harvest have little effect on the rate of soil erosion because there is little ground disturbance, unlike ground-based logging systems.

Ground-based salvage logging of burned trees and hazard trees is proposed on 3582 acres, most of which would occur in Spring Creek subwatershed. In general, ground-based equipment is restricted to areas with average slopes less than 30% because the effects of the equipment on erosion (i.e. compaction, rutting, and displacement) are exacerbated on steep slopes. Minimal gouging may occur in ground-based and skyline units with variable slopes.

Table 3.4-12. Proposed harvest acres by logging system within each subwatershed.

Subwatersheds	Alt. 2 – Proposed Harvest			Alt. 3 – Proposed Harvest		
	Ground	Aerial	Total	Ground	Aerial	Total
Lower Fly	219	9	228	165	0	165
Spring Creek	1597	643	2240	836	465	1301
Street	898	366	1264	448	121	569
Metolius	868	245	1133	679	161	858
Total	3582	1263	4845	2128	747	2875

Two standard riparian buffer widths were applied to activities in Alternative 2 of the Eyerly Salvage. The largest and most conservative buffer width from all the management plans was chosen. All fish-bearing streams (class 1 and 2, category 1) were buffered 320 ft on both sides of the stream. All perennial, non-fish-bearing and intermittent streams (class 3 and 4, category 2 and 4) were buffered 160 ft on both sides of the stream. More conservative values (higher buffer widths) than the buffer widths suggested in the NWFP or INFISH were chosen because of the erosion potential due to lack of riparian vegetation (thereby exceeding NWFP Standards and Guidelines). No salvage activities, besides hauling on existing roads and road decommissioning, would occur within the riparian buffers, thereby, reducing erosion, instability, and sedimentation risk.

Although 24% of RHCA/RRs within the subwatersheds affected by the Eyerly Fire were completely denuded (stand replacing fire) they are still beneficial. The burned riparian

buffers still provide a linear distance between any activity and a waterbody and the new ground cover and down wood helps trap sediment. In addition, no harvest activities are proposed in RHCA/RRs; therefore, not affecting buffer effectiveness or instream sediment storage potential from large wood recruitment.

Harvesting of trees increases erosion by removing ground vegetation that stabilizes or traps soil and by compacting the soil, which concentrates runoff. Areas disturbed by ground-based harvest methods would increase soil compaction on approximately 10 to 20% of an activity unit area. Although vegetation on skid trails and landings would be completely removed, disturbance on nearly 80% of the unit area would be relatively minimal and not preclude the recovery of trampled or re-sprouting plants (Malaby 2000). The recovery of shrub and other herbaceous vegetation within activity units is not likely to be inhibited significantly in the short-term following harvest activities and would be expected to provide cover capable of reducing raindrop impacts at levels similar to areas left unsalvaged within 3 to 4 years (Chou et al. 1994). In addition, activity areas would also generate slash on the soil surface capable of reducing raindrop impact and providing surface roughness to reduce overland flow energies and trap sediment. As a result, proposed activities would not significantly affect erosion losses associated with the removal of vegetation when compared to the No Action alternative.

Soil compaction incurred by harvest activities would increase runoff from units in which skid trails and landings were not subsoiled. Alternative 2 could increase the total amount of soil in detrimental condition (including compaction) by disturbing soil in units not currently at the 20% threshold. Alternative 2 could increase soil compaction in 474 acres (*Table 3.4-11*). To mitigate potential erosion or sediment delivery to streams, all salvage units would be replanted following harvest, harvesting systems would use existing skid trails and landings where available, skid trails would be spaced 100 ft apart, waterbars would be created in skid trails, and slash or logs would be placed back onto skids where possible. The soil disturbance effects of ground-based timber harvesting is assumed to last for about 3 to 4 years (Chou et al. 1994) and one year for helicopter units, but the compaction effects in units not subsoiled may last decades.

Rainfall capable of dislodging soil particles and creating overland flows could transport sediment to waterbodies from disturbed areas adjacent to waterbodies. The amount of sediment transported to the stream decreases the further the activity is from the stream and the flatter the slope. Approximately 1% of the sediment outside the sediment delivery zone (the SDZ is used in the existing condition sedimentation modeling and is estimated to be 480 ft from the stream) is actually transported to the stream. No harvest activities are proposed in RHCA/RRs in order to maintain a viable riparian buffer capable of filtering sediment from overland flows. Although no harvest activities are proposed in RHCA/RRs some activities would occur in units that drain directly into ditch segments that are hydrologically connected to streams. In a worst case scenario (assuming no relief culverts between the unit and the stream), approximately 90 ditch segments below proposed units are hydrologically connected to streams (*Table 3.4-13*). Mitigations to reduce the potential sedimentation contributed from disturbed activity unit areas to these ditch segments include exclusion of machine traffic or ground yarding operations through these ditch segments (Chapter 2, beginning on p.47). Design elements also included in the document restrict skid trails from being constructed perpendicular to these ditches and promote hand-felling to the lead of a skid trail at least 50 feet from the ditch. Units that drain into hydrologically connected ditches would be given a high priority for subsoiling. Monitoring of subsoiling on the Deschutes Nation Forest has shown that subsoiling reduces soil strength to pre-impact conditions and restores infiltration rates (USDA Forest Service 1995b).

Table 3.4–13. Potentially hydrologically connected road ditches (assuming no relief culvert between stream and unit).

SWS	Potentially hydrologically connected road ditch segments below proposed units	
	Alt. 2	Alt. 3
Spring Creek	42	36
Street	31	27
Metolius	15	14
Total	88	77

Harvest, especially ground-based, within the 480 ft. sediment delivery zone would slightly increase sediment delivery, especially during the first few years before riparian vegetation has reestablished. In Alternative 2, ground-based harvest on 812 acres would occur within the 480 ft sediment delivery zone (*Table 3.4-14*). Ground-based harvest areas outside the 480 ft sediment delivery zone may experience some erosion but it would be minimal because slopes would be relatively flat (0 to 30%). In addition, no units would be in the sediment delivery zone adjacent to perennial streams in either Action Alternative. Areas where hazard trees would be removed would be accessed from the road so as to not increase compaction.

The percent increase in sedimentation from salvage activities was estimated based on the assumption that 20% of ground-based and 10% of aerial harvest acres would be disturbed, and that 30% of the sediment from those areas (regardless of slope) in the sediment delivery zone would reach the stream. As a result, an additional 4% of sediment from activities proposed in the sediment delivery zone in Alternative 2 could reach the streams in the Eyerly Salvage analysis area, given a large rainstorm event (*Table 3.4-14*). Even less of that sediment would reach the Metolius River because only intermittent tributaries in the Metolius subwatershed contribute to the Metolius River and much of that sediment would be stored in the tributaries. The minimal amount of predicted sedimentation from the Eyerly Salvage is supported by a study conducted by Chou and others in the central Sierra Nevada Mountains (cited in McIver, Starr 2000). This extensive study which included replicates and a control (import for potentially allowing inferences to other locations) found no detectable difference in sediment output between logged and unlogged units after the Stanislaus fires.

Most of the sediment produced by the proposed salvage activities would be stored behind obstructions or deposited in slow velocities areas in the upstream intermittent reaches adjacent to the sediment delivery zone. Instream wood in these areas and other burn areas is predicted to increase over the next 10 years as standing dead trees in RHCA/RRs fall into the channel; thus helping to trap sediment and create new pools. Although a negligible amount of logging-related sediment may reach pools that fish inhabit, it is not enough to detrimentally effect overall pool habitat.

Table 3.4-14. Proposed harvest acres in the sediment delivery zone (SDZ) for each subwatershed

SWS	Alt. 2 – Proposed Harvest in SDZ				Alt. 3 – Proposed Harvest in SDZ			
	Ground ac	Aerial ac	Total ac	% increase in sedimentation	Ground ac	Aerial ac	Total ac	% increase in sedimentation
Lower Fly	25	6	31	1.5	9	0	9	0.5
Spring	449	191	640	6.4	114	57	171	1.8
Street	183	105	288	4.3	55	45	100	1.4
Metolius	155	92	247	2.3	94	59	153	1.4
Total	812	394	1206	4.1	272	161	433	1.5

The Action Alternatives would also utilize soil restoration mitigations to relieve compaction and return the surface of skid trails, landings and temporary roads capable of contributing sediment to a condition capable of infiltrating rainfall and runoff at natural rates. As After the salvage 20% or less of the soil in any unit would be in detrimental condition unless more than 20% was in detrimental condition prior to the salvage, in which case, the salvage would not exceed that amount. Mitigations to help meet these conditions include using existing trails and/or subsoiling new trails. The majority of disturbed areas would be outside the 480 ft sediment delivery zone and would not input sediment directly into the aquatic system. Priority for subsoiling would be given to skid trails and landings located within the 480 ft sediment delivery zone and in units adjacent to hydrologically connected ditch segments. Subsoiling scattered landings and skid trails (totaling about 116 acres) would not disturb the soil surface more than the proposed harvest activities. Long-term erosion potential would be reduced through improved water infiltration and better vegetation coverage. Monitoring of subsoiling around the Deschutes National Forest has shown this technique to be effective in reducing the effects of excessive soil compaction (refer to Soils Report). Bulk densities were reduced, in many cases, to natural levels.

All units salvaged (which consist of high and moderate burn severity sites) would be replanted to expedite vegetation recovery. In all action alternatives, an area of 2¼ square feet around each seedling would be scraped free of vegetation (scalped). As with any ground disturbing activity, scalping would increase the potential for soil erosion and sedimentation. In all but the most extreme events, soil detached from the scalp zone would likely deposit in the adjacent untreated area surrounding each seedling. Off-site movement of soil would not be expected, and erosion would decrease to its current level after about 3 years. In addition, ground cover next to streams would be maintained and it would provide an additional opportunity to trap any mobilized soil before it reaches the stream network.

Hauling on roads, especially roads adjacent to streams or roads that cross streams, increases the risk of sedimentation in the channels. Driving on wet roads with puddling or dry roads that are dusty can transport sediment to the streams. In Alternative 2, 13 miles of road used for timber hauling are within the riparian buffers (*Table 3.4-15*). Haul roads cross streams approximately 54 times. To aid in the prevention of erosion, both open and closed roads used for hauling would be hardened on the surfaces and cut/fill slopes where necessary, and drainage outflows would be improved. Also, restriction on hauling according to road conditions (i.e. too wet, too dusty) would be specified in the logging contract. This would reduce erosion, increase the capacity of the drainage system to

handle higher flows during storms, and spread out the concentrated flows so they have less energy to cause erosion.

Table 3.4-15. Proposed miles of road within Riparian Reserve/RHCA used for timber hauling by subwatershed

SWS	Haul Road Miles within riparian buffers		Stream crossings by haul roads
	Alt. 2	Alt. 3	Alt. 2 & 3
Spring Creek	5.4	2.1	25
Street	2.4	2.4	19
Metolius	1.0	1.0	5
Total	8.88	5.5	54

Approximately 2 miles of temporary road construction are proposed for salvage of dead and dying trees, one mile of which would be built on existing fire line. Although construction and use of the temporary roads would increase the drainage network, reduce infiltration, and increase soil compaction in the short term, these effects would be mitigated after the harvest by decommissioning and subsoiling the roads. In addition, no road fill or extensive reconstruction would be necessary to create these roads. Also, there would be very little short-term sedimentation effects because these temporary roads would be located on ridges in Metolius and Spring Creek subwatersheds.

Approximately 3.8 miles of mostly riparian road would be decommissioned under Alternative 2 or 3 after harvest, which would help mitigate sedimentation effects in Spring Creek. Although decommissioning these roads would not occur under the “No Action” alternative in this EIS, it would still be a future foreseeable project based on the Eyerly Roads Analysis recommendations. In addition, another 37 miles of road has been recommended for decommissioning under the Eyerly Roads Analysis that would be analyzed under a separate Environmental Analysis. For all alternatives these 37 miles of road would be considered a future foreseeable project. Most of the roads proposed for decommissioning in the Action Alternatives (3.8 miles) and in the Roads Analysis would be temporally improved (ex: inslope the road and create waterbars) for hauling, if necessary, and then decommissioned after the harvest (i.e. 1170-800 road). Decommissioning roads could cause a short-term increase in sedimentation if culverts are pulled or roads are subsoiled.

Although upland timber harvest and fuels treatments would reduce future wildfire severity in some stands, it would not likely reduce sedimentation effects from a future catastrophic wildfire because treatments are not at a magnitude or in a location (i.e. RHCA/RRs) that would considerably reduce sedimentation risk. Short-term sedimentation effects from fuels treatments would be negligible. Fuels created by the harvest (activity fuels) would be piled and burned after the harvest by jackpot burning, grapple piling and burning, or hand piling and burning. Mechanical equipment would be used in some ground-based units to pile activity fuels, and Project Design Element measures such as using existing skid trails would be applied to limit soil impacts. The equipment may occasionally veer off the existing skid trails and could cause effects similar to skid trails. It could increase compaction in ground-based units by 5% (refer to Soils Report); however, as mentioned earlier, units exceeding 20% detrimental soil conditions or greater than pre-harvest detrimental soil conditions would be subsoiled to lower the detrimental soil condition to the threshold or the pre-existing level.

Activity fuel burning would not significantly increase erosion because the ground around the burn piles would already be void of vegetation and ground cover from the Eyerly Fire and the salvage operations. Sediment would not likely be transported to the streams because all mechanical piling would occur on flat slopes (< 30%) in ground-based units and no fuels reduction activities would occur in riparian areas. Down wood and newly established vegetation and ground cover in the riparian areas would help trap sediment transported into the buffers from the prescribed burn area.

Overall, upland erosion caused by activities in Alternative 2 would have only a negligible effect on sedimentation.

Effects of Alternative 3

Activities which would cause ground disturbance and increase sedimentation in the short- and long-term are the same as Alternative 2. The effects of the activities on erosion in Alternative 3 are slightly less than Alternative 2 because of a minor reduction of: harvest acres in the sediment delivery zone, the percent increase in sedimentation, additional detrimental soil acres, riparian haul road miles, and temporary road miles (*Table 3.4-17*). These reductions are primarily due to increased riparian buffer widths (320 ft on each side of class 1 and 2 streams and all of the mainstems of Spring Creek and Street Creek; 200 ft on each side of class 3 and 4 streams), elimination of units or partial units with steep pitches, and elimination of units due to economics (increased snag and downwood requirements in Alt. 3). Riparian buffer widths in Street and Spring Creeks were increased because the filtering capacity of the buffers had been reduced due to the fire and these streams provides bull trout and redband habitat (buffers widths exceed the Standards and Guidelines in the Northwest Forest Plan). Ground-based units with short steep pitches and skyline units with short flat pitches were eliminated to reduce the deleterious effects of the harvest system. As a result, 130 acres proposed for skyline harvest in Alternative 2 would be harvest by helicopter in Alternative 3.

Salvage of dead trees and hazard trees is proposed on 2875 acres, 2128 acres of which is ground-based (*Table 3.4-12*). Salvage of 751 acres are on slopes greater than 30% and would be harvested by helicopter or skyline logging systems. In Alternative 3, 1454 acres less of ground-based harvest would be proposed than in Alternative 2 (the reduction primarily occurring in Spring Creek subwatershed). Fuel loading would be higher under Alternative 3 than Alternative 2 because less acres would be harvested. However, Alternative 3 would compact an additional 249 acres (i.e. increasing existing percent detrimental soil conditions to 20% threshold in proposed units). Alternative 3 would have 225 acres of detrimental soil less than Alternative 2 (*Table 3.4-11*). Having less area in detrimental condition would slightly decrease erosion potential in the subwatersheds affected. Alternative 3 would implement the same BMPs to mitigate potential erosion or sediment delivery to streams as Alternative 2.

Alternative 3 would have 540 acres less of ground-based harvest within the 480 ft sediment transport zone (most of the reduction in harvest occurring in Spring Creek subwatershed), thereby reducing sedimentation risk. (*Table 3.4-14*). Alternative 3 removes a number of units located adjacent to riparian reserves and would treat two-thirds less acres within the 480 ft. delivery zone when compared to Alternative 2. Riparian reserve buffer widths along intermittent reaches of the mainstems of Street and Spring Creeks are extended from 160 to 320 ft for alternative 3 when compared to alternative 2 (thereby exceeding NWFP Standards and Guidelines). The percent increase in sedimentation from the Eyerly salvage area given a large storm event for Alternative 3 is less than 2%, and

only 1% in Street Creek (primary fish habitat). Even less of that sediment would reach the Metolius River because only intermittent tributaries in the Metolius subwatershed contribute to the Metolius River and much of that sediment would be stored in the tributaries. Therefore the risk of sediment delivery to the streams would be less than Alternative 2, but sedimentation from both alternatives would be insignificant.

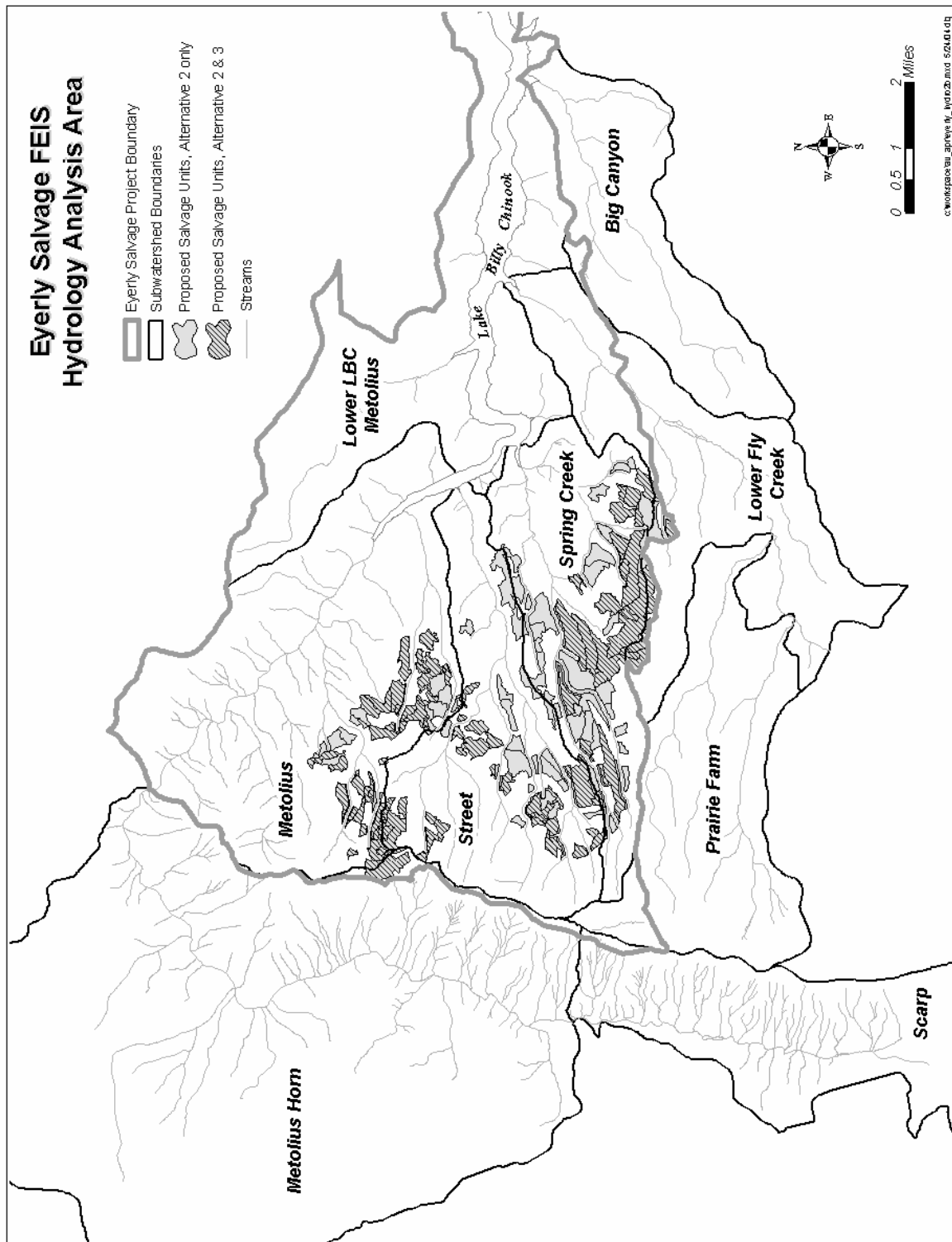
Table 3.4-16. Comparison of potential sediment sources by alternative for the Eyerly Salvage

	Alternative 1	Alternative 2	Alternative 3
Total acres harvested	0	4877	2897
Acres of ground-based harvest	0	3613	2146
Harvest acres within the sediment delivery zone	0	1203	433
Ground-based harvest acres within the sediment delivery zone	0	812	272
Percent increase in sedimentation	0	4.1	1.5
Increase in detrimental soil condition acres within harvest units	0	474	249
riparian haul miles*	0	13	10
Temporary road miles	0	2.1	0.9
Notes: * Calculated for entire SWS (including road/stream occurrences outside of Eyerly Project area).			

Like Alternative 2, mitigations for reducing erosion caused by hauling would be implemented. Three miles of the roads within riparian areas that would be used for hauling in Alternative 2 would not be used in this alternative (*Table 3.4-16*). Likewise, only the upper 700 feet of the 1170-800 road, which is adjacent to a tributary of Spring Creek, would be used for hauling in this alternative. Also, 1 miles less of temporary road construction is proposed for salvage activities in this alternative. As a result of less temporary road miles and less ground-based harvest acres, Alternative 3 would have less area to subsoil, thereby reducing short-term sediment effects related to subsoiling.

Road decommissioning would be the same as Alternative 2 (approximately 2.5 miles of riparian road), which would help mitigate sedimentation effects in Spring Creek. Also, the effects of treatment of activity fuels and would be the same as Alternative 2. Overall, upland erosion caused by activities in Alternative 3 would have only a negligible effect on sedimentation.

Figure 3.4-2. Riparian buffer and Alternative 2 and 3 proposed activity units by subwatershed.



Channel Condition

Impacts of Alternative 1 - No Action

The Eyerly Fire itself would continue to have the greatest influence on channel condition within the analysis area. Conditions and hydrologic function as described in the Existing Condition section would continue as they are. Morphological changes are predicted to occur, especially in Street Creek, given a significant rainstorm/melt event due to predicted increases in peak flows and sedimentation after the Eyerly Fire and existing unstable banks. Changes to channel morphology could include increased bank erosion, changing the location of pools (filling in some and creating others), and increasing sedimentation in spawning gravels. All these effects depend on the timing and magnitude of peak flows and the abundance of in-stream wood. Approximately 24% of RHCA/RRs within the subwatersheds affected by the Eyerly Fire were completely denuded (stand replacing fire) and are more susceptible to erosion. Instream wood has already increased in some streams (i.e. Street Creek) and would continue to increase as standing dead trees in riparian areas fall. Instream wood would help mitigate the predicted increase in sedimentation by trapping sediment and creating new pools. Likewise, culvert replacements completed in 2003 would help mitigate the erosive effect of the predicted increases in peak flows. Vegetation recovery from the Eyerly Fire and past harvest activities would occur at natural rates. Under the “No Action” Alternative, no land-use activities are proposed; therefore, soil compaction would maintain the status quo. In addition, soil effects from past activities would remain unchanged. Fuel treatments within the burn area would not occur; therefore, increased fuel loads from the fire could increase the risk of a future high severity fire and associated soil erosion in some stands. Road decommissioning, primarily riparian roads, proposed in this EIS (3.8 miles) would not occur as a result of the Eyerly Salvage R.O.D.; however, this and additional road decommissioning and closure is proposed in the Eyerly Roads Analysis and could occur as part of a future Environmental Analysis.

Impacts of Alternatives 2 and 3

The action alternatives would have a negligible effect on channel condition because the effect on streamflow, sedimentation, channel stability, and wood recruitment would be negligible. The action alternatives would only have a minimal effect on streamflow because no live trees would be removed and the increase in compaction would not be at a magnitude that would significantly increase streamflow. By not increasing streamflows, especially the more erosive high flows, the action alternatives would not increase the risk of stream erosion. Also, large riparian buffers and down wood would prevent most of the upland erosion caused by activities in the action alternatives from being transported to the streams; thereby, having only a negligible effect on sediment deposition and associated channel erosion. In addition, approximately 3.8 miles of road, primarily within the RHCA of Spring Creek, would be decommissioned after harvest under both Alternative 2 and 3. Subsoiling would reduce the risk of sedimentation and streamflow effects from compaction and removing culverts would restore the natural flow pattern.

In the proposed Action Alternatives, no trees would be harvested within 320 feet of fish-bearing streams or within 160 feet of perennial non-fish bearing streams or intermittent streams (thereby exceeding NWFP Standards and Guidelines; even greater widths for Alt. 3); therefore, existing and newly established riparian vegetation, which provides channel

stability, would not be destroyed by timber harvesting or associated salvage activities. However, newly established vegetation could be at risk from reburn because surface fuels in RHCA/RRs would not be treated.

Wood in streams is important for slowing erosive flows, creating depositional areas, and providing aquatic habitat. Large woody debris recruitment to the channels would be unaffected because no trees would be removed in RHCA/RRs. In addition, planting hardwoods and shrubs (funding secure and scheduled in the spring of 2004) in high and moderate riparian burn areas would help replenish future large woody debris contributions and stabilize stream banks. Under both of the action alternatives, upland units that were harvested would be replanted with conifers. In Alternative 1, there are no project-related plans or funding to replant burned acres. Recovery of vegetation, which would stabilize slopes, reduce overland flow, and reduce the risk of channel erosion would be more rapid under Alternatives 2 and 3 than under the “No Action” Alternative.

In addition, risk of catastrophic landslides resulting from salvage activities would not increase because project design elements such as the use of streamside buffers (described above), harvest systems tailored to site conditions, and location of temporary roads on ridge tops would be implemented. Removing dead trees would not compromise slope stability because tree roots would not be altered.

Water Temperature

Impacts of Alternative 1 – No Action

The Eyerly Fire would continue to have the greatest influence on stream shade within the analysis area. Most of the streams in stand replacing burn mortality are intermittent and are usually dry during summer low flows when shade is most important. However, the perennial reaches of Street (1.6 mi) and Spring (0.25 mi) Creeks are within stand replacing burn areas and water temperature could increase given the significant reduction in shade from the Eyerly Fire. Approximately 5000 hardwoods and shrubs are scheduled to be planted in high and moderate riparian burn areas in the Spring of 2004 as recommended by the BAER team. In areas not re-planted, shade producing trees would continue to recover at natural rates. The increase in surface fuels in RHCA/RRs from the Eyerly Fire could elevate the risk of future catastrophic wildfire and associated water temperature effects.

Impacts of Alternatives 2 and 3

The action alternatives would have a negligible effect on stream temperature because stream shade would not be affected. In the proposed action alternatives, no trees would be harvested within 320 feet of fish-bearing streams or within 160 feet of perennial non-fish bearing streams or intermittent streams (thereby exceeding NWFP Standards and Guidelines; even larger buffer widths in Alt. 3); therefore, stream shade would not be reduced as a result of harvest activity. In fact, stream shade would be improved in the long-term by decommissioning approximately 2.5 miles of road within the RHCA of Spring Creek. Surface fuel loads and associated wildfire risk in RHCA/RRs would remain the same as Alternative 1. Timber harvesting would not likely result in increased landslides because project design elements such as the use of streamside buffers, harvest systems tailored to site conditions, and location of temporary roads on ridge tops would be implemented. The removal of tree boles would have no effect on the decomposition of the

roots because the stabilizing effect of tree roots was already destroyed when the fire killed the trees. Ground-disturbing activities would not likely affect stream shape (width to depth ratio) because no activities would occur within RHCA/RRs and sedimentation would be limited by applying the Project Design Elements at the end of Chapter 2 (*section 2.9.1*).

Nutrients and Retardants

Impacts of Alternative 1 - No Action

The Eyerly Fire itself would continue to have the greatest influence on channel condition within the analysis area. Water yield and sedimentation within the burned area is predicted to increase following the Eyerly Fire due to consumption of much of the ground cover that protected the soil, especially within the areas that burned at high intensities. (*Table 3.4-5*). Therefore, some nutrients and retardant attached to the soil would be transported to the streams (see Environmental Consequences /Sedimentation / Alternative 1). Potential increases in nutrients and/or ferrocyanide (retardant) would be short-term (1 to 2 years) because available nutrients in the ash and retardant would be flushed out during the first few rain storms and/or taken up by new vegetation. Soil erosion rates would continue at elevated levels until ground cover is restored. Under the “No Action” Alternative, no land-use activities are proposed; therefore, soil erosion and compaction would maintain the status quo. In Alternative 1, there are no plans or funding to replant burned acres; however, recovery of soil stability would occur at the same rate as the Action Alternatives because shrubs, grasses, and down wood, capable of trapping sediment, would accumulate regardless of planting. In addition, standing dead trees would fall and help trap sediment

The increased surface fuels in RHCA/RRs from the Eyerly Fire could elevated the risk of reburn and the associated water quality (i.e. increased nutrient and retardant concentrations) effects. Road decommissioning, primarily riparian roads, proposed in the Action Alternatives (3.8 miles) would not occur as a result of the Eyerly Salvage R.O.D.; however, this and addition road decommissioning and closure is proposed in the Eyerly Roads Analysis and could occur as part of a future Environmental Analysis.

Effects of Alternative 2

Within the Eyerly Fire area, the primary nutrients of concern in relationship to timber harvest are phosphorus and nitrogen. Effects to water nutrient concentrations from salvage would be negligible because most nutrients would have been flushed or leached out during the first few storms and / or absorbed by the newly established vegetation before salvage activities would even occur. Studies have shown that water chemistry typically returns to pre-fire levels within one to two years following a fire (Spencer and Hauer 1991; Debano et al. 1998). At the earliest, salvage activities would occur at least 2 years after the Eyerly fire. Already, ground vegetation in the Eyerly Fire area is approximately 60 to 100 % recovered (Suna 2003 and updated by personal observation, C. McCown 2004). Salvage effects on leaching of nutrients would be the same in all alternatives because by the time salvage would be implemented (in 2 years at the earliest) any leaching would have already occurred (Spencer and Hauer 1991). However, some nutrients and retardant (unburned and partially burned ferrocyanide) that have not yet been taken up by plants could be attached to soil particles. As soil in the sediment delivery zone is eroded, available nutrients or ferrocyanide potentially attached to it, are also eroded and could be transported to the streams. Therefore, salvage activities that increase

sediment transport may increase nutrient and retardant contributions to the streams. Salvage effects on nutrient and retardant transport through erosion would be the same as those listed in a previous section under “Sedimentation” for Alternative 2, which are negligible.

Effects of Alternative 3

The effect of the activities on nutrient and ferrocyanide transport, through erosion and sedimentation (i.e. transport of nutrients) are slightly less than Alternative 2 because of a minor reduction in harvest acres in the sediment delivery zone, the percent increase in sedimentation, additional detrimental soil acres, riparian haul road miles, and temporary road miles (*Table 3.3-17*).

Cumulative Effects

Cumulative effects analysis requires analyzing the combined effect of the current project with any past, present, and future foreseeable projects or events. For the hydrology analysis, cumulative effects will be analyzed at the watershed scale (5th field HUC), which directly ties into Aquatic Conservation Strategy (ACS) objectives. The Metolius Watershed Analysis is used to establish existing condition for the Upper and Lower Metolius watersheds (5th fields). It was updated in April 2004 to reflect any changes since 1996, including changed conditions due to the Eyerly, Cache Mountain, Link, and B and B Fires (USDA Forest Service 2004).

Streamflow

The cumulative streamflow effect as a result of the added effect of the Eyerly Salvage would be negligible; therefore, any increases in streamflow above natural conditions would be attributed to fires or past, future, or other management activities. Salvage acres in both Action Alternatives would be less than 1 %⁴ of the area that drains into the Metolius River, and the flow input would only affect the lower 1.6 miles of the mainstem Metolius River (6% of the length of the mainstem Metolius River). No activities are proposed within a mile of the mainstem Metolius River; therefore, all flow input, resulting from disturbance activities, would be delivered to the Metolius River via flow from the tributaries. Within the Eyerly Salvage area, only the Metolius subwatershed (6th field HUC) contributes streamflow to the Metolius River, and that amount is minimal, less than 2%³.

The action alternatives would have a negligible effect on streamflow because no live trees would be removed. In addition, soil compaction, represented by detrimental soil condition, would only increase by 47 acres in Metolius subwatershed (6th field) with only a portion of that occurring in areas that are hydrologically connected. Because salvage of dead trees and associated activities have a negligible effect on streamflow in the subwatersheds, it has an even less effect on the flow of the Metolius River.

⁴ Within the Eyerly Fire area, only the Metolius SWS flows into the Metolius River. The other subwatersheds flow directly into the Metolius arm of the LBC reservoir. The area that drains directly into the Metolius River is 207,684 (excluding areas that drain into LBC). Approximately 1133 acres are proposed for harvest under Alternative 2 in the Metolius SWS. Therefore, less than 1% of the Metolius River contributing area is affected by the proposed salvage activities ($1144/207684 = 0.0055$).

There are no recent past, present or future foreseeable projects in the portion of the Eyerly Salvage area that drains into the Metolius River, except past fire suppression associated with the Eyerly Fire and future road decommissioning proposed in the Eyerly Roads Analysis. The 84 mile long, 10 to 40 ft wide bulldozer line around the fire perimeter was rehabilitated after the fire. Some soil compaction exists from the bulldozer line but it is relatively insignificant because approximately only one pass was made with the equipment. Decommissioning of approximately 10 miles of open and closed roads, 2 miles of which are within RHCA/RRs, would increase infiltration and reduce peak flows.

The Metolius River streamflow data show no trend due to management in the 5th field watersheds; however, detecting a trend would be difficult due to the porous geology. Therefore, the change in the evapotranspiration index, due to the loss or removal of vegetation from recent fires, fire suppression, and past timber management, was used to estimate existing streamflow conditions in the Metolius Watershed (combined Upper and Lower Metolius watersheds). Various vegetation management projects have occurred in the Metolius watersheds; however, recent fires have had the largest predicted evapotranspiration effect. Since 1994, four large-scale fires (Eyerly, Cache Mountain, Link, and B & B Fires) and a few smaller fires burned approximately 35 % of the Upper and Lower Metolius Watersheds. Approximately, 41% of the watershed area that drains into the Metolius River (verses Lake Billy Chinook (LBC) reservoir) was burned, and of that, 11 percent was by a stand replacing fire.

The existing evapotranspiration condition, due to the loss or removal of vegetation from fires and past timber management, was estimated for the Metolius Watershed (combined Upper and Lower Metolius watersheds) using the Canopy Evapotranspiration (CET) model. The CET model uses a 2000 satellite image updated with harvest and fire mortality data between 2000 and 2004. Raster data of percent canopy and vegetation size class from this image were used to estimate the percent of each subwatersheds canopy evapotranspiring at it's potential (referred to as percent CET). Historic percent CET was estimated for each subwatershed by determining historic percent canopy by plant association group (PAG) (Volland 1988). The Forest silviculturist (Jo Boosier) and the District silviculturists (Rob Schantz and Brian Tandy) provided historic ranges and means based on Bill Hopkins Region 6 Old Growth definition for ponderosa pine, CVS plots, representative stands, and professional judgement. These values took into account natural disturbance such as bug infestations and fire. The 2003 canopy evapotranspiration mean estimate was subtracted from the historic canopy evapotranspiration mean estimate to determine the post-fire change in evapotranspiration from historic conditions (refer to the 2004 Metolius Watershed Analysis Update (USDA Forest Service 2004) for a more detailed description of the CET model).

The existing percent CET for the area draining into the Metolius River is 27. This is less than the historic mean of 36 % but within the historic range of variability (7 to 61%). Recent fires have reduced % CET in the watersheds from 34% to 27%. Although CET does not directly translate into streamflow due to watershed characteristics such as infiltration and precipitation, overall streamflow is predicted to increase but be within the range of historic water yields and peaks.

Present and future projects within the Metolius watersheds that could affect streamflow are the Metolius Basin Vegetation Management project (≈12000 ac), McCache Vegetation Management project (≈5500 ac), Lower Jack Reoffer Timber Sale (225 ac), Coil Fiber Timber Sale (170 ac), and B&B roadside hazard tree (< 2000 ac). None of these projects are in the Eyerly Salvage area. The Metolius Basin and McCache timber sales are

primarily thinning projects and would not significantly reduce canopy closure. Modeling showed that the Metolius Basin Vegetation Management Project would reduce % CET by less than 1% in the Metolius watersheds (5th field HUCs). Therefore, these thinning projects are predicted to have a negligible effect on streamflow in the Metolius River. Likewise, the remaining projects have a negligible effect on streamflow because they only remove dead and dying trees. In addition, compaction from these activities would not exceed Forest Plan standards.

Sedimentation

Metolius River

The cumulative sedimentation effect as a result of the added effect of the Eyerly Salvage would be negligible; therefore, any increases in sedimentation above natural conditions would be attributed to fires or past, future, or other management activities. Salvage acres in both alternatives would be less than 1 %⁴ of the area that drains into the Metolius River, and the sediment input would only affect the lower 1.6 miles of the mainstem Metolius River. No activities are proposed within a mile of the mainstem Metolius River; therefore, all sediment input, resulting from disturbance activities, would be delivered to the Metolius River via flow from the tributaries. Within the Eyerly Salvage area, only the Metolius subwatershed (6th field HUC) contributes streamflow to the Metolius River, and that amount is minimal, less than 2%³.

Although a negligible amount of logging-related sediment may be delivered to the mainstem Metolius River in the short-term (3 to 4 years), only a small portion of the Metolius River (1.6 miles out of 27 miles; 6% of the length) would be affected, and the additional sediment input volume would not be enough to alter the sediment input regime. In Alternative 2, 1133 acres are proposed for harvest in the Metolius 6th field subwatershed. Some future down wood in upland areas, which would help trap sediment created from salvage activities, would be removed. Likewise, salvage activities would reduce newly established ground vegetation and increase compaction on approximately 47 acres, a portion of which is hydrologically connected to streams. However, activity slash would help trap sediment created by salvage activities.

As a result of salvage activities in the sediment delivery zone, an additional 2% of sediment could be delivered to streams in the Metolius 6th field subwatershed (i.e. Bean Creek and other unnamed tributaries) during a large rainstorm event for Alternative 2, and 1% for Alternative 3 (Table 3.3-18). Much of the additional sediment predicted to be delivered to these tributaries would be stored behind obstructions or deposited in slow velocities areas in the upstream intermittent reaches adjacent to the sediment delivery zone. Instream wood in these areas and other burn areas is predicted to increase over the next 10 years as standing dead trees in RHCA/RRs fall into the channel. No harvest activities are proposed in the RHCA/RRs; therefore, instream wood, which helps trap sediment and create new pools, would not be altered by the action alternatives.

Lake Billy Chinook

Salvage acres in both alternatives would be less than 2 %⁵ of the area that drains into the Metolius River and LBC. Although the Eyerly Fire will likely increase sedimentation in the subwatersheds, at most an additional 4% of sediment from salvage activities in the sediment delivery zone proposed in the Action Alternatives could reach streams in the Eyerly analysis area, given a large rainstorm event. Even less of that sediment would reach LBC reservoir because most of the sediment from salvage activities would be stored behind obstructions or deposited in slow velocities areas in the upstream intermittent tributaries adjacent to the sediment delivery zone. Any remaining sediment would quickly deposit once it reached the reservoir.

Past, present, and future foreseeable projects and events

There are no recent past, present or future foreseeable projects in the Eyerly Salvage area, except past fire suppression activities associated with the Eyerly Fire and future road closure and decommissionings proposed in the Eyerly Roads Analysis. The 84 mile long, 10 to 40 ft wide bulldozer line around the fire perimeter was rehabilitated after the fire. Some soil compaction exists from the bulldozer line but it is relatively insignificant because approximately only one pass was made with the equipment.

Decommissioning of approximately 10 miles of open and closed roads, and 2 miles of road in RHCA/RRs, would contribute sediment in the short-term primarily to Bean Creek and other tributaries in the Metolius subwatershed (6th field). A minimal amount of this sediment would reach the lower 1.6 miles of the Metolius River because it would be stored behind logs and obstructions in the tributaries. Decommissioning of approximately 34 miles of open and closed roads would contribute sediment in the short-term primarily to Street and Spring Creek subwatersheds (approximately 4 of these miles are proposed for decommissioning under the Action Alternatives). Approximately, 6 miles of road proposed for decommissioning are within RHCA/RRs (approximately 2 of these miles are proposed for decommissioning under the Action Alternatives). A minimal amount of this sediment would reach the LBC reservoir because it would be stored behind logs and obstructions in the tributaries, and any sediment that did reach the reservoir would quickly deposit.

Although, road decommissioning would contribute sediment in the short-term, in the long-term it would improve slope stability and reduce sediment yield once the soil stabilizes and is revegetated (≈ 2 years). Decommissioning would consist of decompacting the road surface, removing drainage obstructions, and in some places, recontouring hillslopes. This would reduce cross-slope interception of water, decrease slope failures, prevent erosion associated with water from running down the unused road, and eliminate culvert or other drainage obstructions that lead to road failures. As vegetation reestablishes in the old road-bed, erosion rates would decrease.

The Eyerly Fire also occurred in the Eyerly Salvage area during the summer of 2002, and has increased potential sediment delivery to the 6th field Metolius subwatershed by 420 % during a storm event within the first year following the fire. Although very little sedimentation occurred in the first two years after the fire, the sedimentation risk remains until vegetation reestablished, slopes stabilize, and peak flow magnitudes return to pre-fire ranges. As a result, some sediment from the Eyerly Fire area may reach the lower 1.6

⁵ The area that drains directly into the Metolius River and LBC reservoir is 286,308 acres. Approximately 4845 acres are proposed for harvest under Alternative 2. Therefore, less than 2% of the Upper and Lower Metolius watersheds are affected by the proposed salvage activities ($4877/286308 = 0.017$).

miles of the Metolius River. The effect of tributary input in the Eyerly Fire area to the LBC reservoir is minimal, less than 2%³. The Eyerly Fire has increased potential sediment delivery in Street and Spring Creek subwatershed by 935% and 1610%, and by some lesser amount in the lower 1.6 miles of the Metolius River, given a storm event. Instream wood in the fire area is predicted to increase, and will help trap sediment in the tributaries to the Metolius River and LBC. However, some sediment from the Eyerly Fire may reach LBC reservoir, where it will quickly deposit.

In order to establish existing sedimentation conditions reflective of past management activities at the watershed scale (5th field HUC), measurements and trends of fine sediment in spawning gravels of tributaries and in the mainstem of the Metolius River were evaluated. Ten sites, including the Metolius River, have been monitored using modified McNeil core sampling techniques at the same locations since 1988 (USDA Forest Service 2004). Prior to the 1996 flood, fine sediment (< 6.4 mm) slightly decreased at all the sites that were monitored (5 sites), and statistically decreased in Roaring Creek. Following the 1996 flood, fine sediment significantly decreased in Roaring Creek, Jefferson Creek, Abbot Creek and Jack Creek. The South Fork Lake Creek declined in fine sediment after the 1996 flood, but is now similar to pre-flood conditions. Since the 1996 flood, fine sediment significantly increased only at the Metolius River site upstream of Lake Creek.

Fine sediment (< 6.4 mm) on average in all tributary spawning sites is approximately 25% (range from 17 to 38%), and approximately 28% in the Metolius River above Lake Creek. US Fish and Wildlife Service recommends fines <20% in spawning gravels for a properly functioning bull trout habitat (USFWS 1998). Although, these sediment levels are slightly above the USFWS recommendation, the Metolius Watersheds support a robust spawning population of both redband trout and bull trout (refer to Fisheries Report). Levels of fine sediment in the Metolius watershed streams were found to be similar to that of the chinook salmon and bull trout spawning habitat of the upper Warm Springs River (personal communication, Mike Weldon, Fishery Biologist, Bureau of Natural Resources, Warm Springs).

These results are supported by a study of sediments accumulated in the Metolius Arm of Lake Billy Chinook reservoir from 1964 to 1998 (O'Connor et al. 2003). The report states that there is no detectable delta and that sediment yields for the 34-year period between 1964 and 1998 are remarkably low and possibly the lowest in the region. This is especially notable because the 34-year period includes the two largest flow events in the last 140 years. Therefore, sedimentation from past management is assumed to be within the historic range.

Sediment from past projects and fires upstream of the Eyerly Salvage area has been transported into the Metolius River, will eventually be deposited in LBC reservoir. Although, recent fires are predicted to significantly increase sedimentation in tributaries and possibly in the Metolius River, the effect to LBC reservoir would most likely be minimal because the 1964 and the 1996 floods did not even have a detectable effect on the Metolius Arm delta (O'Connor et al. 2003).

Present and future projects within the Metolius watersheds that could affect sedimentation are the Metolius Basin Vegetation Management project (≈12000 ac), McCache Vegetation Management project (≈5500 ac), Lower Jack Reoffer Timber Sale (225 ac), Coil Fiber Timber Sale (170 ac), and B&B roadside hazard tree (< 2000). None of these projects are in the Eyerly Salvage area. In addition, none of these projects would remove trees or wood from RHCA/RRs; therefore, not disturbing the filtering capacity of riparian buffers. In

addition, detrimental soil acres would not exceed Forest Plan standards. No new roads would be built and Project Design Elements and BMPs would be used to help mitigate sedimentation effects. Overall, these projects would have a minimal effect on sedimentation in the Metolius River and LBC reservoir. In addition, the effects of these projects would be short-term (3-4 years; Chou et al. 1994) and not all these project would overlap in timing.

The B&B, Link, Cache, and Eyerly Fire areas are predicted to deliver increased amounts of sediment to tributaries of the Metolius River during a storm event. However, the risk of sedimentation increases in the mainstem Metolius River is only low/moderate because instream wood, capable of trapping sediment, is predicted to increase in the tributaries. In addition, the risk of morphological change in the Metolius River is low due to the well-vegetated streambanks and armoured channel substrates that minimize bank instability and scouring during higher flow events.

Fine sediment in spawning gravels was monitored in Jefferson Creek, primarily a spring-fed stream, before and for 2 years after the 1996 Jefferson Fire. Results showed no significant change in fine sediment in spawning gravels due to the fire, which burned approximately 10% of the Jefferson Creek subwatershed (Houslet et al. 1999). Approximately 6 months after the Jefferson Fire, a smaller, 5-year flood event occurred. Fine sediment collected before and after this smaller flood did not show a significant change in percent fines. In addition, results showed that the February 1996 flood (occurred prior to the fire), approximately a 20 year event, significantly reduced fine sediment. This suggests that although a large rain/melt event after a fire can contribute large amounts of sediment, the associated flood may also flush the sediments out of the system. This depends primarily on the depositional character of the stream, percent of the subwatershed burned, amount/intensity of rainfall, and extent of landslide activity after the storm/melt event. In addition, other studies have shown large increases (200 to 1000%) in sedimentation after fires (Hauer and Spenser 1998; Helvey 1980), which are generally a result of intense rainfalls occurring within the short-term period before the re-establishment of effective ground cover. Therefore, sedimentation could increase in the Metolius River and LBC reservoir as a result of the large-scale fires in the Metolius watersheds.

Channel Condition

The cumulative channel condition effect as a result of the added effect of the Eyerly Salvage would be negligible; therefore, any degradation to channel condition would be attributed to fires or past, future, or other management activities. Salvage activities would have a negligible effect on channel condition in the Metolius River because salvage effects on streamflow, sedimentation, channel stability, and wood recruitment would be negligible. Salvage acres in both alternatives would be less than 1 %⁴ of the area that drains into the Metolius River, and the streamflow and sediment input would only affect the lower 1.6 miles of the mainstem Metolius River. No activities are proposed within a mile of the mainstem Metolius River; therefore, all streamflow and sediment input, resulting from proposed disturbance activities, would be delivered to the Metolius River via flow from the tributaries. Within the Eyerly Salvage area, only the Metolius subwatershed (6th field HUC) contributes streamflow to the Metolius River, and that amount is minimal, less than 2%³.

Because salvage of dead trees has a negligible effect on streamflow in the subwatersheds (6th fields), it has an even less effect on the flow of the Metolius River. At most an

additional 2% of the sediment could reach the streams in the Metolius subwatershed (i.e. Bean Creek and other unnamed tributaries to the south) from salvage activities in the sediment delivery zone given a large rainstorm event. Most of the sediment from salvage activities would be stored behind obstructions or deposited in slow velocities areas in the upstream intermittent tributaries adjacent to the sediment delivery zone. Instream wood recruitment and channel stability would be unaffected because no activities would occur within RHCA/RRs.

There are no recent past, present or future foreseeable projects within the subwatersheds affected by the Eyerly Salvage and that drain directly into the Metolius River, except past fire suppression activities associated with the Eyerly Fire and future road closure and decommissioning proposed in the Eyerly Roads Analysis. The 84 mile long, 10 to 40 ft wide bulldozer line around the fire perimeter was rehabilitated after the fire. Some soil compaction exists from the bulldozer line but it is relatively insignificant because approximately only one pass was made with the equipment. Overall, future road decommissioning and closures would improve channel condition by increasing infiltration, thus reducing overland flow. This is especially true in riparian areas. Road closures and decommissionings in riparian areas would also increase instream wood recruitment as vegetation reestablishes and potentially improve floodplain function.

The Eyerly Fire also occurred in the Eyerly Salvage area during the summer of 2002, and is expected to significantly increase streamflow and sedimentation in the 6th field Metolius subwatershed. The effect on channel condition in the 1.6 miles of the Metolius River below the Eyerly Fire would be less because streambanks in the Metolius River are already stable and instream wood, capable of dissipating flows and trapping sediment, is predicted to increase in the tributaries.

Trends in large woody debris, riparian vegetation, channel stability, and pool habitat in the Metolius River are used to evaluate the effects of past management and to establish the existing channel condition at the watershed scale (5th field HUC). Average instream wood densities for the Metolius River meet the INFISH minimum guideline of 20 logs/mile (USDA Forest Service 2004; USDA and USDI 2003). However, large wood densities are probably still below historic frequencies due to active wood removal in the Metolius River between 1930 and 1950. Large woody material has been actively added to the Upper Metolius River since 1986 and accounts for 85% of the recruited pieces over the last 17 years (Houslet 2004). Improved management and active wood placement is responsible for 25% of the total wood biomass in the Upper Metolius River. Two reaches in the Upper Metolius were slightly below the INFISH standard but were in ponderosa pine forest type, which have a low rate of natural recruitment of wood. Also, the RHCA/RRs in those stands have less mortality associated with drought related insects and root disease, which may attribute to the lower instream wood count. Overall, RHCA/RRs in the Upper Metolius are dominated by medium and large trees, which will be recruited for instream wood overtime.

Riparian vegetation along the Metolius River is generally healthy and well established (USDA Forest Service 2004). In addition, the percent unstable banks along the Metolius River is only about 1%, primarily due to its stable spring-fed flow. However, pool habitat is lacking in the Metolius River. Current pools per mile is only about 4 and the INFISH guideline is approximately 20 pools per mile. Some reasons for the low pool frequency is the geology (some bedrock constraints), the channel type, and a lack of large wood. Although pool frequency is low, the pools that exist are large and deep and hold spawning migrations of bull trout (USDA Forest Service 2003; USDA Forest Service 1999).

Present and future projects within the Metolius watersheds that could affect channel condition are the Metolius Basin Vegetation Management project (≈ 12000 ac), McCache Vegetation Management project (≈ 5500 ac), Lower Jack Reoffer Timber Sale (225 ac), Coil Fiber Timber Sale (170 ac), and B&B roadside hazard tree (< 2000 ac). None of these projects are in the Eyerly Salvage area. The Metolius Basin and McCache timber sales are primarily thinning projects and are predicted to have a negligible effect on streamflow in the Metolius River. Likewise, the remaining projects have a negligible effect on streamflow because they only remove dead and dying trees. In addition, compaction from these activities would not exceed Forest Plan standards. Overall, these projects would have a minimal effect on sedimentation in the Metolius River. The sedimentation effects of these projects would be short-term (3-4 years; Chou et al. 1994) and not all these project would overlap in timing. In addition, none of these projects would enter RHCA/RRs, except the Metolius Basin project and it has mitigations to protect stream channels; therefore, there are no direct effects to channel condition from these projects.

The B&B, Link, Cache Mountain, and Eyerly Fires are predicted to have large increases in streamflow and sedimentation in tributaries to the Metolius River given a storm event (6th fields). In addition, the risk of increased streamflow in the mainstem Metolius River is high; however, the risk of sedimentation increases is only low/moderate because instream wood, which helps trap sediment, in the tributaries is predicted to increase. Although the risk of increased streamflow is high, the risk of morphological change is low in the Metolius River due to it's well vegetated and stable banks. Evidence of the low susceptibility of the Metolius River to morphological changes from streamflow was demonstrated after the 1996 flood (USDA Forest Service 2004).

Water Temperature

The Eyerly Salvage would not increase water temperatures; therefore, there is no cumulative water temperature effect as a result of the combined effects of the Eyerly Salvage and other past, present or foreseeable projects. The Eyerly Salvage would not affect stream temperatures because no activities would occur within RHCA/RRs. The single most important event affecting water temperature within the analysis area would continue to be the Eyerly Fire. Grass and shrubs have re-sprouted, but hardwood and conifer regeneration has not yet occurred.

Nutrients and Retardants

The cumulative nutrient/retardant effect as a result of the added effect of the Eyerly Salvage would be negligible; therefore, any increases nutrient or retardant levels above natural conditions would be attributed to fires or past, future, or other management activities. Although the Eyerly Fire could increase nutrients and retardant concentrations in the Metolius River and LBC reservoir, salvage activities would only have a negligible effect on retardant, nutrients, and associated parameters (i.e. chlorophyll *a* and pH, which are 303(d) listed parameters in LBC) in the Metolius River and LBC reservoir. The concern with retardant is transport of ferrocyanide into subwatershed streams and the potential transformation into cyanide (toxic). While this may be a concern in the subwatersheds (refer to Existing Conditions/Water Chemistry/ Nutrients/Wildfire section), cyanide transported to the subwatershed streams would be diluted once it reached the Metolius River and the reservoir.

The only potential effect the project would have on the transport nutrients is through the addition of available nutrients attached to sediment which is transported to the streams; therefore, the cumulative effects of sedimentation (refer to previous section, “Sedimentation”) would be the same or less for nutrients. Salvage acres in both alternatives would be less than 2 %⁵ of the Upper and Lower Metolius watersheds (5th fields). At most an additional 4% of sediment from salvage activities in the sediment delivery zone proposed in the Action Alternatives could reach streams in the Eyerly analysis area, given a large rainstorm event. Even less of that sediment would reach LBC reservoir because most of the sediment from salvage activities would be stored behind obstructions or deposited in slow velocities areas in the upstream intermittent tributaries adjacent to the sediment delivery zone. In addition, nutrient spikes usually occur immediately following the first few storms after a fire. Therefore, any potential nutrient spike associated with the Eyerly Fire has probably already occurred and others (i.e. from salvage) would be unlikely because vegetation, which can take up available nitrogen and phosphorous, has already begun reestablishing.

There are no recent past, present or future foreseeable projects within the subwatersheds affected by the Eyerly Salvage and that drain directly into the Metolius River, except past fire suppression activities associated with the Eyerly Fire and future road closure and decommissioning proposed in the Eyerly Roads Analysis. The effects of future road decommissioning and the Eyerly Fire on the transport of nutrients to the Metolius River and LBC reservoir via sediment is discussed in the cumulative effects section on sedimentation.

The Eyerly Fire also occurred in the Eyerly Salvage area during the summer of 2002, and is expected to significantly increase streamflow and sedimentation in the 6th field Metolius subwatershed. As a result, short-term (1 to 2 years; Spencer and Hauer 1991; DeBano 1998) increases in nutrient and possibly retardant concentrations would be expected in the tributaries and possibly the lower 1.6 miles of the Metolius River and LBC reservoir. Nutrient spikes from the Eyerly Fire would most likely occur before the proposed Eyerly Salvage activities would be implemented.

Nutrient trends monitored in the Metolius River and its tributaries from 1996 to 2003 are used to evaluate the effects of past management and to establish the existing nutrient conditions at the watershed scale (5th field HUC). Overall, nitrogen levels in the Metolius River are considered low, because most sites are below 0.1 mg/L (USDA Forest Service 2004). There are no ODEQ criteria for nitrogen for surface waters in this watershed; however, and a level of 0.3 mg/L is considered likely to prevent eutrophication in waters flowing into lakes (McDonald et. al 1991).

Water quality monitoring in the Upper Metolius River show that orthophosphorus levels continue to be high, ranging from 0.05 to 0.08 mg/L, due to natural phosphorous rich volcanic rock in the Metolius basin (USDA Forest Service 2004). Although no standards are established for phosphorus, MacDonald et al. (1991) suggests streams entering lakes or reservoirs should not exceed 0.05 mg PO₄-P/L. When these waters enter the reservoir concentrations drop to 0.03 to 0.06 mg/L (Johnson 1985), within the range suggested by MacDonald and others (1991). Regardless, once these waters are impounded, they begin to stratify and blue-green algae forms (CTWSR and PGE 2002), thus resulting in water quality exceedences for chlorophyll *a*. However, phosphorous concentrations are not at a level that is adversely affecting pH in the Metolius River. The Metolius River has the lowest pH of all the tributaries to LBC reservoir and it is below the State and Tribal standard of 8.5. Based on this data nutrients concentrations is assumed to be within the historic range and not significantly impacted from past activities.

Present and future projects within the Metolius watersheds that could affect nutrients in the Upper Metolius subwatersheds are the Metolius Basin Vegetation Management project (≈ 12000 ac), McCache Vegetation Management project (≈ 5500 ac), Lower Jack Reoffer Timber Sale (225 ac), Coil Fiber Timber Sale (170 ac), and B&B roadside hazard tree (< 2000 ac). None of these projects would remove trees or wood from RHCA/RRs; therefore, not disturbing the filtering capacity of riparian buffers. In addition, detrimental soil acres would not exceed Forest Plan standards. No new roads would be built and Project Design Elements and BMPs would be used to help mitigate sedimentation effects. Overall, these projects would have a minimal effect on sedimentation and associated nutrient transport in the Metolius River. In addition, the effects of these projects are short-term (2-3 years for nutrients to leach out, get transported by runoff, or be utilized by plants) and not all these projects would overlap in timing.

The B&B, Link, Cache Mountain, and Eyerly Fires may produce short-term nutrient spikes in the Metolius River and LBC reservoir following a storm event, but this is difficult to predict because nutrient increases in the soil may be taken up by plant growth or bacteria before entering LBC reservoir. Likewise, it is possible that the potential increase in nutrients in the reservoir from the fires could increase chlorophyll *a* and pH in the short-term. Both nitrate and phosphorous concentrations are often higher in surface waters after wildfires, but spikes are usually short-term (1 to 2 years; Spencer and Hauer 1991; Debano et al. 1998). However, studies on lake ecology following fires in lakes in northern Minnesota (Write 1976, Tarapchak and Wright 1986) and in Yellowstone Lake (Gresswell 1999) showed little effect. Studies have also shown that nitrate concentrations are directly related to the proportion of the watershed burned (Robinson and Minshall 1996), and that the highest levels of nutrient increase correlated to those areas with high burn severity (Hauer and Spenser 1998). Only 14% of the Metolius Watersheds (5th fields) experienced a stand replacing burn from the recent fires. In addition, nutrient effects from the different fires may not have overlapped in time and space because the Cache Mountain (Upper Metolius watershed) and Eyerly Fires (Lower Metolius watershed) occurred in the summer of 2002 and the B & B and Link Fires (Upper Metolius watershed) occurred in the summer of 2003.

❖ 3.5 Fish Habitat (Issue 3)

❖ 3.5.1 Introduction

Issue: Effects of the proposed activities on fish habitat, specifically bull trout critical, redband trout, and essential Chinook salmon . Bull trout are listed as a threatened species, and inhabit the Metolius River and watershed. Proposed critical bull trout habitat occurs within the project boundary. Potential effects to fish habitat is a concern expressed by several members of the community.

This section describes both the existing condition and the environmental consequences to fish and fish habitat found within the area. It starts with a brief overview of the bull trout and redband trout populations and management direction. This section is followed by a more detailed discussion of the indicators which measure fish habitat found in the fish bearing waterbodies of the analysis area, and finally the management direction for evaluating fish habitat. The next section analyzes environmental consequences associated with the alternatives. Finally, the fish habitat issue concludes with a discussion on the alternative response to the Aquatic Conservation Strategy objectives.

❖ 3.5.2 Existing Condition

Landscape Setting

Nearly 30 fish species inhabit the water within the Eyerly Salvage project area including Lake Billy Chinook and the Metolius River (Fies et al. 1995). Within the Spring and Street sub-watersheds brown trout, redband trout and kokanee inhabit these waters. An occasional juvenile bull trout is reported in Street Creek (Dachtler 1999 and 2003) and could potentially use Spring Creek.

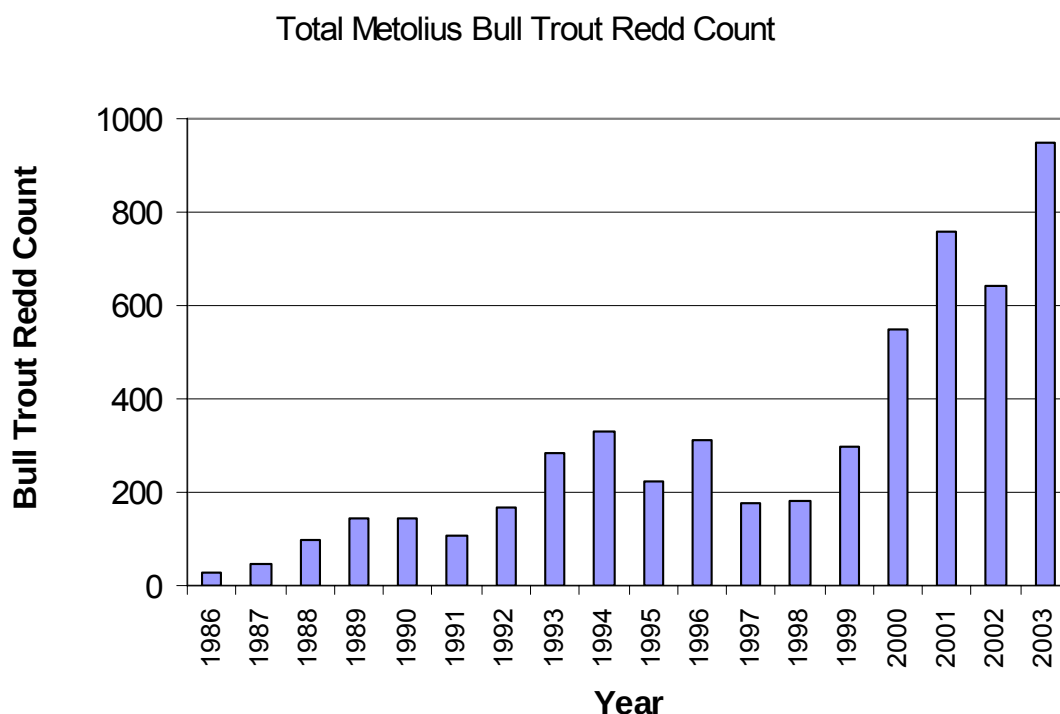
Fish Populations

Bull trout life history and population

Bull trout are associated with a range of habitat types depending on life history strategy and age. Juvenile bull trout are closely associated with headwater streams, preferring water temperatures <13°C (Fraley and Shepard 1989; Rieman and McIntyre 1993; Houslet and Riehle 1998). Subadults typically emigrate from these natal headwater streams to large bodies of water such as lakes, large rivers and reservoirs where they live and feed until age five when spawning migrations occur to their natal stream. Bull trout spawning begins in late May and June as they stage at the mouth of the Metolius River and begin moving upstream. Spawning occurs in September and completed by the middle of October. For a more comprehensive life history of the Metolius bull trout population see (Riehle and Nolte 1992; USDA and USDI 2003).

The Metolius River/Lake Billy Chinook bull trout is a sub-population of the Deschutes Recovery Unit and is healthy as stated by Ratliff and Howell (1992) and Buchanan et al. (1997). Trends in spawning population size have increased since 1986 from 27 redds to over 800 redds by 2003 (*Figure 3.5-1*). The increase is attributed to protection from harvest by more restrictive angling regulations (Riehle et al. 1997). The Metolius bull trout population is the only population with an allowable angler harvest in the state of Oregon. Oregon Department of Fish and Wildlife regulations allow one bull trout over 24 inches to be harvested daily on Lake Billy Chinook. In 2002, 380 legal bull trout were kept during March and April creel census surveys, while 4297 were reported caught and released (PGE and CTWS 2003). The number caught is nearly 3 times that of the year 2000 and an 850% increase in the number kept in 1999 (PGE and CTWS 2003).

Figure 3.4-1: Bull trout redds counted in the Metolius Watershed from 1986 to 2003



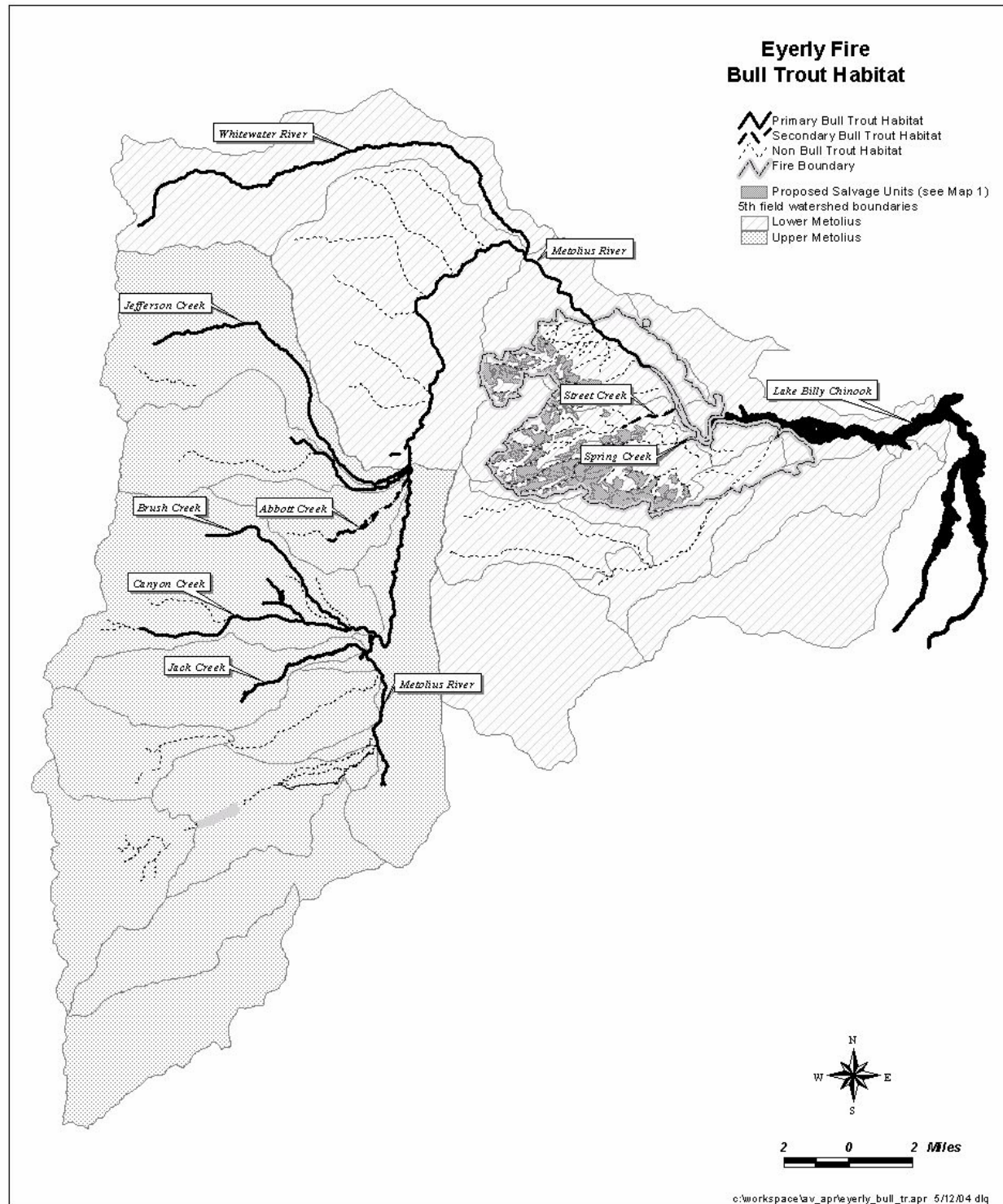
Notes:

Counts are from Metolius River, Heising Spring, Jack Creek, Canyon Creek, Roaring Creek Jefferson Creek, and Candle Creek, totaling nearly 20 miles of river surveyed. Data from USFS (2004).

The Metolius River bull trout population contains a mixture of both fluvial and adfluvial fish. Some resident segments of the population may exist. All life strategies use small tributaries to the Metolius River for spawning. Surveys have been conducted documenting streams used by bull trout in the Metolius drainage. Spawning occurs in spring-fed reaches of Jack Creek, Heising Spring, Canyon Creek, Roaring Creek, Candle Creek, Jefferson Creek and Whitewater River. Mainstem river spawning has been documented in only a 0.5 mile reach of the upper Metolius River near the mouth of Jack Creek. Rearing habitat is found in all spawning streams plus Brush Creek, Abbot Creek, Spring Creek near Lake Creek, and the Metolius River (*Figure 3.5-2*). Lake Billy Chinook (Round Butte Dam) provides additional rearing habitat. Street and Spring Creeks, tributaries to the Metolius Arm of Lake Billy Chinook is suspected to provide additional rearing habitat for the Metolius bull trout population. Fish surveys of these two streams found only one individual twice in Street Creek and have yet to be observed in Spring Creek.

Most juveniles move out of the spawning and rearing streams at age 2 and move into the Metolius River and eventually into Lake Billy Chinook. Primarily, age 3 and older bull trout reside in the lake. At age 5, most bull trout mature and move up the Metolius River and into tributaries to spawn.

In the Metolius basin, young bull trout less than 100 mm were found most consistently in the coldest, spring-influenced tributaries (Ratliff 1992). In the Metolius River system, bull trout Age 0+ range between 20-40 mm, 1+ range between 60-99 mm, 2+ range between 100-159 mm and 3+ are greater than 160 mm (Ratliff et al. 1996). In other systems, bull trout less than 110 mm feed on aquatic insects, macro-zooplankton, and mysids while those larger are primarily piscivorous (Horner 1978; Shepard et al. 1984). Growth differs little between resident and migratory forms during stream residence but diverges as migratory fish move into larger and more productive waters. Resident adults range from 150 to 300 mm in length (Goetz 1989; Mullan et al. 1992) while migratory bull trout commonly exceed 600 mm (Shepard et al. 1984; Pratt 1984; and Goetz 1989).

Figure 3.5-2: 5th Field Watershed Known Primary, Secondary, and Non Bull trout Habitat

Redband trout population

Redband trout is classified as a sensitive species by the Region 6 US. Forest Service. Redband trout occur within Street and Spring Creeks, Metolius River and Lake Billy Chinook (*Figure 3.5-3*). Spawning occurs mostly within the upper Metolius River, Lake Creek and Abbot Creek. Houslet and Riehle (1997) found redband trout began spawning in the headwaters of the Metolius River started as early as January in locations where water temperatures were near 7°C similar to water temperatures described in Becker (1983). Rainbow trout typically spend 2 yrs rearing in the natal stream before migrating to larger waters for maturation (Becker 1983). Juvenile redband trout have been found to use wood and pockets of slow water in the streambank more than open water areas in the Metolius River (Houslet 2004).

Subsequent spawning surveys have found redds increased from 240 redds in 1996-1997 sampling to nearly 1200 redds in 2002/2003 (*Figure 3.5-4*; Cotter and Wise 2004). Street Creek is suspected to operate in this manner; providing spawning and rearing habitat. From the 1999 stream survey four springs were identified supplying 14 to 16°C water temperatures. Redband trout might find this stream available for spawning during winter and spring as they migrate from Lake Billy Chinook to Street Creek. Summer sampling by Dachtler (1999, 2003) found only juveniles in Street Creek and Spring Creek.

Figure 3.5-3: 5th Field Watershed Known Primary, Secondary, and Non redband trout Habitat

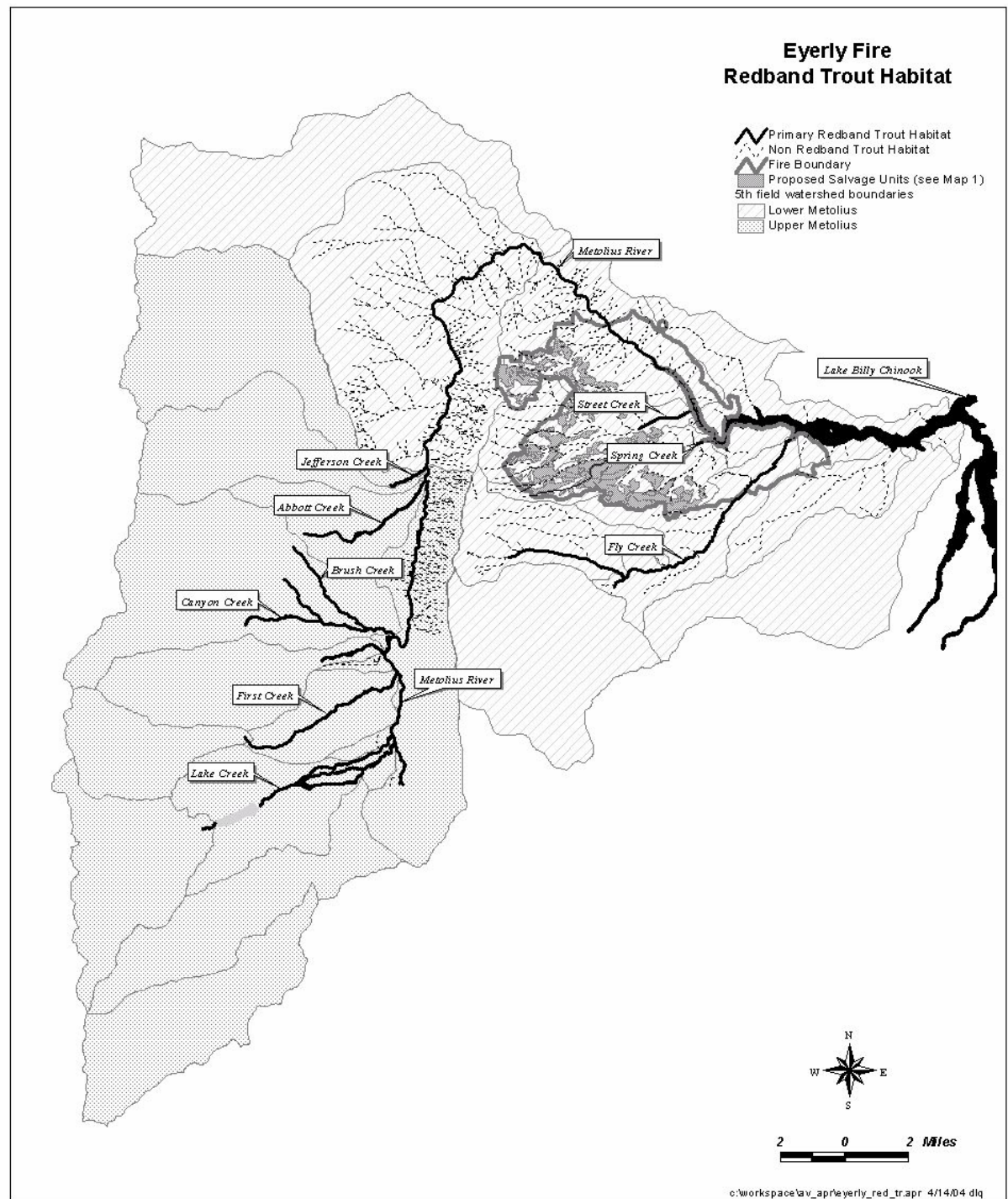
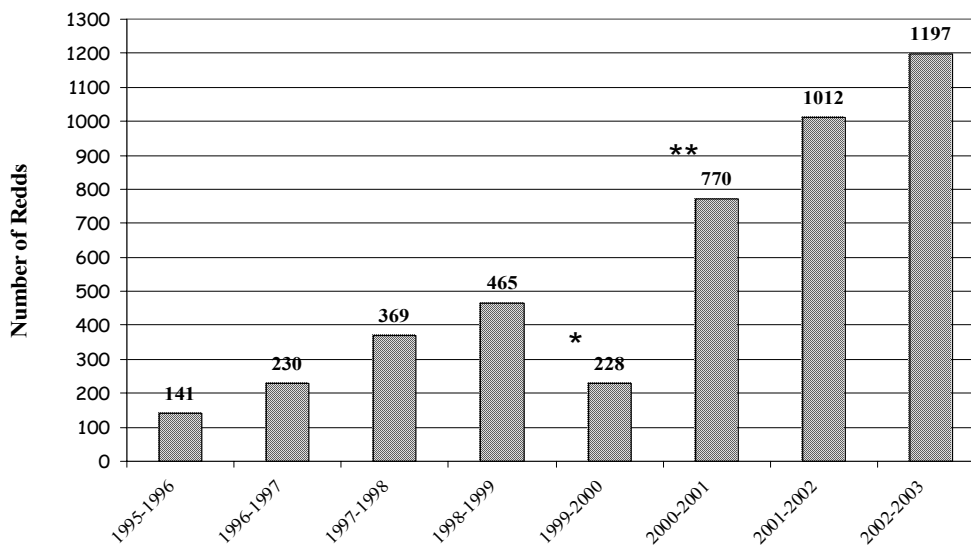


Figure 3.5-4: Metolius River Redband Redd Counts 1995 through 2003 (Sections 0 through 7)



Notes:

* Denotes Sections 6-7 were not surveyed 1999-2000, sections 0-5 were not surveyed as frequently as other years.

** Denotes Sections 6-7 were sampled less frequently in 2000-2001 than in other years.

Source: USFS (2004).

Measurement of Fish Habitat

Three indicators are used for determining the existing condition of bull trout and redband trout habitat in occupied subwatersheds in the Eyerly project area.

- ▶ Fine Sediment (measured in % fine sediment <5.7mm diameter within potential spawning habitat)
- ▶ Woody Material (wood density measured in # pieces/mile down woody material measuring 12" diameter by 35' length)
- ▶ Water Temperature (based on the CEQ threshold of 12°C for bull trout habitat, and 18°C for redband habitat)

These indicators serve as a baseline to determine the effects of land management activities on fish habitat. Fine sediment filling pools and interstitial spaces of redds can affect spawning and rearing habitats; woody material is important for pool formation and volume, and provides biomass and cover for fish habitat; and water temperature is important to these fish species which prefer cold water habitats.

Fine Sediment <5.7mm

Aquatic habitat is developed and persists around varieties of and scales of disturbances (Swanston 1991). These watershed disturbances recruit and remove a variety of material within the channel acting as resetting and recycling mechanisms. Fine sediment production is one type of respondent of watershed or channel disturbance such as wildfire (Beaty 1994; Minshall et. al 1997; Benda et al 2003a; Wondzell and Kinng 2003) floods (Houslet and Riehle 1998b) and clearcutting (Hall and Lantz 1969). Changes from wildfire may increase the risk of increasing fine sediments in channels with high burn severity as bank stability decrease from the loss of root structure (Minshall et. al 1997; Beaty 1994) and peak flows increase.

As noted previously, percent of fine sediment <5.7mm diameter within potential spawning habitat was identified as a measure of aquatic health. Fine sediment monitoring on the Deschutes National Forest following large wild fires has shown mixed results. Monitoring of fine sediment in Jefferson Creek after the 1996 Jefferson Fire found that there was no significant change in fine sediment in potential bull trout spawning habitats between pre-fire and 3 years of post-fire monitoring (Houslet et al. 1999); Although, many effects of the Jefferson Fire may have been masked by the 1996 flood. Large-scale changes to sediment supply were thought to be more long term or at least longer than the 3 years of study; five years were expected before tree failure occurred and uprooting of dead trees began disturbing the soils. Dachtler (2003b) found mixed results from modified Wolman pebble counts in Street Creek after the Eyerly fire having the upper most site change but not the lower most site (*Table 3.5-2*). One year after the fire site three continued to increase whereas the other sites did not change from the post fire condition to one year later.

Table 3.5-1. Miles of bull trout and redband trout spawning and rearing habitat

❖ Condition	Spring	Street	Metolius
Bull trout spawning	0	0	2.0
Bull trout rearing	0.25	1.6	2.0
Redband trout spawning	0.25	1.6	2.0
Redband trout rearing	0.25	1.6	2.0
Note: Results from occupied subwatersheds			

Fine sediment can affect spawning and rearing habitats of bull trout and redband trout through filling pools and filling the interstitial spaces of redds after spawning. Fine sediment <6.4 mm diameter can reduce survival of egg to emergence for bull trout in the Flathead Drainage (Shepard et al. 1984). Bull trout survival declined to <50% when fine sediment <6.4 mm diameter exceed 35%. Brown (1995) recommended fine sediment <6.4mm to be <15% for bull trout habitats in Washington State, whereas USFWS recommends fines <20% for a properly functioning bull trout habitat (USFWS 1998). Fine sediment monitoring in the Upper and Lower Metolius Watersheds has occurred using two different methods. These two methods unfortunately have different separations sizes for analysis. The modified McNeil core samples tested fines less than 6.4 mm

diameter (see Houslet and Riehle (1998b) for methods and measurements). The modified Wolman pebble counts analyze fine sediment < 5.7 mm diameter. The difference in results between 5.7 mm and 6.4 mm diameter could be identified to be negligible. The USFS will interchangeably refer to pebble counts of 5.7 mm to be used in relation to meeting the USFWS criteria for 6.4 mm diameter threshold.

Fine sediment in the Upper Metolius Watershed is a concern and may have increased from past road construction and riparian logging and is a concern for Street and Spring Creeks in the Lower Metolius Watershed. The low gradient, spring-fed reaches are particularly sensitive to fine sediment loading due to their low sediment transport rates. Current levels of fine sediment in the Upper Metolius Watershed range from 17% to 31% and are supporting a robust spawning population of both redband trout and bull trout. Continued McNeil core sampling has shown fines <6.4 mm diameter have not increased since 1996 (USFS 2004). Current percentage of fine sediment <5.7 mm diameter, as determined by pebble count method, in Street and Spring Creek is about 20 to 25 % (*Table 3.5-3*). Fine sediment monitoring of Street Creek riffles using modified Wolman style pebble counts found mixed results from post fire sampling. The upper most sampling site increased in fine sediment <5.7 mm diameter after the fire but returned to pre-fire conditions the following summer finding no difference between 2003 and other sampling years. Site two increased after the fire and remained elevated the following summer. Site three (downstream of site 2) changed only after spring of 2003. The lower most site, number 4, didn't change between any of the sampling years (*Table 3.5-2*; Dachtler 2003b).

Table 3.5-2. Street Creek modified Woman pebble count results (%) of fine sediment (<5.7 mm diameter) at 4 sample sites

❖ Street Creek sample site	❖ 1999	❖ 2002	❖ 2003
Site #1 (Upper most site)	19 ^a	❖ 32 ^a	25
Site #2 ⁺	NA	❖ 23	29 ^d
❖ Site #3 ⁺	NA	18 ^e	29 ^e
❖ Site #4* (Lower most site)	❖ 25	16	16
Notes: * No difference found for site 4 for any year (p>0.05). + Same transect data from 1999 survey. NA Not applicable – no survey data. Surveyed 1999, 2002 (fire year) and 2003 (summer following the fire). Similar letters denote years of change (Chi Square test p<0.05). Site 2 and 3 were split from the 1999 stream survey. Two identified transects created for 2002 and 2003. Data: Dachtler (2003b).			

Table 3.5-3. Percentage of fine sediment in potential bull trout or redband spawning habitat

❖ River	❖ year	❖ Method	❖ % fine sediment *
Metolius River	2000	Wolman Pebble Count	17.3
Street Creek	1999	Wolman Pebble Count	16.0
Street Creek	2002	Wolman Pebble Count	22.0
Spring Creek	2003	Wolman Pebble Count	22.5
Notes: ❖ * <5.7 mm diameter Results within Eyerly project area.			

Woody Material

Large wood has been found to enhance fish and invertebrate biomass and production (Dudley and Anderson 1982; Bilby and Ward 1989; Fausch and Northcote 1992). Wood also has a great impact on channel morphology and hydrologic stability (Abbe and Montgomery 1996). Large wood is important for pool formation and pool volume. Wood can also influence the contribution and retention of organic matter and sediment (Fausch and Northcote 1992; Angermeier and Karr 1984; Smock et al. 1989; Beechie and Sibely 1997). Bisson et al. (1988) also found that pools associated with large wood produced higher densities of juvenile salmonids. Large wood promotes a more complex environment that produces increased fisheries biomass (Fausch and Northcote 1992) and greatly increase the resiliency and resistance of fish species to floods and droughts (Pearsons et al. 1992). Redband trout have been found to use wood and pockets of slow water in the streambank more than open water areas in the Metolius River (Houslet 2004). Bull trout were found to use wood most frequently as cover in streams of the Metolius Watershed (Goetz 1994). Chinook are closely associated with slow water habitats most often found in pools (Hillman and others 1987, Hillman 1992, Roper 1994).

Wood removal from a system can have a variety of indirect impacts to aquatic systems and communities. Clearcutting can remove woody material essential to system function and production of allochthonous inputs (Eaglin and Hubert 1993, Golladay et al. 1987). Golladay et al. (1987) discusses the impacts of wood removal on allochthonous inputs providing seston to macroinvertebrates and fish communities. These are important system nutrients and food sources for macroinvertebrates and thus fish can be negatively impacted by removal of these streamside sources.

Density of large woody material is measured in # pieces/mile down woody material. Large wood density defined by the INFISH guidelines require 20 pieces per mile of wood >12" diameter and 35 ft in length. Northwest Forest Plan does not specify wood density and size. The perennial section of Spring Creek has few large wood debris >12" diameter and 35 ft in length (*Table 3.5-4*). Recruitment of large wood material is low in the perennial flow reach. A campground, boat ramp, and access roads remove large wood from the system. Recruitment of fire damaged trees in the intermittent reaches of Spring Creek can provide some recruitment providing spring time flows are sufficient to transport material into the perennial reach of Spring Creek within the Campground. A new bridge on the 64 road will allow greater opportunities to transport various sized debris into the perennial reach of Spring Creek although a culvert in the above campground would limit the size of wood debris passed.

Large wood in Street Creek >12" diameter and 35 ft in length is less than the recommended 20 pieces per mile in the perennial reach and just meets the 20 pieces per mile in the intermittent reach (Dachtler 2003a). This is more a result of the dry ponderosa pine and juniper plant association group (PAG) this section of stream flows through. This PAG tends to be low in density and smaller trees. The newly recruited dead material caused by the Eyerly Fire will provide a source of large wood in this stream system. A windstorm that occurred after the Eyerly Fire contributed to a great increase in wood in reach 2 (from springs to the end of the perennial flow- *Table 3.5-4*; Dachtler 2003a). Typically 50% of dead trees become recruited to the ground within 10 years.

Table 3.5-4. Comparison of measurements between alternatives that effect fish habitat.

Measurement	Alternative 1	Alternative 2	Alternative 3
Perennial stream RR/RCHA width	NA	320	320
RR/RCHA for the Forks to Street and Spring Creek	NA	160	320
RR/RCHA for intermittent channels	NA	160	200
Acres of Soil Compaction in Street subwatershed	NA	183	121
Acres in sediment delivery zone in the Street sub-watershed	NA	288 (30%)	100 (10%)
Acres of harvest inside sediment delivery zone and bull trout habitat (See fig 1. for habitat)	NA	0	0
Acres of harvest inside sediment delivery zone and redband trout habitat (See fig. 3 for habitat)	NA	0	0
Percent contribution to sediment input to Street Creek system	NA	5%	1.3%
Wood density input	Increase*	Increase*	Increase*
Total treatment acres within the shade influencing area of Street Creek and Spring Creek	0.5 ⁺	0.5 ⁺	0.5 ⁺
Water Temperature effect from current (18.8°C)	No change	No change	No change
Notes: *= addition from road side hazard felling and leaving for down wood to riparian habitat or in-channel wood. += hazard tree treatments along road crossings NA Not Applicable.			

In the Metolius River densities of large wood meet PACFISH and INFISH standards based on USDA FS level II stream surveys (Riehle, 1993; USDA-FS, 1995). Trees that have died from the effects of drought and associated insects and disease have been increasing in-stream wood densities in most mid elevation streams of the Upper Metolius Watershed. The Metolius River remains low in large wood due to in-stream wood removal programs during the earlier half of the century (USDA-FS, 1995). Wood recruitment projects have occurred in the Metolius River improving wood densities (Houslet, 2004). Current wood densities are 21 pieces /mile >12 inches diameter and 35 ft in length; meeting INFISH guidelines.

Due to the stability of spring- dominated streams within the Upper and Lower Metolius watersheds, little wood is transported out during normal spring flows. Wood density is therefore a reflection of recruitment methods available to the watershed. Recruitment estimates from Benda et al, (2003b) estimates about 80% of the wood recruitment occurs within 100 to 120 feet from the stream edge regardless of recruitment method.

Water Temperature

Bull trout habitat in the Upper and Lower Metolius Watersheds are in good condition. Water temperature in most spawning and rearing streams are below 10° C during spawning and rarely exceed 12° C during the peak of the summer (USFS unpublished data). Within the project area fish habitat exists in the lower 1.6 miles of Street Creek, 0.25 miles of Spring Creek, the Metolius River and Lake Billy Chinook. Water temperatures are monitored annually throughout the Metolius River and in 2000 and infrared aerial survey occurred on the Metolius River (Watershed Sciences 2000). Thermographs were installed in Street Creek (1999, 2003) during the stream surveys by USFS.

Water temperatures for both Spring Creek and Street Creek met the ODEQ standard for salmonid spawning (12°C) and rearing (17.8°C) prior to the Eyerly Fire. Seven-day average maximum water temperature in Street Creek was found to increase 2°C in 2003, exceeding the summer rearing temperature by 1°C (18.8°C). The Spring Creek thermograph failed to start in 2003 so only calibrated hand held thermometer reading were recorded. The maximum water temperature during the survey in August was 14.5°C. The upper most spring was 13.0°C (Dachtler 2003c). These water temperatures in Street Creek exceed the seven-day mean maximum of 10°C of bull trout established by ODEQ. This naturally warmer water is mainly why Street Creek is identified as secondary rearing such as Abbot Creek.

Water temperature is a fundamental parameter affecting a waterbody's ecology (Minshall, 1978; Vannote et al, 1980). As a stream moves from headwaters to mouth exposure to solar radiation increases and water warms to near the ambient air temperature (Bartholow, 1989; Collier and Payne, 1998). Land management activities can significantly affect water temperature. Vegetation manipulation by overstory removal or altering the water table to allow encroachment of upland vegetation into the riparian zone can affect the shade cover and the amount of solar radiation input into the water surface. Flow modification is another land management activity that can significantly affect water temperature. Reducing stream water volume via irrigation withdrawal can raise the water temperature by decreasing the volume exposed to heat energy inputs.

Creating openings within the riparian zones of streams can lead to increased water temperatures (Fowler et al, 1988; Metzler, 1988). Fowler et al, (1988) found no change in various water chemistry parameters in three watersheds of eastern Washington but did have maximum water temperature increase about 1°C. Metzler, (1988) found water temperatures increased 2.5°C resulting from a 1000 ft stretch of clearcut in which no riparian trees were left.

Management Direction

The Eyerly fish habitat analysis is derived from the Oct. 2003 Biological Assessment (Houslet, 2003), which documents the review and findings on species listed as TES by the US Fish and Wildlife Service or the Pacific Northwest Regional Forester. The BA was prepared in compliance with the requirements of appropriate Forest Service Manual (FSM) and the Endangered Species Act of 1973, as amended (ESA) (Subpart B; 402.12, Section 7 Consultation). The Aquatic TES BA report (Houslet, 2003) is part of the Eyerly Project record, located at the Sisters Ranger District, Sisters, OR.

PACFISH, INFISH, Northwest Forest Plan (NWFP) guidelines, and USDA FS Best Management Practices (1988), Deschutes National Forest Riparian and Wetlands Standards and Guidelines: Project design criteria within these management plans focus on the alterations of fish habitat and disturbance effects from water quality, fine sediment, and in-stream wood. The design criteria are designed to protect and maintain high channel complexity and stability, and abundance and diversity of side channel habitats. Project activities would include the implementation of all appropriate Best Management Practices (BMP) in conjunction with the DNF Riparian and Wetlands S&Gs in order to control erosion from roads and skid trails, protect water quality during prescribed fire, and protect wetlands. All BMP elements applicable to this project, and explanations of consistency with INFISH and Forest Plan S&Gs, are listed in the Effects Analysis for *Redband and Bull Trout Habitats* (Houslet, 2003), contained within the Eyerly Salvage project record. Project design elements for the Eyerly Salvage Project is listed in *section 2.8.1.2 Project Design Elements for the Protection of Fish Habitat*.

Northwest Forest Plan: Aquatic Conservation Strategy: The Aquatic Conservation Strategy (ACS), as defined by the Northwest Forest Plan was developed to restore and maintain the ecological health of the watershed and the aquatic ecosystems contained within them. A detailed discussion of how the Eyerly Project alternatives address each of the nine ACS questions is located at the end of the environmental consequences in this section.

❖ 3.5.3 Fish Habitat Environmental Consequences

Introduction

Alternative 1, the no action alternative, would result in the dead or dying timber remaining in place, and no project activities would affect in-stream habitat. Implementing Alternative 1 will reduce the impacts that create a harsher environment than the current aquatic system in the project area, but would not manage for the most desirable fire regime, potentially result in less than desirable future fire activity and intensity.

All perennial streams will receive 320 ft riparian reserve under Alternative 2. All intermittent and ephemeral streams will receive 160 ft riparian reserve for all land management areas.

Under alternative 3, the riparian reserve width of Spring and Street Creeks and their main forks is 320 ft on each side. The riparian reserves of the remaining intermittent and ephemeral channels will be 200 ft for all land management areas. Alternative 3 proposes no harvest on slopes between roads and streams.

Fine Sediment < 5.7mm

Effects of Alternative 1 - No Action

No indirect effects of fine sediment to bull trout spawning habitat would occur since no bull trout documented spawning habitat is within the Eyerly Fire perimeter. If a storm event were to occur, impacts of fine sediment may reduce pool volume and carrying capacity to secondary rearing habitat in the 1.6 mile perennial section of Street Creek. No effects of fine sediment intrusions are expected to rearing habitat within Lake Billy Chinook and Metolius River.

Indirect effects of fine sediment to redband trout spawning and rearing habitat may occur but would be limited as a result of allowing natural processes to continue to occur. Redband trout use Street Creek for spawning and rearing habitat. There is a risk of fine sediment intrusion that would have an effect on spawning habitat if fine sediment <5.7 mm diameter becomes excessive if a storm event were to occur in the next 2- 4 years.

Alternative one proposes no upland treatments of removing dead timber with the exception of treating roadside hazards. Disturbance to fish habitat would be a result of allowing natural processes from the Eyerly Fire to continue to occur. Disturbance is very important to the development and maintenance of habitat and for maintenance of community composition that ecosystems tend to depend on (Cairns 1982; Reeves et al. 1995). Fine sediment production is respondent from watershed or channel disturbance such as wildfire (Beaty, 1994; Minshall et. Al, 1997; Benda et al, 2003a; Wondzell and King, 2003) floods (Houslet and Riehle, 1998) and clearcutting (Hall and Lantz, 1969). Aquatic habitat is developed and persists around these varieties of and scales of disturbances (Swanston, 1991). These watershed disturbances recruit and remove a variety of material within the channel acting as resetting and recycling mechanisms. For instance floods have a tendency to transport substrate and sediment, significantly reducing fines from the stream (Houslet and Riehle, 1998; Houslet et al, 1999). However, recruitment of fines to the system is then needed to maintain flood plains and stabilize substrate. Recruitment can then occur through bank erosion and lateral channel migration or trees fall. During low flow years storage in the substrate occurs, and is enhanced by velocity breaks such as woody material. Fires that burn over channels and uplands denude vegetation and increases low impact raveling or more dramatically, mass wasting on steep slopes (Wondzell and King, 2003). In most disturbances sediment and wood occur directly or indirectly in association with each other. Landslides would move both soil and wood simultaneously. After a wildfire soils are subject to rilling and gullyng while indirectly dead trees become recruited through windstorms and root failure. Woody material is important for retaining sediment on uplands, floodplains and in channel.

The fire interval is roughly <30 years for ponderosa pine forests and of a low intensity low disturbance fire regime (Agee, 1994). If the bull trout and redband trout populations have evolved with an environment of frequent low intensity disturbances, high intensity fires may produce conditions outside the variability under which these species have evolved. The intensity and severity of the Eyerly Fire may create harsher conditions such as greater daily water temperature variations and increased sediment loading. Other effects include the burning out of in-channel and riparian down wood allowing more movement of upland sediment through the system until events occur that recruit the standing dead to the forest floor and stream channels. Habitat refugia and the species resistance or resilience becomes very important for maintenance of the population.

The concern of this movement is the deposition of fine sediment on potential redband trout spawning habitat in Street Creek and Spring Creek. Fine sediment monitoring by Dachtler, (2003b) in Street Creek found an overall increase in fine sediment <5.7 mm diameter in riffle habitat between the 1999 sampling and samples from the fall of 2002. No changes occurred from 2002 to summer of 2003. The current surface composition of riffle habitat is about 25% fine sediment <5.7 mm diameter. This concentration is not different from the current spawning and rearing streams in the Upper and Lower Metolius Watersheds that supports a robust redband trout population. Sediment movement and storage will continue to occur in alluvial fans, and floodplains (Benda et al, 2003a). It is well known that annual flooding provides sediment and nutrients for floodplain maintenance. Although large sediment influxes can lower pool density (Benda et al, 2003a) did not observe this phenomenon. Proper functioning streams with wood and floodplains can maintain pools through stream discharge velocities moving fines and wood recruitment allowing pool formation. Benda et al, (2003b) provides a review of fire disturbance on channel morphology. Implementing alternative one allows these processes to continue to occur. Fine sediment inputs may have indirect effects to the redband trout population through reduced survival rates of egg to emergence if fine sediment becomes excessive. These concerns become less annually because most of the typical effects from disturbance occur during the first three years

Effects of Alternatives 2

There will be no direct or indirect effects to bull trout spawning habitat. No documented bull trout spawning habitat occurs in the Street or Spring subwatersheds or the last 2 miles of the Metolius River. Bull trout rearing habitat occurs in Lake Billy Chinook, and the Metolius River. There will be no direct or indirect effects of fine sediment to rearing habitat in these two waterbodies. Less than 1% of the area draining the Metolius River is directly exposed to the activities of the Eyerly Salvage. Street Creek provides secondary rearing habitat for bull trout. Only one bull trout has been reported in this stream since 1999. The effects of fine sediment as a result of implementing alternative two would not reduce overall pool volume and rearing habitat for bull trout in Street Creek.

Essential Chinook Habitat occurs within the 2 miles of the Metolius River inside the project boundary. No direct or indirect effects of fine sediment will occur to essential chinook habitat.

Redband trout are found throughout the project area. Juvenile redband trout are found in Street and Spring Creeks. Although spawning surveys have not been conducted in these two streams spawning by redband trout is suspected by the high presence of different juvenile age classes and the knowledge that fry mobility is low. Modeling by the project hydrologist and soil scientist estimate a 935% increase in sedimentation could occur during a 2-yr storm event in Street Creek. The disturbance of 288 acres within the sediment delivery zone would only contribute an additional 5% to potential sediment increase of 935% from the fire in Street Creek. A potential risk of this input remains high during implementation of this alternative (see *hydrology* and *soils specialist reports* for analysis). Under these conditions, the impacts of a 2-yr 1-hr storm event could have significant impacts to the spawning habitat for redband trout. Hydrology analysis predicted no significant difference in fine sediment strictly as a result of implementing alternative 2 during a 2-yr 1-hr storm event is not expected to reduce overall carrying capacity, or spawning habitat of Street and Spring Creeks above what would occur from conditions of the fire.

No salvage of dead trees or building of roads would occur within the identified riparian habitat. Three miles of temporary roads would be built on ridge tops to access skyline units in the Metolius and Spring sub-watersheds. These roads are not in the identified sediment delivery zone. Concerns of sedimentation from existing road use and maintenance would be mitigated provisions described in *Section 2.8.2 Project Design Elements for the Protection of Fish Habitat*. These are practices identified by the Environmental Protection Agency to meet the Clean Water Act for non-point source pollution (USDA –FS, 1988).

About 1200 acres of harvest would occur from this alternative between the outer 480 ft of the sediment delivery zone and 160 ft from the stream in some areas. In the Street Sub-watershed 288 acres of harvest would occur, disturbing about 47 acres in the sediment delivery zone and would only be in the non-fish bearing intermittent reaches. In most areas and recovering conditions this sediment delivery zone would be less than the estimated 480 ft due to lower gradients, recovering riparian and upland vegetation and wood recruitment to the forest floor. Also, an additional 183 acres of soil compaction is also estimated for the proposed action in Street Creek above the current condition. Priority mitigation measures and subsoiling would occur first inside the sediment delivery zone where about 25% of the detrimental soil conditions in the Street Creek subwatershed would occur. At current levels of 25% fine sediment for pools and riffles in Street Creek, a 12-inch diameter tree perpendicular to flow and within the bank full elevation stores nearly 3 tons of fine sediment <2.0 mm diameter in Street Creek. The greatest risk is during the first year following a fire. These risks have since been reduced two years after the fire. Transport of fines from the intermittent reach to the perennial fish bearing reach down stream would occur over many years as transport and deposition continue to occur under the local hydrological pattern.

Effects of Alternatives 3

There will be no direct or indirect effects to bull trout spawning habitat. No documented spawning habitat occurs in the Street or Spring subwatersheds or the last 2 miles of the Metolius River. Bull trout rearing habitat occurs in Lake Billy Chinook, and the Metolius River. There will be no direct or indirect effects of fine sediment to rearing habitat in these two waterbodies. Less than 1% of the area draining the Metolius River is directly exposed to the activities of the Eyerly Salvage. Street Creek provides secondary rearing habitat for bull trout. Only two bull trout has been reported in this stream since 1999. The 1.3% increase above background levels of fine sediment as a result of implementing alternative three would not reduce overall pool volume and carrying capacity of rearing habitat for bull trout in Street Creek.

Essential Chinook Habitat occurs within the 2 miles of the Metolius River inside the project boundary. No direct or indirect effects of fine sediment will occur to essential chinook habitat. The 1.3% increase in sediment input over current conditions as a result of implementing alternative 3 would not detrimentally affect essential chinook habitat.

Redband trout are found throughout the project area. Juvenile redband trout are found in Street and Spring Creeks. Although spawning surveys have not been conducted in these two streams spawning by redband trout is suspected. The presence of juveniles and life history of redband trout suggest Street Creek to provide spawning and rearing habitat. The 1.3% increase in sediment input over current conditions as a result of implementing

alternative 3 would not reduce overall carrying capacity and would not detrimentally affect the current spawning habitat of Street and Spring Creeks.

Alternative 3 proposes to harvest nearly 11 million board feet over 2,800 acres. The total treatment acres will be less than 10% of the fire burned area and about 2000 acres less than Alternative 2. Differences between Alternative two and three include removing portions of units that lie between roads and stream channels so that any runoff effects are intercepted at the road cut. Increased undisturbed area between roads and streams allow for increased filtering compared to alternative 2. This results in fewer disturbances between roads and the stream channels. Extra protection to intermittent tributaries is also afforded by this alternative. The mainstem tributaries to Spring and Street creeks will be expanded to 320 ft regardless of flow regime and other intermittent tributaries will have a buffer of 200 ft. The increased area not disturbed by the salvaging provides more acreage available for natural processes to occur such as natural recruitment of trees, forbs and shrubs to the upland and riparian habitat to provide increased sediment interception. Also, the amount of recovered vegetation, up to 60% in upland plots will allow rooting strength in the soil reducing the effects of upland runoff should it occur under the current conditions.

No salvage of dead trees or building of roads would occur within the identified riparian habitat. One and a half miles of temporary roads would be built on ridge tops to access skyline units in the Metolius and Spring sub-watersheds compared to three miles under alternative 2. These roads are not in the sediment delivery zone. Concerns of sedimentation from existing road use and maintenance would be off set by best management practices listed in Appendix B. These are practices identified by the Environmental Protection Agency to meet the Clean Water Act for non point source pollution (USDA -FS 1988).

About 430 acres of harvest would occur in the project area from this alternative between the outer 480 ft of the sediment delivery zone and 200 ft from the stream in some areas. In the Street Sub-watershed about 100 acres of harvest would occur, disturbing about 15 acres in the sediment delivery zone and would only be in the non-fish bearing intermittent reaches. An additional 502 acres of soil compaction in the uplands is also estimated for the proposed action. This would be negligible in the overall addition to Street Creek and Spring Creek from its current condition. Implementation of Alternative three would contribute <2% to the overall sediment input to Street Creek (See hydrology report for more information of the sediment delivery).

At current levels of 25% fine sediment for pools and riffles in Street Creek, a 12-inch diameter tree perpendicular to flow and within the bank full elevation stores nearly 3 tons of fine sediment <2.0 mm diameter in Street Creek. These risks have since been reduced two years after the fire. Transport of fines from the intermittent reach to the perennial fish bearing reach down stream would occur over many years as transport and deposition continue to occur. The increased riparian reserve width afforded in this alternative reduces the potential sedimentation by 33% compared to alternative 2.

The increased area of no harvest around intermittent channels compared to alternative 2 would reduce disturbance and increase success of sediment trapping along with post fire erosion control methods. Natural vegetative recovery has also occurred over the past two seasons showing about 50 to 60% ground cover recovering on uplands. The project soil scientist and hydrologist determined that mass wasting or landslides continues to remain a low risk in the Street and Spring sub-watersheds. There is no expected loss of habitat or stream carrying capacity due to intrusions of fine sediment as a result of implementing alternative 3 and less associated risk of sedimentation than alternative two.

Woody Material

Effects of Alternative 1 – No Action

Little indirect effects to bull trout spawning or rearing habitat would occur as a result of implementing alternative one and allowing natural processes to occur. Bull trout habitat is limited within the project area to secondary rearing in the 1.6 miles perennial section of Street Creek and potentially Spring Creek. No effects to wood recruitment would occur that would affect bull trout and redband trout rearing habitat in Lake Billy Chinook and Metolius River. There would be no effects to redband trout spawning and rearing habitat in Street Creek and Spring creek from implementing alternative one on wood recruitment.

Disturbance is very important to the development and maintenance of habitat and for maintenance of community composition that ecosystems tend to depend on (Cairns 1982; Reeves et al. 1995). These disturbances provide the source material for wood recruitment. Wood will continue to be recruited to stream channels and across riparian habitat and uplands over the next decade. Benda et al. (2003b) and Bisson and Bilby (1998) provide a review of wood recruitment processes to channels. Chronic and episodic methods are covered and the importance of each. The majority of trees recruited to channels occur within 120 ft of the stream edge (Benda et al. 2003b). Tree mortality as a result of wildfires especially stand replacement wildfires can provide chronic recruitment over decades as boles weaken and become susceptible to wind (Benda and et al. 2003b). After this initial spike in recruitment wood recruitment will lessen over time until stands adjacent to the channels matures and a new disturbance (e.g., insects, disease, fire) again occurs. These indirect effects of continued recruitment of wood to replace wood lost from the fire will continue to support the fish populations in Street Creek over the next one to two decades. The perennial section of Spring Creek will most likely continue to have low woody material due to the impacts of campground maintenance. Active management of hazard tree placement in-stream would, to a degree, offset this condition.

Table 3.5-5. Fish bearing stream wood counts within the Eyerly Project area.

Stream Name	Year	Reach length	Stream section	>20" & 35' in length	12"-20"&>35' in length	<12"& >20ft in length	Total
Metolius River	2000	12.2	Headwater	61	108	230	399
Street Creek	1999	1.4	Reach 2	9	3	11	23
Street Creek	2002	1.4	Reach 2	18	10	40	68
Street Creek	1999	1.6	Perennial	18	14	40	72
Street Creek	2002	1.6	Perennial	32	22	73	127
Spring Creek	2003	0.25	Perennial	0	0	4	4
Notes:							
Street Creek separated by 1999 and 2002 post fire surveys: demonstrating the influence of wood recruitment to the channel within bank full.							
Reach #2 shows the effects of a windstorm on wood recruitment after a fire.							

Effects of Alternatives 2

There would be no direct or indirect effects to bull trout spawning habitat. No documented bull trout spawning habitat occurs in the Street or Spring sub-watersheds or the last 2 miles of the Metolius River. There would be no direct or indirect effects to bull trout, redband trout rearing habitat or essential chinook habitat in Lake Billy Chinook, and the Metolius River as a result of implementing alternative 2 on wood recruitment.

Alternative 2 would not harvest along the streamside allowing the function of leaves, needles twigs and other organic debris to continue to feed the aquatic system important to macroinvertebrates and fish communities (Golladay et al. 1987). Wood recruitment would remain, as no woody material would be removed within 320 ft of perennial streams and 160 ft of intermittent streams. These exceed the distance estimated by Benda et al, (2003b) where 80% of the recruitment occurred within 90 to 120 feet of the stream. Habitat complexity would be maintained by allowing wood recruitment to occur unhindered to the channel and riparian habitat. Street and Spring Creek sub-watersheds are not prone to mass wasting producing episodic large inputs of wood therefore wood recruitment to the Street and Spring Creek drainages would continue to occur as wildfire killed trees fall over from root failure and windstorms and potentially from lateral channel migration. Recruitment rates will vary depending on future climatic events (e.g., wind storms) but is expected to have 50% of the dead trees on the ground within 10 years. Implementing this alternative would not affect the wood recruitment process into Street and Spring Creeks.

Redband trout use Street Creek for spawning and rearing of juveniles before entering Lake Billy Chinook for maturation. Woody material provides rearing cover as well as pool formation and spawning habitat along these pool tail-outs although the current levels of wood are estimated to be low for wood >12" diameter and >35 ft in length. However, due to the size of this system wood smaller than this would still function as efficiently as the larger material. The Eyerly Fire will produce increased recruitment with dead trees within 100 feet of the stream bank. Since landslides are a low risk in these drainages wood recruitment from uplands will not be a significant factor of in-channel wood production. Dachtler, (2003a) reported a loss of old in-channel wood in Street Creek as a result of the Eyerly Fire, but have also noted recruitment of over 100 pieces within a short time period, exceeding the amount counted in 1999 (Refer to *Table 3.5-4*). Contour felling from BAER implementation and local recruitment over the past two winters are providing wood on uplands, riparian habitat and in the stream channels. Providing a zone of no treatment along the streams within the project area riparian reserve will increase the opportunities of dead fall occurring within this zone and trapping sediment as well as wood that is recruited to the stream channel will also help off set this concern to redband spawning habitat. Wood will also be recruited in intermittent, perennial and riparian habitats as a result of treating roadside hazards in the Eyerly project area. With the implementation of the 2003 Joint Programmatic Biological Assessment (USDA and USDI, 2003) as well as the listed BMP's, there would be no loss of wood recruitment sources affecting fish habitat in Street, Spring or Metolius sub-watersheds during implementation of Alternative 2.

Effects of Alternatives 3

There will be little indirect effects of implementing alternative 3 on wood recruitment for bull trout, redband trout spawning rearing habitat and essential chinook habitat in the lower two miles of Metolius River, Lake Billy Chinook and the perennial section of Street Creek.

Alternative 3 proposes to harvest nearly 11 million board feet over 2,800 acres. The total treatment acres will be less than 10% of the fire burned area. The volume removed will also be about 10% of the total fire killed trees that occurred from the Eyerly Fire. Greater than 70% will be harvested by ground based machinery (2129 acres) and the remaining being skyline (262 acres), cable (80 acres), or helicopter (421 acres) yarding methods. Differences between Alternative 2 and three include removing portions of units that lie between roads and stream channels so that any runoff effects are intercepted at the road. Extra protection to intermittent tributaries is also afforded by this alternative. The mainstem tributaries to Spring and Street creeks will be expanded to 320 ft regardless of flow regime and other intermittent tributaries will have a buffer of 200 ft. The increased area not disturbed by the salvage logging would provide more acreage available for natural processes to occur such as natural recruitment of trees to the upland and stream channel to provide sediment interception, pool formation and other channel processes, and overhead cover for juveniles.

Alternative 3 will not harvest along the streamside allowing the function of leaves, needles twigs and other organic debris to continue to feed the aquatic system important to macroinvertebrates and fish communities (Golladay et al. 1987). Wood recruitment will remain, as no woody material would be removed within 320 ft of perennial streams and 160 ft of intermittent streams. These exceed the distance estimated by Benda et al. (2003b) where 80% of the recruitment occurred within 90 to 120 feet. Habitat complexity would be maintained by allowing wood recruitment to occur unhindered to the channel and riparian habitat. Street and Spring Creek sub-watersheds are not prone to mass wasting producing episodic large inputs of sediment and wood. Wood recruitment to the Street and Spring Creek drainages would continue to occur as wildfire killed trees fall over from root failure and windstorms. The increased width of alternative 3 along intermittent stream channels compared to alternative 2 provides increased acreage of potential deadfall for sediment storage on uplands, riparian habitat and in-channel as well as woody material for potential transport to perennial sections for fish habitat. Recruitment rates will vary depending on future climatic events (e.g., windstorms) but is expected to have 50% of the dead trees on the ground within 10 years.

Redband trout use Street Creek for spawning and rearing of juveniles before entering Lake Billy Chinook for maturation. Woody material provides the impetus for rearing cover as well as pool formation and spawning habitat along these pool tail-outs although the current levels of wood are estimated to be low for wood >12" diameter and >35 ft in length. However, due to the size of this system wood smaller than this would still function as efficiently as the larger material. Effects of the Eyerly Fire will produce increased wood recruitment with dead trees within 100 feet of the stream bank and is occurring (Dachtler 2003b). Over 100 pieces of wood have been recruited in 3.0 miles of Street Creek between 1999 and 2002. Numerous uncountable pieces have also been recruited in Street Creek but are above bankfull (Dachtler, 2003b). Since landslides are a low risk in these drainages wood recruitment from uplands will not be a significant factor of in-channel wood production. Contour felling from BAER implementation and local recruitment over the past two winters are providing wood on uplands in critical areas,

riparian habitat and in the stream channels. Providing a zone of no treatment along the streams within the project area riparian habitat will increase the opportunities of dead fall occurring within this zone and trapping sediment as well as wood that is recruited to the stream channel will also help offset this concern to redband spawning habitat. With the implementation of the 2003 Joint Programmatic Biological Assessment (USDA and USDI, 2003) as well as the listed BMP's, there would be no loss of wood affecting fish habitat during implementation of Alternative 3.

Water Temperature

Effects Common to All Alternatives

Within the perennial section of Spring Creek the Eyerly Fire burned fairly light maintaining much of the canopy. All alternatives would maintain the current riparian conditions of Spring Creek. There would be no effect to water temperatures from implementation of any of the three alternatives on Spring Creek. Sufficiency analysis demonstrates the effectiveness of the riparian reserve widths of the Northwest Forest Plan in regulating water temperatures (USDA and USDI 2004). By meeting these riparian reserve widths there would be no negative effects to water temperature.

All alternatives would not affect the water temperatures of the Metolius River or Lake Billy Chinook. No treatments from any alternative would affect tributary water temperatures that would have a cumulative increase in the Metolius River or Lake Billy Chinook water temperatures.

Water temperatures in Street Creek were found to increase 2.0°C between 1999 and 2003 sampling. Years 2002 and 2003 were low water years. Seven-day average maximum water temperatures increased by at least one degree in many streams in the Upper Metolius Watershed. Within the perennial water reach of Street Creek 21% of the riparian zone received high intensity burn with lesser impact on the south bank of Street Creek (Dachtler 2003a). Summer wetted riffle width is about 7 ft. To produce shade over 50% of the wetted width vegetation would have to be 8 ft tall at the stream bank. Any trees greater than 80 feet in height within 30 ft of the stream on the south bank would be providing shade to the perennial section of Street Creek. Because there are no treatment units near the perennial section of Street Creek, implementation of any of the listed alternatives would not affect the shade potential, negatively affecting fish habitat in along the perennial sections of Street or Spring Creeks.

Along the intermittent reaches of Street and Spring Creeks, burn intensity was greater. Increased peak flows and increased duration of flow is expected for the next few years until vegetative recovery and evapotranspiration increases. This response has the potential of adding increased volume of warmer water to the perennial section of Street and Spring Creeks due to increased exposure to insolation until riparian vegetation recovers. However, the increased water volume within the perennial section will not be subjected to increased heating.

In the intermittent reaches the channel width of Street Creek is about 3 feet. With a solar angle of 64°, streambank vegetation, such as vine maple would have to be 5 ft in height to cover 80% of the wetted stream width in Street Creek.

The angular canopy density is related to vegetative species, bank slope and sun angle. Green, or live, canopy conditions will provide greater canopy closure and therefore a shorter distance to the stream bank than in burned environments. Alternative one provides the greatest bole density of for shade than Alternative two or three. Alternative three provides for greater bole density than alternative two for angular shade density. However, the steep slopes in the Street and Spring sub-watersheds and established riparian reserve boundaries will provide no difference in solar heating of water in the intermittent channels due to the narrow stream widths in these two systems.

Cumulative Effects

The fires and management activities depicted at the beginning of Chapter 3 (*Past, Present, and Reasonably Foreseeable Future Projects*; and *Map 9. Recent Activities within Metolius Watershed*) total more than 143,000 acres although many of these acres have overlapping disturbance. All but the Eyerly Fire occurred in upstream of the proposed activities in the Upper Metolius Watershed.

Restoration, rehabilitation and habitat enhancement projects are also occurring within the Metolius Basin. In stream wood recruitment project occur annually along 12 miles of the Metolius River and would also occur in tributaries as a result of treating roadside hazards within the B& B and Eyerly wildfire perimeters. A large-scale bull trout protection project is occurring over eight miles of bull trout spawning habitat to lessen the impacts of dispersed recreation near bull trout spawning habitat. About five acres of riparian thinning has occurred in the First Creek Drainage to encourage increased growth rates for trees.

These cumulative impacts from salvaging in association with the current condition post Eyerly Fire will remain low. Post fire surveys on Street Creek have found some changes occurred effecting wood in the channel (Dachtler 2003). Some loss of woody material occurred from the fire but an increase of wood was also documented. Since wood recruitment is already occurring in the channel this will help create additional pools during the higher spring peak flows that are expected. Effects to the perennial sections of Spring Creek might be masked due to the location and current impacts from the campground.

Overall, the cumulative effects of the Eyerly Fire Salvage along with other district projects current and foreseeable will not effect the Metolius River bull trout sub-population of the Deschutes Recovery Unit or impact the redband trout population. The portion of harvest within the watershed draining into the Metolius River is approximately 30% of the project area or about the last two miles of the Metolius River before entering Lake Billy Chinook. Bean Creek is an ephemeral channel and drains mostly through the Metolius roadless area. This roadless area will not be harvested with the Eyerly Salvage project, providing increased distance from disturbance activities to the Metolius River. No bull trout spawning occurs in Street or Spring creeks and limited rearing occurs in Street Creek. This project will not jeopardize the overall spawning and rearing habitat for bull trout of the Metolius River sub-population. Street Creek supports spawning and rearing for redband trout. This project will not negatively affect wood recruitment processes important for providing spawning and rearing habitat in the Metolius River, Spring or Street Creeks.

Water temperature in Street Creek is above and has always been above the standards for bull trout. Water temperature has risen above the summer rearing standard in Street Creek but is under the stressful or lethal thresholds of 24°C for redband trout. The effects of the

actions from any of the three alternatives will not alter the current temperature regime currently in the Street and Spring Creeks. There would be no cumulative effects of implementing any of the three alternatives with other current and foreseeable district projects on the water temperatures of waterbodies in the project area.

❖ **3.5.4 Aquatic Conservation Strategy**

The Aquatic Conservation Strategy (ACS) as defined by the Northwest Forest Plan was developed to restore and maintain the ecological health of the watershed and the aquatic ecosystems contained within them. On March 23, 2004, the Oregon and California State Offices of the Bureau of Land Management and the Pacific Southwest and Pacific Northwest Regional Offices of the Forest Service amended the 1994 Northwest Forest Plan (NWFP) to clarify provisions related to the ACS objectives. The decision clarifies that the nine ACS objectives would be attained at the watershed scale (20,000 to 100,000 acres) and not at the project or site level. Most 6th field subwatersheds on the Deschutes NF are less than 20,000 acres in size; therefore, the Lower Metolius 5th field watershed was used to evaluate the proposed projects compliance with the ACS objectives as specified in the Northwest Forest Plan (pages C31-C38).

1) How will this project contribute to the distribution, diversity, and complexity of watershed and landscape scale features?

Implementing either of the Action Alternatives would maintain or improve the distribution, diversity or complexity of landscape scale features that would affect aquatic systems to which species populations and communities are uniquely adapted. The Action Alternatives would jump-start the process of contributing to the distribution, diversity and complexity of watershed scale stand and fuel loading features. Under the current condition large acres of stand replacement fire occurred. Proposed salvage would occur primarily within Stand Replacement mortality areas, removing dead trees, thus treating fuel loads, on approximately 3% of the nearly 146,000 acre, 5th field, Lower Metolius Watershed. Treatment areas are spread across the landscape and would help create a mosaic of stand and fuel conditions in the post-fire environment. Post salvage tree planting would also occur within activity units, contributing to an increase in the diversity, distribution and complexity of stand conditions and age classes when compared to those provided under natural recovery rates. Conifer seed sources on site are suspect following the fire and it would take much longer to establish conifer cover on areas that were not planted.

Riparian reserve (RR) widths meet or exceed NWFP standards and guidelines, and no activities, besides hauling on existing roads and approximately 2 miles of road decommissioning, are proposed within the RRs. In addition, the proposed project would not affect large wood recruitment and associated channel complexity. Therefore, the project would maintain or improve existing riparian distribution, diversity, and complexity and would not affect the aquatic or riparian dependent species in the Lower Metolius Watershed.

2) How will this project maintain spatial and temporal connectivity within and between watersheds.

Drainage Network Connections

The action alternatives would maintain the spatial and temporal drainage network connectivity within the Lower Metolius Watershed and between the Upper and Lower Metolius Watersheds because no activities, besides road decommissioning, would occur within RRs. Approximately 2 miles of riparian road decommission is proposed and would improve drainage network and lateral connectivity. In addition, the project would not create conditions that would chemically obstruct routes to areas critical for fulfilling life history requirements of aquatic and riparian dependent species because proposed activities would have a negligible effect on sediment, nutrients, and water temperature in the 4 miles of perennial fish bearing streams occur within or downstream of the project area, and even less effect on refugia habitat in Lake Billy Chinook (LBC) reservoir. Beaver, mink, otter within the Lower Metolius Watershed are only found in the Metolius River and Lake Billy Chinook. Dispersal would most likely occur through these drainage network corridors rather than laterally over subwatersheds to other intermittent channels. The Metolius River provides a connectivity corridor between the Upper and Lower Metolius River Watersheds, and Lake Billy Chinook provides connectivity to Squaw Watershed.

Longitudinal and Lateral Connections

The action alternatives would maintain the spatial and temporal longitudinal and lateral connectivity within the Lower Metolius Watershed and between the Upper and Lower Metolius Watersheds because no activities, such as road construction, which would create obstructions are proposed. For some species migration laterally and longitudinally may be easier in stand replacing burn areas after the proposed project because dead trees in excess of snag and down wood requirements, which would later cover the ground, would be removed. In addition, the harvest of dead trees could improve the future longitudinal, lateral, and drainage network connectivity if it prevents another large-scale fire.

3) How will this project maintain and restore the physical integrity of the aquatic system?

The project would maintain the physical integrity of the aquatic system, including shorelines banks and bottom configurations, by not altering streamflow, sedimentation, channel stability, and wood recruitment in the Lower Metolius River and Lake Billy Chinook. Only the lower 1.6 miles of the Metolius River, it's tributaries (i.e. Metolius 6th field subwatershed), and tributaries of LBC reservoir could be affected by the proposed project. Salvage acres would be less than 1 % of the area that drains into the Metolius River for Alternative 2, and even less for Alternative 3. Streamflow contribution to the Lower Metolius River from the Eyerly Salvage area is from intermittent tributaries and is less than 2%. No activities are proposed within a mile of the mainstem Metolius River; therefore, all flow and sediment input, resulting from disturbance activities, would be

delivered to the Metolius River via flow from the tributaries in the Metolius 6th field subwatershed (i.e. Bean Creek and other unnamed tributaries to the south).

Because salvage of dead trees has a negligible effect on streamflow in the subwatersheds (6th field), it has an even less effect on the flow of the lower Metolius River (5th field) and the water level of LBC reservoir. At most an additional 4% of sediment from salvage activities in the sediment delivery zone could reach tributaries to the Metolius River and LBC reservoir in the Eyerly Salvage area given a large rainstorm event; however, only 2% of the sediment could reach the streams in the Metolius subwatershed (i.e. Bean Creek and other unnamed tributaries). Most of the sediment from salvage activities would be stored behind obstructions or deposited in slow velocities areas in the upstream intermittent tributaries adjacent to the sediment delivery zone. Instream wood recruitment and channel stability would be unaffected because no activities would occur within RRs or within a mile of the lower Metolius River or LBC reservoir. Instream wood is integral for developing and maintaining the physical structure of the aquatic system by contributing to the development of pools and slow water depositional areas that retain sediment. All RR widths in the Action Alternatives meet or exceed the NWFP standards and guidelines.

4) How will this project maintain and restore water quality necessary to support healthy riparian, aquatic, and wetland ecosystems?

All Alternatives

The primary concerns to water quality include increases in sedimentation, water temperature, and nutrients into the Metolius River and Lake Billy Chinook (LBC) reservoir. LBC reservoir is listed on the Oregon 2002 303(d) list for water quality exceedences above the State and Tribal standard for chlorophyll *a* and pH. However, pH in the reservoir is now considered in compliance with State and Tribal standards because the pH “exceedance would not occur without the impoundment and all practicable measures have been taken to bring the pH in the impounded waters into compliance with the criteria” (ODEQ 2002A; CTWSR, PGE 2002). The USFS and BLM are writing a Water Quality Restoration Plan to address management actions influencing the pH and chlorophyll *a* in Lake Billy Chinook. The Oregon Department of Environmental Quality will establish a Water Quality Management Plan and Total Maximum Daily Load for these parameters by 2006.

The Action Alternatives would have a negligible effect on sedimentation, water temperature, and nutrients in the Lower Metolius watershed (5th field); therefore, maintaining water quality necessary to support healthy riparian, aquatic, and wetland ecosystems. Proposed salvage activities are likely to reduce the extent and intensity of future large-scale wildfires, which have an inherent risk to water quality, within the 6th field subwatersheds. The effect of the Action Alternatives on sedimentation in the Metolius River and LBC reservoir is negligible (see discussion in ACS #5), as a result of limited activity in the sediment delivery zone, BMPs, project design criteria, conifer planting, and road decommissioning. The proposed Eyerly Salvage would not affect stream temperatures because no activities would occur within RRs, thereby not affecting stream shade. All RR widths in the Action Alternatives meet or exceed the NWFP standards and guidelines.

The only potential effect the project would have on transport of retardant or nutrients is through the addition of sediments to the streams. The concern with retardant is transport

of ferrocyanide into subwatershed streams and the potential transformation into cyanide (toxic). While this maybe a concern in the 6th field subwatersheds (refer to Existing Conditions/Water Chemistry/ Nutrients/Wildfire section), cyanide transported to the subwatershed streams would be diluted once it reached the Metolius River and the reservoir.

In the project area the primary concern with any nutrient increase in the streams, is a potential for increasing the pH and chlorophyll *a* in LBC reservoir. Because nutrient increases would only occur through surface erosion and sedimentation, salvage activities would only have a negligible effect on nutrients and associated parameters (i.e., chlorophyll *a* and pH). Salvage acres would be less than 3 % of the Lower Metolius Watershed. The streamflow contribution to LBC reservoir would be less than 4% per year and would not increase the already high chlorophyll *a* concentrations and pH. In addition, most nutrient effects would have already occurred prior to salvage activities because nutrient spikes usually occur within the first one to two years following a fire.

5) How will this project maintain and restore the sediment regime under which aquatic ecosystems evolved? Elements of the sediment regime include the timing, volume, rate, and character of sediment input, storage and transport.

Sediment Input

Salvage acres would be less than 1 % of the area that drains into the Metolius River for Alternative 2, and even less for Alternative 3. Within the Eyerly Salvage area, only the Metolius subwatershed (6th field HUC) contributes sediment to the lower 1.6 miles of the Metolius River (6% of the length of the mainstem Metolius River). Streamflow contribution to the Lower Metolius River from the Eyerly Salvage area is less than 2%. No activities are proposed within a mile of the mainstem Metolius River; therefore, all sediment input, resulting from disturbance activities, would be delivered to the Metolius River via flow from the tributaries.

Although a negligible amount of logging-related sediment (additional 2%) may be delivered to the mainstem Metolius River in the short-term (3 to 4 years), only a small portion of the Metolius River (1.6 miles out of 27 miles) would be affected. This additional *sediment input volume* would not be enough to alter the sediment input regime of the lower Metolius River and Lake Billy Chinook. Likewise, *the rate of sediment input* (sediment input volume / time) would be maintained because salvage effects to sediment input volume would be negligible. In addition, other proposed activities and indirect effects such as road decommissioning and fuels reduction would help decrease sediment input volume in the long-term. The proposed salvage activities would likely reduce the extent and intensity of future large-scale wildfires, which have an inherent risk to water quality, within the 6th field subwatersheds.

In Alternative 2, 1144 acres are proposed for harvest in the Metolius 6th field subwatershed, and 856 acres are proposed in Alternative 3. Some future down wood, which would help trap sediment created from salvage activities, would be removed. Likewise, salvage activities would reduce newly established ground vegetation on approximately 47 acres, a portion of which is hydrologically connected to streams, under Alternative 2, and 23 acres under Alternative 3. However, activity slash would help trap sediment created by salvage activities.

As a result of salvage activities in the sediment delivery zone salvage, an additional 2% of sediment could be delivered to streams in the Metolius 6th field subwatershed during a large rainstorm event for Alternative 2, and 1% for Alternative 3. Much of the additional sediment predicted to be delivered to these tributaries would be stored behind obstructions or deposited in slow velocities areas in the upstream intermittent reaches adjacent to the sediment delivery zone. Instream wood in these areas and other burn areas is predicted to increase over the next 10 years as standing dead trees in RRs fall into the channel. No harvest activities are proposed in the RRs; therefore, instream wood, which helps trap sediment and create new pools, would not be altered by the action alternatives. All RR widths in the Action Alternatives meet or exceed the NWFP standards and guidelines.

Timing of sediment input to 6th field subwatersheds would not be altered because the volume of sediment delivered to the Lower Metolius River would be negligible.

Soil compaction in the sediment delivery zone could increase the volume and speed of overland flow. Salvage activities would disturb 47 acres of soil in the Metolius 6th field subwatershed and only a portion of that would be in the sediment delivery zone. No other effects to timing of sediment input would occur because the storm/melt events that transport sediment to the streams would not be affected.

Sediment Storage

The timing, volume, and rate of sediment storage would be maintained by the Action Alternatives because no harvest activities are proposed within RRs. Instream sediment storage potential from large wood recruitment would not be affected. The amount of down wood is predicted to rapidly increase over pre-fire conditions in the next 10 years. Only 21% of the burn area is proposed for harvest and a specified amount of down wood and snags (in accordance with the LSRA and Northwest Forest Plan) within this area would be left. In addition, contour felled logs would not be removed by the proposed activities. More than 80% of the post-fire down wood would be unaffected and would meet LSRA and NWFP standards for down wood in all units. The amount of logs proposed for removal is likely to have a negligible effect on sediment storage. In addition, no structures or activities would occur in channel or on the banks that would reduce storage capacity of the channel such as channelizing or removing wood from the system of the Lower Metolius Watershed.

Sediment Transport

Sediment transport timing, volume and rate depends on streamflow competency. Within the Eyerly Salvage area, only the Metolius subwatershed (6th field HUC) contributes flow to the Metolius River, and the streamflow input affects only the lower 1.6 miles of the mainstem Metolius River (6% of the length of the mainstem Metolius River). Streamflow contribution to the Metolius River from the Eyerly Salvage area is minimal, less than 2%. The action alternatives would have a negligible effect on streamflow because no live trees would be removed. In addition, soil compaction, represented by detrimental soil condition, would only increase by 47 acres in Metolius subwatershed (6th field) in Alternative 2 and 23 acres in Alternative 3, with only a portion of these acres occurring in areas that are hydrologically connected. Overall, salvage acres are less than 1 % of the area that contributes flow directly to the Metolius River. Salvage activities would have a negligible effect on streamflow in the Metolius River; therefore, the timing, volume, and rate of sediment transport in the Metolius River (5th field).

6) How will the project maintain and restore in-stream flows sufficient to create and sustain riparian, aquatic, and wetland habitats and to retain patterns of sediment, nutrient, and wood routing. How will this project protect the timing, magnitude, duration, and spatial distribution of peak, high, and low flows?

Salvage acres would be less than 1 % of the area that drains into the Metolius River for Alternative 2, and even less for Alternative 3. Within the Eyerly Salvage area, only the Metolius subwatershed (6th field HUC) contributes streamflow to the Metolius River, and the flow input affects only the lower 1.6 miles of the mainstem Metolius River (6% of the length of the mainstem Metolius River). Streamflow contribution to the Lower Metolius River from the Eyerly Salvage area is minimal, less than 2%. No activities are proposed within a mile of the mainstem Metolius River; therefore, all flow input, resulting from disturbance activities, would be delivered to the Metolius River via flow from the tributaries (Bean Creek and other unnamed creeks).

The action alternatives would have a negligible effect on streamflow because no live trees would be removed. In addition, soil compaction, represented by detrimental soil condition, would only increase by 47 acres in Metolius subwatershed (6th field) with only a portion of that occurring in areas that are hydrologically connected. Because salvage of dead trees and associated activities have a negligible effect on streamflow in the Metolius 6th field subwatershed, it has an even less effect on the flow in the Metolius River (5th field). In addition, other proposed activities and indirect effects such as road decommissioning, conifer planting, and fuels reduction would help decrease peak flows in the long-term.

Changes to the timing, magnitude, duration, and spatial distribution of peak, high, and low flows are predicted to be very slight as a result of estimated increases in compaction levels in the subwatersheds. Any increases in overland flows associated with compaction would be offset to some degree by an increase in ground cover from activity fuels, conifer seedlings planted following harvest and fuels treatments, and the subsoiling of the primary skid trails and landings within the proposed activity units. The recovery of vegetation capable of providing precipitation interception would not be impeded significantly in the short-term when compared to the No Action alternative, while the planting of conifer seedlings would give a head start on the return of evapotranspiration processes in these areas.

Base flows and peak flows would be no different than the “No Action” Alternative as a result of the fire-induced loss of vegetation capable of evapotranspiration. Therefore, instream flows capable of creating and sustaining riparian, aquatic, and wetland habitats would be maintained by the Action Alternatives. The action alternatives are expected to maintain post-fire patterns of sediment, nutrient, and wood routing to the aquatic system as described under ACS objective #5 and under the Sedimentation and Nutrient Effects sections of the FEIS. Changes in sediment and nutrients amounts delivered to the streams are likely to be very low due to the implementation of BMP’s, including no treatment in RRs. All RR widths in the Action Alternatives meet or exceed the NWFP standards and guidelines. Wood recruitment into stream channels would not be altered because no material would be harvested in RRs, nor within one mile of the mainstem Metolius River.

7) How will this project maintain and restore the timing, variability, and duration of floodplain inundation and water table elevation in meadows and wetlands.

Floodplain inundation and water table elevations are affected by evapotranspiration and streamflows. The Action Alternatives would have a negligible effect on evapotranspiration because no live trees would be removed. Salvage acres would be less than 1% of the area that drains into the Metolius River for Alternative 2, and even less for Alternative 3. Within the Eyerly Salvage area, only the Metolius subwatershed (6th field HUC) contributes streamflow to the Metolius River, and the flow input affects only the lower 1.6 miles of the mainstem Metolius River (6% of the length of the mainstem Metolius River). Streamflow contribution to the Lower Metolius River from the Eyerly Salvage area is minimal, less than 2%. No activities are proposed within a mile of the mainstem Metolius River; therefore, all flow input, resulting from disturbance activities, would be delivered to the Metolius River via flow from the tributaries (Bean Creek and other unnamed creeks). In addition, LBC reservoir levels are controlled by the dam.

In addition, soil compaction, represented by detrimental soil condition, would only increase by 47 acres in Metolius subwatershed (6th field) with only a portion of that occurring in areas that are hydrologically connected. As a result, salvage of dead trees and associated activities would have a negligible effect on streamflow in the Metolius 6th field subwatershed, and an even less effect on the flow in the Metolius River and water level in LBC reservoir. In addition, no activities besides road decommissioning, which would help restore water table elevations, would occur within RRs. All RR widths in the Action Alternatives meet or exceed the NWFP standards and guidelines. Therefore, implementing Alternative 2 or 3 would maintain the timing, variability, and duration of floodplain inundation and the water table elevations of meadows and wetlands currently existing in the Lower Metolius Watershed (5th field).

8) How will this project maintain the species compositions and structural diversity of plant communities in riparian areas and wetlands to provide adequate summer and winter thermal regulation, nutrient filtering, appropriate rates of surface erosion, bank erosion, and channel migration and to supply amounts and distributions of coarse woody debris sufficient to sustain physical complexity and stability?

All RR corridor widths in the Action Alternatives meet or exceed the NWFP standards and guidelines. No activities would occur within the Riparian Reserves therefore, the Action Alternatives would not have a direct effect on species composition and structural diversity of plant communities in riparian areas or wetlands. By not harvesting the RR corridors, summer and winter thermal regulation, nutrient filtering, surface erosion and coarse woody debris recruitment would be maintained by the project. In fact, species composition in riparian areas would be slightly improved in the long-term by decommissioning approximately 2 miles of riparian road. The Action Alternatives would maintain the same rate of bank erosion and channel migration in the streams of the Lower Metolius watershed as the No Action Alternative because salvage activities would have a negligible effect on streamflows.

9) How will this project maintain and restore habitat to support well-distributed populations of native plant, invertebrate, and vertebrate riparian-dependent species?

All RR widths in the Action Alternatives meet or exceed the NWFP standards and guidelines. Action Alternatives would maintain post-fire native plant, invertebrate and vertebrate riparian habitats because no harvest activities would occur within RRs. Habitats would be allowed to restore under natural, vegetative succession and would be enhanced slightly by diversity conifer and shrub planting that occurred in areas after the Eyerly Fire. Hazard tree felling within riparian reserves would occur in a few areas but these trees would be left on the ground for riparian and inchannel habitat. Neither of the Action Alternatives, would alter instream wood recruitment, an important component for invertebrate and vertebrate species. Also, the Action Alternatives would not significantly alter the substrate, that could affect invertebrate diversity or composition of the Metolius River or Lake Billy Chinook, because salvage activities would have a negligible effect on streamflow. In addition, precautions would be taken to avoid spreading noxious weeds.

❖ 3.6 Wildlife Habitat (Issue 4)



❖ 3.6.1 Introduction

Issue: Wildlife resources affected by Eyerly project proposed activities include Northern bald eagle essential habitat, Northern spotted owl habitat, and landscape relationships among wildlife habitat, snags, and down wood. The Northern Bald Eagle and Northern Spotted Owl are listed as a USFWS threatened species; standards and guidelines provide direction for suitable nesting and foraging habitat within the project area. Landscape relationships were an issue in many public comments received.

This section describes both the existing condition and the environmental consequences to wildlife and wildlife habitat. The existing condition starts with a brief summary of some relevant management direction. This is followed by a detailed description of the affected environment of wildlife habitat and wildlife species. The environmental consequences section follows the existing condition. The following outline is the format in which both the existing condition and environmental consequences sections are presented:

- 1) Management Direction (Existing Condition Section Only)
- 2) Landscape Relationships – This section discusses important wildlife habitat components such as snags, down woody material, and connectivity and late and old structural conditions.
- 3) Federally Threatened and Endangered Species; and Region 6 Sensitive Species (TES)
- 4) Management Indicator Species (MIS)
- 5) Survey and Manage Species (S&M)
- 6) Neotropical Birds (NTMBs)
- 7) Other Wildlife Information (Existing Condition Only)

The information presented here is derived primarily from two documents: the Biological Evaluation (BE) of Threatened, Endangered, and Sensitive Wildlife (K. Hennings, 2003); and The Eyerly Fire Salvage Project Wildlife Report for Non-TES Species (K. Hennings, 2003).

The BE describes and displays the existing conditions and effects to threatened, endangered and sensitive fauna species associated with the Eyerly Fire Salvage Project. The Wildlife Report discusses landscape relationships, snags/down woody material (DWM), habitat/green tree replacements (GTRs), connectivity, Management Indicator Species, Species of Concern (SOC), Survey and Manage species, and neotropical migratory birds.

Essential findings of wildlife habitat analysis are contained within this section. A “determination of effects” summary table, which lists species and federal classification, is located in *Appendix F* of this document. The BE and Wildlife Report documents are part of the Eyerly Fire Salvage project record, located at the Sisters Ranger District, Sisters, OR.

❖ 3.6.2 Existing Condition

Management Direction

The Deschutes National Forest Land and Resource Management Plan (LRMP), referred to as the Forest Plan, presents standards and guidelines for the maintenance of wildlife habitat. Short-term impacts are addressed looking out 15-30 years while long-term impacts are addressed projecting out >30 years.

The Northwest Forest Plan Record of Decision amends the Forest Plan standards and guidelines within the range of the Northern Spotted Owl on lands administered by the USDA Forest Service, which includes lands analyzed for the Eyerly Fire Salvage project.

- Northwest Forest Plan Standards and Guidelines provide specific management direction regarding how Designated Areas, Matrix lands, and Key Watersheds are to be managed. Standards and guidelines specific to particular land allocation categories, or relative to specific types of management activities, are listed in Section C of the Northwest Forest Plan Standards and Guides.

A Deschutes Forest Biological Assessment was completed for 2003- 2006 projects. The BA established project design criteria to streamline consultation with U.S. Fish and Wildlife Service (USFWS) for 2003 and future projects. Project Design Criteria (PDC) are used as sideboards and filter in the action agency's planning process and the biological assessment and streamlining consultation with the USFWS. Criteria focus on habitat alteration and disturbance effects. Projects will follow the process below:

- 👉 The alternative meets and is consistent with all applicable PDC's, no further consultation is needed.
- 👋 The alternative does not meet all applicable PDC's. An effects determination is made in a biological evaluation and is forwarded to the line officer for review. It is then forwarded to the level 1 team for review and comment.
- 👉 The alternative is modified to meet applicable PDC's. No further consultation is needed.
- 👉 The alternative is not modified to meet applicable PDC's. A site specific biological assessment is prepared and submitted for formal consultation with the USFWS.

The Deschutes National Forest is following guidelines from the "Conservation Strategy for Landbirds of the East-Slope of the Cascade Mountains in Oregon and Washington" (Altman 2000) document which outlines conservation measures, goals and objectives for specific habitat types found on the east-slope of the Cascades and the focal species associated with each habitat type. The species identified for burnt ponderosa pine forests is the Lewis' Woodpecker.

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

species in Alaska, and Endangered Species Act candidate, proposed endangered or threatened, and recently delisted species.

The Deschutes National Forest is following guidelines from the “Conservation Strategy for Landbirds of the East-Slope of the Cascade Mountains in Oregon and Washington” (Altman 2000) document which outlines conservation measures, goals and objectives for specific habitat types found on the east-slope of the Cascades (including Central Oregon) and the focal species associated with each habitat type. Responding to these guidelines, the Lewis’ Woodpecker has been identified as the focal species within the Eyerly project area.

Landscape Relationships

Overview: This section discusses some of the landscape-level wildlife habitat components. It is included first because it describes many of the habitat elements that are important to the individual species that are analyzed in this EIS. The section covers three important habitat components: Snags; Down Woody Material; and Connectivity and Late and Old Structure.

Snags: Snags are an important structural component in forest communities. Studies have shown that snags are used by nearly 100 species of wildlife in western Oregon and approximately 60 species in eastern Oregon, many of which are cavity nesters. The dependency of these species on dead trees ranges from absolute to incidental.

Many aspects of snags (and down woody material) have been noted in recent studies to be of more importance for associated species. Hollow trees (and logs) are important structural components across the landscape and should be retained wherever possible. This habitat component is used by many species for night roosts, denning, resting, nesting, cover, and foraging habitat.

Snag species preferred on the landscape are those generally used by cavity excavators. Ponderosa pine, western larch, and aspen are preferred in most areas. Douglas-fir snags may also be important especially where larch and aspen are limited. Larger diameter snags are also preferred (>20”dbh). These tend to stand the longest, can accommodate cavities of any woodpecker species, and provide the most stable microclimate because of wood thickness. Taller snags can also provide a wider range of nesting and roosting structure across the landscape. Some woodpecker species may stratify snag use where snags are limited.

Decay class is important as well. Recent snags that have little decay and still have their bark and limbs are used primarily for foraging. Secondary cavity excavators and primary cavity excavators that prefer softer wood use snags that have more decay.

Snag distribution also seems to be important. Most woodpecker species have been found to prefer clusters of snags over evenly spaced trees (Saab and Dudley, 1997). Bate, (1995) recommends to manage snags on every 5 to 25 acres due to territoriality. This also tends to evenly distribute snags across the landscape and provides for the maximum level of cavity excavators. Snags found on a variety of aspects and slope positions provide habitat for species with different habitat preferences. Snags adjacent to green trees provide cover. Snags in the open will likely be utilized by species such as bluebirds and flickers.

In order to evaluate the effects of the Eyerly fire of 2002 on snag numbers, and the effects of proposed salvage alternatives on these numbers, a method of modeling was developed that used a District-wide photo-interpretation database, stand exams where available, burn intensity from a post-fire satellite change detection, and snag numbers from District-wide inventory plot data.

Snag numbers were calculated on a stand basis and presented on a per acre average for the project area. This includes areas outside of the fire perimeter. Private land and non-forest types such as meadows, rock, and scablands were not considered in these averages. See Appendix C of the Eyerly Silviculture Report (project files) for a summarization and methods used in this analysis.

The Decayed Wood Advisor (DecAID) was considered in the evaluation of the levels of snags found within the Eyerly Project Area.

What is DecAID?

The DecAID Advisor is an Internet-based summary, synthesis, and integration of published scientific literature, research data, wildlife databases, forest inventory databases, and expert judgment and experience. The information presented on wildlife species use of snags and down wood is based entirely on scientific field research and does not rely on modeling wildlife populations. As such, it offers a new way of estimating or evaluating levels of dead wood habitat that provide for a wide array of species and ecological processes.

DecAID also helps land managers evaluate effects of forest conditions and existing or proposed management activities on organisms that use snags, down wood, and other wood decay elements.

DecAID makes it is possible to relate the abundance of dead wood habitat, both snags and logs, to the frequency of occurrence of various wildlife species that require dead wood habitat for some part of their life cycle.

DecAID includes information on primary cavity excavators as well as a host of other organisms that use dead wood habitat.

DecAID uses tolerance intervals to estimate the percent of all individuals in a population that use habitats that contain snags or down wood within a specified range of values.

DecAID is applied within the project area by matching Plant Association Groups (PAGS) found within the project area to comparable habitat types in DecAID. Existing conditions within the project area can then be correlated with the research information found in the tool. Two habitat types identified in DecAID are used to represent conditions occurring within the project area. The ponderosa pine/Douglas-fir small/medium habitat tree type is best represented by the PPD (ponderosa pine dry) and PPW (ponderosa pine wet) PAGS found within Eyerly. The Eastside Mixed Conifer/Blue Mountains small/medium tree habitat type is most representative of the MCW (mixed conifer wet) and MCD (mixed conifer dry) PAGS found within Eyerly.

DecAID provides a summary, synthesis, and integration of published scientific literature, research data, wildlife databases, forest inventory databases, and expert judgment and experience. This data provides a tool to supplement existing guidance (including the Metolius LSR requirement) for retention of snags. *Table 3.6-1* shows the results of that

summary, synthesis, and integration of information for the habitat types found within Eyerly. A short discussion of attaining and considering tolerance levels follow.

Table 3.6-1. Values associated with tolerance levels by habitat type

Tolerance Level	30 %		50 %		80 %	
DBH	≥ 9	≥21	≥ 9	≥21	≥ 9	≥21
Ponderosa Pine PAGS (Snags/Acre)	1.3	1.1	2.7	1.1	7.2	2.5
Mixed Conifer PAGS (Snags/Acre)	6.7	2.7	12.6	4.3	25.3	8.6

The tolerance level figures presented are collected from a range of sources within a given habitat type (e.g, CVS Plots, species requirements for Lewis' Woodpecker, Black-backed Woodpecker, Northern Flicker, etc.). Simply put they show the variety of snags per acre found within a habitat type when viewed at the landscape scale.

The tolerance level is a statistical term that helps describe the number of snags found on a portion of the habitat type. For example, it can be demonstrated that within the Ponderosa Pine habitat type 30% of the landbase has less than 1.3 snags greater than 9" (of which 1.1 snags/acre are greater than 21"). And conversely, 70% of the landbase would be expected to have snags that exceed these numbers.

Another way of looking at this is that 30% of the landbase within the mixed conifer habitat types has between 0 and 6.7 snags/acre (greater than 9" with 2.7 of these being greater than 21"); 20% of the landbase (50% tolerance less 30% tolerance) has between 6.7 and 12.6 snags per acre; 30% of the landbase (80% tolerance less 50% tolerance) has between 12.6 and 25.3 snags per acre; and 20% has greater than 25.3 snags per acre.

Two key points that need to be made in relation to the use of this information: First, these figures describes proportionate snag levels found within a habitat type on the sampled landscape and does not describe the existing condition within the Eyerly project. Second, within the Eyerly project area both of the PAGs displayed in the above table are represented by fire regimes that have high fire frequency and are comprised of the more dry plant series. Current densities within Eyerly are a result of the recent fire and are not at levels that are sustainable. That is to say the large snag densities per acre displayed at the 50 and 80% tolerance level would be unlikely to persist due to the frequent fire regime.

Table 3.6-2 provides a summary of the amount of acres that fall within the parameters from Table

3.6-1. It provides a breakdown of the Eyerly project area in terms of the distribution of snags based on tolerance levels from DecAID.

Snag data contained different size class categories than DecAID. Therefore, snags less than 21" diameter at breast height (dbh) were compared against numbers greater than 10" dbh in DecAID (with a subset of those snags measuring less than 9") ; and snags greater than or equal to 21" dbh were compared against numbers greater than 20" dbh in DecAID.

Table 3.6-2. Existing distribution of snags on the project area (within NF lands)

No Action/Alternative 1								
Tolerance Level	0-29 %		30-49 %		50-79 %		≥ 80 %	
DBH	≥ 9	≥21	≥ 9	≥21	≥ 9	≥21	≥ 9	≥21
Ponderosa Pine (Acres)	1,745	4,628	779	0	630	6,480	12,212	4,258
Mixed Conifer (Acres)	2,161	8,239	3,788	506	1,877	741	2,249	589

Down Wood: Dead and down woody material is also an important habitat component. This material serves as sites for feeding, reproducing, cover, and resting for many wildlife species. Over 150 species have been documented to utilize dead and down material as either a primary or secondary component of their habitat requirements in both western and eastern Oregon.

Logs provide organic and inorganic nutrients in soil development, contribute to water economy, provide microhabitats for invertebrates, plants amphibians, and other small vertebrates, and provide structure for riparian associated species in streams and ponds. It has been shown that size, distribution, and orientation may be more important than tonnage or volume. Small logs provide escape cover or shelter for small species. It is still unknown what levels of down woody material are needed to provide quality habitat for associated species. Too much may impede travel by big game and present a fire hazard. However, increased levels also provide cover for small invertebrates and may protect seedlings from browse and scorching. So leaving adequate levels across the landscape is important. Orientation has also been shown to be important. Logs that lie along a contour are used more than those lying across contours. Larger sized logs are also used more and by more species than smaller logs. (Bull, Parks, and Torgersen 1997).

The Eyerly fire itself consumed most of the down wood that existed during the pre-fire era. Within the fire perimeter a large portion of the existing down woody material (dwm) are trees that have fallen since the Eyerly fire. Therefore, a large majority of the dwm has fallen recently and is currently in the early stages of decay.

Down log averages per acre are characteristically higher within the mixed conifer wet and riparian PAGs and generally the lowest within the ponderosa pine PAGs. Down wood abundance on the Deschutes National Forest is highly variable due to many factors. The Deschutes National Forest lies on the eastside of the Cascades where there is a limited availability of water and nutrients as compared to the west side of the Cascades. This, combined with overcrowded stand conditions due to fire suppression, has led to tree mortality above historic levels especially within smaller size classes. In particular, plant associations groups that tend to be drier (i.e. ponderosa pine and mixed conifer dry) may recruit a higher level of down wood today than did historically.

Connectivity and Old and Late Structure: Wildlife species associated with late and old seral conditions depend on the connectivity of these habitats to allow free movement and interaction of adults and dispersal of young. Connectivity is one of the key habitat components needed to insure species viability. Direction pertaining to connectivity can be found in the Project Design Criteria in the Programmatic Biological Assessment. Connectivity is also addressed in the Metolius LSRA (USDA 1990) especially for the spotted owl. Goals for Strategy Area H in the LSRA address the need to provide dispersal habitat for spotted owls moving north and south and between the Cascades and Green

Ridge and to manage for late-successional fire climax habitat. Goals for Strategy Area L in the LSRA address the need to maintain habitat for 1 pair of spotted owls, manage for a mosaic of climatic climax and fire climax late-successional habitat, and to maintain late-successional habitat adjacent to the Metolius River and north slopes.

Connectivity is addressed in the Programmatic Biological Assessment (USDA 2003) as an important constituent element of habitat for the spotted owl where habitats are protected from disturbances or are representative of the historical, geographical, and ecological distributions of the species it is designed for. Functional connectivity, according to Noss and Cooperrider (1994) is measured according to the potential for movement and population interchange of the target species. For spotted owls, connectivity is affected more by the suitability of the overall landscape than by the presence or absence of discrete corridors because spotted owls disperse randomly (USDA 1990b). Corridors have become an important tactic for preserving biological diversity however. Rosenberg et al. (1997) defined corridors as “a linear landscape element that provides for movement between habitat patches, but not necessarily for reproduction. Thus, not all life history requirements of a species may be met in a corridor.”

Rosenberg et al. (1997) also indicated that the primary rationale for establishing corridors is to increase population persistence by allowing exchange of individuals among connected populations. They may also facilitate movement between home ranges. However, few studies have demonstrated that corridors actually increase the rate of successful movement between patches. For late-successional species, dispersal is likely to be successful when habitat in a “corridor” is similar to the habitat in which a species lives (Wiens 1989). Rosenberg also showed similar findings. Given a choice between habitat and non-habitat, animals are likely to select pathways that have components of their habitat.

Rosenberg et al. (1997) also demonstrated that a linear corridor needs to have more suitable habitat elements than the surrounding landscape for a species to choose to use it. Survival rates are then increased. The fewer the habitat elements, the more chance for predation. He also showed that animals showed compensatory behavior in less favorable environments. In other words, they moved more quickly through low quality habitat versus high quality habitat.

Depending on the length and width, corridors are sometimes referred to as edge habitats. Edge habitat is increasing, sometimes at the expense of interior habitat. This is cause for concern because corridors may not be providing habitat for the species most in need of protection. Many edge species have high birth and survival rates and providing habitat for them may not maintain regional diversity (Robbins et al. 1989).

Currently there are 449 acres of ponderosa pine and 1,418 acres of mixed conifer that exhibit old and late structural stand characteristics. That makes up about 7% of the project area within USFS boundaries. No treatment activities will take place in old and late structural stands. Overall, 16% of the area (within USFS boundaries) meets 30% canopy closure or greater. Movement across the project area could be accomplished using unburned denser patches or individual live white fir trees through the ponderosa pine area. However, a large portion of the project area is burned or is comprised of the ponderosa pine PAG, which does not provide desirable dispersal habitat due to the openness of stands and patches that do exist are usually very dense making movement through them difficult. Dispersal could occur along unburned riparian reserves where stand densities are greater. Movement would probably be concentrated along both the west edge of the project area where there are more mixed conifer stands facilitating primarily north/south

movement. Connectivity is further discussed under the spotted owl section found in the next section.

Federally Threatened and Endangered, and Region 6 Sensitive Species (TES)

Overview: The biological evaluation process is set up to identify threatened, endangered, and sensitive wildlife species that may be associated with the Eyerly project area. A six-step process to evaluate any impacts the project may have to those species includes: a pre-field review; surveys, determination of effects; analysis of significant effects on population; determination of conclusions; recommendation of mitigations; and consultation with USFWS (as appropriate). The following species that are federally identified as threatened or candidate species are discussed: Canada lynx, northern bald eagle, northern spotted owl, and spotted frog.

All species on the Forest Service Region 6 (Pacific Northwest) Sensitive Species List that have potential habitat within the project area on the Sisters Ranger District were considered. The following species do not have potential habitat within the planning area and will not be discussed further in this document: peregrine falcon, horned grebe, red-necked grebe, yellow rail, tri-colored blackbird, western sage grouse, and pygmy rabbit. The following sensitive species are discussed: bufflehead, California wolverine, harlequin duck, and the Pacific fisher.

Federally Threatened and Candidate Species

The **Canada Lynx** is a USFWS Threatened Species. The lynx requires a mix of habitats to support it and its primary prey species, the snowshoe hare. This species requires dense, multi-layered, early successional stands that provide a forage base both in summer and winter months. Douglas squirrels may also be an important prey species. They tend to occur in greater densities in older, closed-canopy forests with substantial quantities of coarse woody debris and lower in young stands that lack cone production (Layne 1954, Obbard 1987, Klenner and Krebs 1991). The lynx also requires old or mature stands with high canopy closure and if possible, large accumulations of down woody material. This provides security sites for denning. Travel between denning and forage areas and between other suitable areas is usually located on prominent ridges, through saddles, and along riparian areas. Consistent snow depths are also required for lynx. The majority of lynx occurrences and use has been above the 4500' elevational level in the Oregon Cascades.

The Eyerly Salvage project area does not occur within a designated Lynx Management Unit (LAU) or Key Linkage Area (KLA). The very western portion of the project area was defined as an LAU under more liberal assessments of habitat during the first mapping effort. Further refinement of lynx habitat by the Lynx Science Team has led to the determination by the Deschutes and Ochoco National Forests and Crooked River Grasslands that Canada lynx and its habitat are currently not present on the Forests. The Eyerly Salvage project area consists primarily of ponderosa pine plant associations, which do not equate to suitable lynx habitat.

The **Northern Bald Eagle** is a USFWS threatened species. Bald eagles are permanent residents of Oregon. Essential habitat elements for the recovery and eventual delisting of the northern bald eagle are nest sites, communal night roosts, foraging areas, and perch sites. On the Deschutes National Forest, ponderosa pine and Douglas-fir trees averaging 32 inch+ dbh with large, open limb structure are preferred for nesting. Nests consist of bulky stick platforms built in the super-canopy of such trees, or less frequently on cliffs. They are typically constructed within one mile of appropriate foraging habitat, which includes rivers and large (typically 90 surface acres or greater) lakes and reservoirs. Bald eagles are sit-and-wait predators, which predominantly capture prey from perches over water; ideal perches are large trees and snags within 330 ft. (100 m) of water (Anthony et al. 1995). Prey items include fish, waterfowl and other birds, small mammals, and carrion (Stalmaster, 1987). Most of the large lakes, reservoirs, and rivers on the Sisters Ranger District provide suitable habitat for bald eagles.

Within the project area, 12,830 acres are allocated as Metolius Wildlife Primitive with an emphasis on Bald Eagle Habitat. However, the LRMP states that bald eagles are known to inhabit only a portion of the Metolius Wildlife Primitive Management Area. Metolius Wildlife Primitive Standards and Guidelines (S&G's) state that suitable nesting and foraging habitat will be provided. The project area also lies within the High Cascades Bald Eagle Recovery Zone 11 (McAllister and Anderson 1990). For this project bald eagle habitat will be managed for within 1 ½ miles of the Metolius River and Lake Billy Chinook (Figure 3.6-1).

The planning area contains two historic bald eagle nest sites, Spring Creek and Eyerly. Fire severity ranged from high to moderate in both nest stands and as a result the Spring Creek nest site was lost. Both sites contain historic nests as well as active nests and both sites produced young in 2002. Young fledged just prior to the fire burning through the nest groves (*Table 3.6-3* shows the history of each pair). Both pairs use the Metolius River and Lake Billy Chinook as their primary foraging areas year round.

Figure 3.6-1. Eyerly Salvage Project Essential Bald Eagle Habitat.

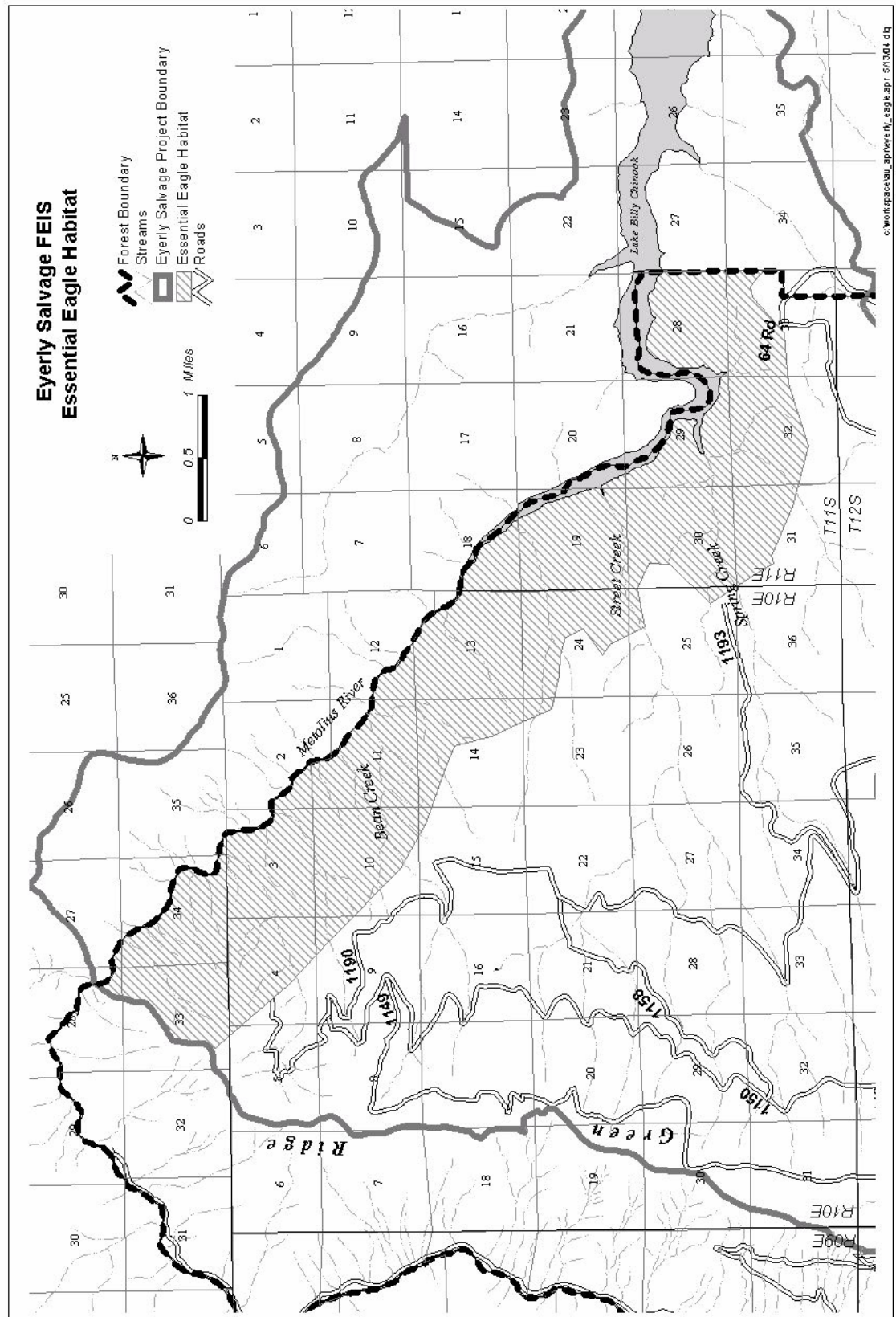


Table 3.6-3. History of Eyerly and Spring Creek Bald Eagle Pairs

Year	Eyerly Pair	Spring Creek Pair
1981	Failed	No Record Of This Pair
1982	1 Young	No Record Of This Pair
1983	Unoccupied	No Record Of This Pair
1984	1 Young	No Record Of This Pair
1985	1 Young	No Record Of This Pair
1986	Failed	No Record Of This Pair
1987	Failed, known to be occupied	No Record Of This Pair
1988	2 Young	No Record Of This Pair
1989	Failed, known to be occupied	No Record Of This Pair
1990	2 Young	No Record Of This Pair
1991	2 Young	No Record Of This Pair
1992	Failed, known to be occupied	No Record Of This Pair
1993	1 Young	No Record Of This Pair
1994	2 Young	No Record Of This Pair
1995	Failed, known to be occupied	No Record Of This Pair
1996	Failed, known to be occupied	Failed, known to be occupied
1997	2 Young	Failed, known to be occupied
1998	1 Young	Failed, known to be occupied
1999	Failed, known to be occupied	1 Young
2000	Failed, known to be occupied	Failed, known to be occupied
2001	2 Young	2 Young
2002	1 Young, nest tree burned	1 Young, nest tree burned
2003	Nesting in burned tree they used last year. Failed, known to be occupied	Nesting in new green tree less than 0.1 miles from last years nest. 1 young.
2004	Nesting in new tree near Monty Campground.	Nesting in 2003 nest

The **Northern Spotted Owl** is a USFWS Threatened Species. The northern spotted owl is primarily an inhabitant of old growth and mature forests. Suitable spotted owl habitat contains adequate quantities of dead and down woody material, decadent trees, a medium to high crown closure, multiple layers in the overstory, and trees at least 200 years old or greater than 32 inches dbh (USDA, 1990a). However, eastside forests contain habitat that may not typically fit the above definition. Suitable nesting, roosting, and foraging habitat (NRF) is described as having the following structural characteristics for the Deschutes National Forest: Forest stands, regardless of plant association, having a total canopy cover greater than or equal to 40% and a canopy cover of at least 5% among trees >21" dbh. This definition assumes that the stand is multi-storied and contains some large trees. This definition was refined in FY2001 to better define NRF habitat on the Forest since the insect and disease epidemics in the early 1990's.

Approximately 11,028 acres of the project area is located within the Metolius Late-Successional Reserve, RO245. *Table 3.6-4* summarizes allocations within the Northwest Forest Plan (NWFP) for the Eyerly planning area.

Table 3.6-4. Total NWFP Allocation Planning Acres within the Eyerly Project Area

Metolius Late Successional Reserve	Matrix	Administratively Withdrawn
11,028	4,485	2,233

There is a portion of Critical Habitat Unit (CHU) OR-3 (approximately 3,697 acres) occurring within the project boundary. This CHU was designated to develop and maintain essential nesting, roosting, and foraging habitat and help support the dispersal of owls along the eastern slope of the Oregon Cascades. OR-3 is important for maintaining the eastern extent of the subspecies range within the Eastern Cascades province and for providing the north-south continuum of critical habitat areas along the east slope of the Cascade Mountains.

The Forest GIS layer definition of NRF was broadly defined to capture all potential conditions where NRF may occur across the Forest. Lauri Turner and Kris Hennings (Wildlife Biologists) updated the Forest NRF layer after field reconnaissance revealed the fire had removed all NRF within the fire perimeter. Approximately 1,314 acres of NRF (within USFS lands) currently exist within the Eyerly Salvage project area, however it is all outside of the fire perimeter. Figure 3.6-2 shows existing Spotted Owl Habitat.

Connectivity was analyzed for the project area and viewed in the larger landscape context in order to provide connectivity across the landscape. Due to a large portion of the project area consisting of more open ponderosa pine stands, connectivity was located in more sustainable plant associations and has the ability to connect to Black Butte and the Confederated Tribes Lands. With Black Butte and the Confederated Tribes lands as focal points, a corridor was developed that runs south to north along the scarp of Green Ridge connecting the north face of Black Butte to the Forest Boundary adjacent to the Confederated Tribes land. A minimum of 30% canopy closure should be maintained within the corridor to facilitate movement from Black Butte to the Confederated Tribes Land.

One known spotted owl home range (Castle Rocks) occurs within the Eyerly Salvage Project Area. The activity center for the Castle Rocks pair is approximately 0.8 miles east of the project area boundary. The Castle Rocks pair was discovered in 1988. Nesting and reproduction (1 juvenile) were confirmed that year. The site was not surveyed again until 1990. Again, nesting and reproduction were confirmed with two young produced. One visit per year in years 1991, 1995, and 1996 were conducted at the site. However, no birds were found. It is unknown if this site is still viable. In the spring of 2003, surveys were conducted to protocol but no birds were detected.

Table 3.6-6 summarizes the existing nesting, roosting, foraging (NRF) habitat within the Castle Rocks home range. This shows NRF habitat designated from the Forest GIS layer. Roughly 520 acres of the Castle Rocks home range are outside Forest Service lands. Of the 2,361 acres that are on Forest Service land, 1,710 acres are within the Mixed Conifer Dry PAG. Less than 40% of the Castle Rocks home range contains suitable habitat. However, the dominant PAG's within the home range are mixed conifer wet and mixed conifer dry. Therefore, the home range has the potential to recover over time.

Table 3.6-6. Castle Rocks spotted owl home range information (USFS lands only)

Area	Acres	Percent of Home Range (2,995 acres)
Acres within the fire perimeter	228	8
Acres of NRF within home range before the Eyerly Fire	663	23
NRF in home range within fire perimeter	65	2
Acres of NRF remaining in home range	598	21

Table 3.6-5 displays the existing dispersal habitat conditions within the Eyerly project area. Acres were calculated for USFS lands only.

Table 3.6-5. Existing dispersal habitat within the Eyerly project area (USFS lands only)

Dispersal Type	Acres	Percent of the project area
Westside Dispersal 11-40	1,982	11
Eastside Dispersal 11-30	1,746	10
Total	3,728	21

The **Oregon Spotted Frog** is a USFWS Candidate Species. Spotted frogs generally inhabit warm (>20C) perennial marshes, lakes, ponds, or slow moving waters with abundant aquatic vegetation (Corkran and Thoms 1996). This species is most often associated with non-woody wetland plant communities with species such as sedges, rushes, and grasses (Leonard et al. 1993). They require very shallow water for breeding, and often use flooded meadows or water trapped in flattened vegetation at the edges of ponds. Populations have been reduced throughout much of their range due to wetland reclamation and introduction of non-native amphibian and fish species (Leonard et al. 1993; Corkran and Thoms 1996).

Suitable habitat for spotted frogs is minimal in the project area. Water temperatures are generally too cold and emergent wetland vegetation is absent except in isolated areas along the Metolius River and springs. There are no known occurrences of Oregon spotted frogs on the Sisters Ranger District.

USFS Region 6 Sensitive Species

Bufflehead: Buffleheads nest near mountain lakes surrounded by open woodlands containing snags. In many areas, the preferred nest trees are aspen but they will use ponderosa pine and Douglas-fir snags. In Oregon, most nest in artificial nest boxes. This duck eats both animal and plant material. However, during the breeding season, aquatic insects and larvae are the most important item in their diet. They also eat seeds of pondweeds and bulrushes. Bufflehead population numbers are generally low in Oregon and a shortage of natural cavities has brought attention to the breeding segment of the population (Csuti et al. 1997).

Buffleheads have been sited on Lake Billy Chinook during the winter. No sitings of nesting birds have occurred. However, no surveys have been conducted for this species. Potential habitat exists along the Metolius River, especially in open slack water and along Lake Billy Chinook.

California Wolverine: In addition to being a Region 6 Sensitive Species, the wolverine is listed as threatened in the State of Oregon and as a Species of Concern by the USFWS. At the present time, no wolverine studies have been conducted in the Cascades. The most recent and comprehensive wolverine study was in northwestern Montana, by Hornocker and Hash (1981) conducted during 1972-1977. Wilderness or remote country where human activity is limited appears essential to the maintenance of viable wolverine populations. Habitat use is probably dictated largely by food availability; wolverines are primarily scavengers, but also depend on a variety of prey items. High elevation wilderness areas appear to be preferred in summer, which tends to effectively separate wolverines and humans. In winter, they tend to den in the ground under snow or in rocky ledges or talus slopes (Ingram 1973; Banci 1994). Wolverines make little use of young, thick timber and clear-cuts (Hornocker and Hash 1981).

Wolverines appear to be extremely wide-ranging and unaffected by geographic barriers such as mountain ranges, rivers, reservoirs, highways, or valleys. For these reasons, Hornocker and Hash (1981) concluded that wolverine populations should be treated as regional rather than local.

Several historic sitings have been documented outside of the project area. One siting occurred near Suttle Lake, while the remainder of sitings occurred within the Mt. Jefferson and Mt. Washington wilderness areas. All the sitings were recorded in the 1970's or earlier. The project area is fragmented with open road densities averaging 2.35-miles/sq. mile. The road densities are skewed due to the 10.5 miles of inventoried roadless area within the project. Much of the project area is comprised of low elevation ponderosa pine forests, receives moderate recreation use, and may not be suitable for wolverine use.

Two aerial flights were conducted of the Three Sisters, Mt. Washington, and Mt. Jefferson wilderness areas and adjacent roadless areas during the winter/spring of 1998 and 1999 by an interagency group consisting of several National Forests, ODFW, and PNW. A potential den site was located approximately 23 miles southwest of the project area during the 1998 flight, but nothing was detected during the 1999 flight. The den site also corresponds to an earlier visual sighting in the same vicinity in 1992. An infrared camera system was placed near the wilderness boundary to try and detect wolverine presence. Wolverines were not detected using this method. No other surveys were conducted for this species.

Harlequin Duck: In addition to being a Region 6 Sensitive Species, the Harlequin duck is also listed as Sensitive, Undetermined Status by the State of Oregon. Harlequins breed along relatively low-gradient, slower-flowing reaches of mountain streams in forested areas. It is easily disturbed and seeks out the most remote streams for breeding. It uses swift waters and rapids during other seasons. They feed primarily on aquatic insects and their larvae, which are found on stream bottoms. (Cassirer and Groves 1989).

PGE and district employees conducted surveys for harlequin ducks along the Metolius in 1998. The surveys began at Jack Creek and proceeded to Lake Billy Chinook. No harlequin ducks were detected during these surveys (Concannon 1998). Two harlequins were sited near the Wizard Falls fish hatchery bridge during the fall of 2001 (district files). The Wizard Falls fish hatchery bridge is approximately 13 river miles upstream of the Eyerly Fire project area.

Potential habitat exists along the Metolius River. The best potential habitat occurs along the Metolius River west of Monty Campground, which consists of shrubby riparian vegetation and low human disturbance. There are numerous logjams and large rocks that would make for potential loafing sites. The lower stretch of the Metolius River has a large species richness of caddisflies, but abundance is low. The reason for the low abundance of caddisfly levels is due to lack of organic matter, which consists of deciduous leaf litter and algae (Riehle, pers. comm. 02-24-03). The lower stretch of the Metolius also has few pools and water is moving at a high velocity. Pools are important to broods when first hatched and the lack of them, along with low caddisfly abundance on the Metolius, may limit harlequin use.

Pacific Fisher: In addition to being a Region 6 Sensitive Species, fishers are identified as a Species of Concern by the USFWS. Fisher populations are considered to be extremely low in Oregon, Washington, and parts of the Rocky Mountains. They occur in landscapes dominated by late-successional and mature forests. Fishers have been found to use riparian areas disproportionately to what exists. On the Westside of the Cascades, fishers tend to be associated with low to mid-elevation forests dominated by late-successional and old growth Douglas-fir and western hemlock. However, on the eastside of the Cascades, they occur at higher elevations in association with true firs and mixed conifer forests. They tend to prefer areas with high canopy closure and late-successional forests with relatively low snow accumulations. Critical features of fisher habitat include physical structure of the forest and prey associated with forest structure. Structure includes vertical and horizontal complexity created by a diversity of tree sizes and shapes, light gaps, down woody material, and layers of overhead cover. Major prey species include small to medium sized mammals, birds, and carrion. Porcupine is the best known prey species but fisher will also prey on snowshoe hare, squirrels, mice and shrews. (Powell and Zielinski 1994)

Suitable spotted owl habitat (NRF) serves as suitable habitat for fishers. Approximately 1,314 acres of suitable habitat occurs in the project area. Existing suitable habitat is minor in the project area (3%) and fragmented. Most of the existing habitat in the project area is found in the MCW PAG that is located on the east side of Green Ridge. Vertical and horizontal structure complexity may not occur to the level preferred by fishers. Snow accumulations also tend to be deep in this area (4-5'), so habitat quality inside the project area may not be ideal but habitat does exist.

Field reconnaissance has not been conducted for this species.

Management Indicator Species (MIS)

Management Indicator Species are animals listed to indicate overall multiple-use objectives stated in the Forest Plan. Bird species are discussed first and it is then followed by mammals (including bats).

Birds

Primary cavity excavators include the following: pileated woodpecker, black-backed woodpecker, northern flicker, downy woodpecker, hairy woodpecker, white-headed woodpecker, Williamson's sapsucker, three-toed woodpecker, and Lewis' woodpecker. The flammulated owl will be discussed separately. Primary cavity excavators depend on

snags and logs for nesting, roosting, and foraging. Most of these species are associated with late-successional habitats in various plant association groups. Black-backed and three-toed woodpeckers are associated with lodgepole pine, while Lewis' woodpeckers prefer ponderosa pine associations. Pileated woodpeckers and Williamson's sapsuckers prefer mature and late-successional habitats in mixed conifer plant associations while northern flickers and hairy woodpeckers are found in a mix of habitats, especially those associated with edges. Downy woodpeckers are associated with riparian habitat, but can also be found in a mix of habitats.

Tables 3.6-7 and 3.6-8 contain synthesized data used to create the cumulative species curves for wildlife use of snag densities from various studies for the Ponderosa Pine/Douglas-fir and Eastside Mixed Conifer Cascades/Blue Mountains Wildlife Habitat Types and Open Canopy Structural Condition Class in recent post-fire habitats (from Mellen et al. 2002).

Table 3.6-7. Cumulative species curve for snag size ≥ 9.85 inches in recent post-fire habitats.

Species	30% t.l. Snag Density (#/acre)	30% t.l. Sample size	Species	50% t.l. Snag Density (#/acre)	50% t.l. Sample size	Species	80% t.l. Snag Density (#/acre)	80% t.l. Sample size
BBWO	62.2	35	BBWO	88.3	35	BBWO	126.1	35
HAWO	12.7	91	HAWO	41.8	91	HAWO	85.3	91
LEWO	9.5	202	LEWO	24.8	202	LEWO	48.1	202
MOBL	6.8	98	MOBL	29.7	98	MOBL	63.9	98
NOFL	5.4	99	NOFL	29.8	99	NOFL	66.4	99
WEBL	9.2	103	WEBL	32.1	103	WEBL	66.5	103
WHWO	20.0	14	WHWO	51.4	14	WHWO	95.5	14

Table 3.6-8. Cumulative species curve for snag size ≥ 19.7 inches in recent post-fire habitats.

Species	30% t.l. Snag Density (#/acre)	30% t.l. Sample size	Species	50% t.l. Snag Density (#/acre)	50% t.l. Sample size	Species	80% t.l. Snag Density (#/acre)	80% t.l. Sample size
LEWO	0.0	202	LEWO	6.2	202	LEWO	16.1	202
MOBL	0.0	61	MOBL	12.4	61	MOBL	38.0	61
NOFL	2.2	39	NOFL	17.4	39	NOFL	39.6	39

DecAID predicts the following species will use recently burned ponderosa pine/Douglas-fir and Eastside Mixed Conifer E. Cascades/Blue Mountains vegetation: Black-backed woodpecker (BBWO), Hairy woodpecker (HAWO), Lewis woodpecker (LEWO), Mountain bluebird (MOBL), Northern flicker (NOFL), White-headed woodpecker (WHWO), and Western bluebird (WEBL). The range of snags by species is shown in the above tables, but basically range from a low of 5.4 snags/acre ≥ 9.85 " at the 30 percent tolerance level for the Northern flicker to a high of 126.1 snags/acre ≥ 9.85 " at an 80 percent tolerance level for black-backed woodpecker. Northern flicker, hairy woodpecker, and Lewis' woodpecker have been documented in the project area. However, no formal surveys have been conducted to determine the extent that each species is present on the landscape and all sitings have been incidental.

DecAID was used to estimate potential use of habitat associated with the Eyerly fire. For the analysis the following assumptions were used:

- “It is our fundamental assumption that patterns of species' use and selection of dead wood size and amounts represent behaviors that have adaptive advantage for the species and that serve to bolster individual fitness” (Mellen et al. 2002).
- Snags ranging from 9” to 20.9” dbh in the snag modeling were compared against trees greater than 10” dbh in DecAID and snags greater than 21” dbh were compared against trees greater than 20” dbh in DecAID.

Using *Tables 3.6-7 and 3.6-8* from the DecAID advisory tool and estimates of average snags per acre by size class, the project area acres of existing habitat were calculated. Acres that were outside of the fire perimeter were not used in this analysis because habitat values were used for recent post-fire habitat. Table 3.6-9 indicates acres of potential habitat for seven post-fire species.

Table 3.6-9. Existing acres of habitat for cavity nesters (within NF boundary)

Species	0 - 29 % tolerance (acres)	30 - 49 % tolerance (acres)	50 - 79 % tolerance (acres)	80 % + tolerance (acres)
Lewis' Woodpecker	4,109	12,051	2,090	415
Black-backed Woodpecker	15,507	1,705	1,122	331
Hairy Woodpecker	5,441	8,197	3,462	1,565
White-headed Woodpecker	8,455	5,944	3,034	1,232
Northern Flicker	12,562	5,843	260	0
Mountain Bluebird	3,118	14,783	763	0
Western Bluebird	4,020	7,618	4,141	2,886

Currently there are an estimated 2,090 acres of Lewis' woodpecker habitat within the 50 to 79% tolerance level and 415 acres in the 80% plus. That means 2,090 acres of habitat meets the criteria of at least 24.8 snags per acre greater than or equal to 9 inches dbh and has at least 6.2 snags per acre greater than or equal to 21 inches dbh. It also means that 415 acres of habitat meets the criteria of at least 48.1 snags per acre greater than or equal to 9 inches dbh and has at least 16.2 snags per acre greater than or equal to 21 inches dbh (criteria identified in DecAID from empirical studies {Mellen et al. 2002}).

Coopers and Sharp-Shinned Hawks: Cooper's hawks often pursue and capture their prey in the air. They routinely use dense cover to hunt. Frequently taken prey includes robin-sized birds, however small mammals will be taken occasionally. They are generally found in densely wooded coniferous forests and to a lesser degree, in deciduous woods. They select nest sites in dense second growth of mixed conifer and ponderosa pine stands usually near water. (Jackman and Scott 1975).

The sharp-shinned hawk is an aerial predator pursuing and capturing most of its food in the air. It feeds primarily on sparrow and warbler-sized birds. Suitable habitat usually

includes thickets in mixed conifer and deciduous woods. It routinely uses dense cover to escape detection by predators or from being harassed. (Jackman and Scott 1975).

Nesting habitat for the sharp-shinned hawk has been grouped into 3 types by Reynolds (1976):

- Young, even-aged conifer stands with single-layered canopies
- Mature, old-growth stands of mixed conifer with multi-layered canopies
- Dense stands of aspen

Currently there are 1,023 acres of suitable habitat (within USFS lands) for Cooper's and sharp-shinned hawks (*Table 3.6-10*). Suitable habitat is currently found in areas that are dominated by trees that range from 5-8.9" in diameter.

Table 3.6-10. Suitable Cooper's and Sharp-shinned Hawk habitat located in the Eyerly project area (Within USFS lands)

PAG	Total (acres)
MCD	189
MCW	164
PPD and PPW	644
RIP	26
Total	1,023

No known nests have been located to date inside the project area. Landscape level surveys have not been conducted in this area so it is unknown how many territories may have been impacted.

Flammulated Owl: The flammulated owl is a focal species for fire climax ponderosa pine and mixed conifer dry habitats. Preferred habitat is typically a mosaic of open forests containing mature and old growth ponderosa pine and Douglas-fir trees, interspersed with dense patches of second growth providing roosting areas. All stands with a significant component of mature and old growth trees are considered potential habitats. The flammulated owl nests in medium to large snags (12" to 25 dbh") and uses cavities created by flickers or pileated woodpeckers. It forages primarily on arthropods and other insects (USDA(b) 1994). In the spring of 2003, a pair of flammulated owls were detected in T.11S, R.10E, Section 34.

Great Blue Heron: Great blue herons are colonial nesters and nest in large deciduous and conifer trees adjacent to water. They forage in shallow water or open fields for fish, crustaceans, insects, rodents, amphibians, and reptiles. They are very sensitive to disturbance, especially during the nesting season. (Jackman and Scott 1975). Riparian reserves along the Metolius River provide marginally suitable habitat as well as meadows in the project area. The Metolius River and Lake Billy Chinook are deep. The river moves at a high velocity so foraging opportunities are limited to the few shallow slower moving pools. Foraging opportunities are limited for great blue herons within the project area. Great blue herons have been observed foraging both on the Metolius River and on the shores of Lake Billy Chinook. There are no known nesting sites located within the project area.

Within the project area there are two campgrounds and small tracts of private land with houses along the Metolius River and Lake Billy Chinook. Great blue herons use may be limited in these locations, especially during the summer months, due to the heavy amount of human use and the loss of snag habitat as trees are removed for safety reasons. This limits the available nesting sites along the river. Therefore, snag habitat outside of designated areas is very important to retain since a large portion of snag habitat will be lost in the recreation sites.

Great Gray Owl: The great gray owl is usually associated with meadows in conjunction with late-successional habitats. Mixed conifer/lodgepole pine/mountain hemlock communities associated with meadows are considered habitat for this species. Recent studies in the Blue Mountains (Bull and Henjum, 1990, Bull et al. 1988) have shown that owls will inhabit openings created by timber harvest activities, especially those that mimic natural gaps.

Within the Eyerly fire's perimeter there is limited suitable habitat. The southern portion of the 1149 road provides the best potential habitat with abundant clear-cuts, a meadow with available prey species, and an open area in T.10S, R.10E, Sections 20, 30, and 31 along with T.12S, R.10E, Section 6. Some mature and late-successional ponderosa pine stands may provide habitat as well especially if they possess dense inclusions with open understories.

Surveys according to the Regional protocol (USDA 1995) were conducted during the spring of 2003. No nest sites were located, however one audio response was heard in T.12S, R.10E, Section 6. Great gray owls will be surveyed again in the spring of 2004.

Northern Goshawk: This species is associated with mature and old growth forests, and is a fire and climatic climax focal species for the project. All mature and late-successional habitats are considered potential nesting habitat and all other forested seral stages are considered potential foraging habitat. Moist mixed conifer and moist ponderosa pine late-successional areas are preferred habitats. Preferred nest stands have a minimum of 40% canopy cover. Nest sites within these stands have >60% canopy closures (Reynolds et. al 1991).

Potential nesting habitat coincides with spotted owl NRF habitat west of the NWFP boundary within the project area, which is located primarily along the scarp of Green Ridge and in the western portion of the project area. However, managing for goshawk and spotted owl habitat in or near each other is not recommended. Additional goshawk nesting habitat occurs outside spotted owl NRF habitat, primarily in the mixed conifer wet and dry PAGs and along riparian reserves. Consideration should be given to small dense patches of medium to large ponderosa pine to be managed as potential nest stands.

Existing goshawk habitat occurs within the project area (*Table 3.6-11*), however it is scattered across the landscape.

Table 3.6-11. Existing Goshawk Habitat in the Eyerly planning area

Habitat Type	Foraging Habitat	Nesting Habitat
Acres	681 acres	248 acres

There was one known historic nest site within the fire perimeter, South Fork Street Creek. This site was last active in 1993 and nesting was believed to fail that year. See *Table 3.6-12* for a survey chronology.

Table 3.6-12. South Fork Street Creek Goshawk Survey Chronology

Year	Status
1993	Nest considered failed
1994	No Response
1995	No Response
2000	No Response
Note: No landscape level goshawk surveys conducted within the project area.	

Osprey: Osprey nest near lakes and rivers in the tops of large snags or they may use artificial platforms if available. Their main prey is fish – slow-moving species that swim near the surface. However, they may also take other vertebrate species (birds, reptiles, and small mammals). (Csuti et. al 1997).

The Metolius River and Lake Billy Chinook provide suitable habitat for osprey for both nesting and foraging. There are 16 known osprey nest sites within the Eyerly project area. Of those 16, seven are located on the Warm Springs Reservation. Locations of the nests are located in *Table 3.6-13*.

Table 3.6-13. Osprey nest sites within the Eyerly Project Area

Nest	Location
540-001	T 10S. R. 10E. Section 27
539-001	T 10S. R. 10E. Section 35
538-001	T 11S. R. 10E. Section 3
537-001	T 11S. R. 10E. Section 2
536-001	T 11S. R. 10E. Section 11
535-001	T 11S. R. 10E. Section 11
534-001	T 11S. R. 10E. Section 11
533-001	T 11S. R. 10E. Section 11
532-001	T 11S. R. 10E. Section 11
531-001	T 11S. R. 10E. Section 12
530-001	T 11S. R. 10E. Section 12
529-001	T 11S. R. 10E. Section 12
528-001	T 11S. R. 10E. Section 12
527-001	T 11S. R. 10E. Section 12
526-001	T 11S. R. 10E. Section 14
525-001	T 11S. R. 10E. Section 14

Competition for nesting structure occurs between osprey and other raptor species so retention of snag habitat is important, especially outside campgrounds, private land boundaries, and major travel routes.

Red-tailed Hawk: The red-tailed hawk inhabits mixed country of open areas interspersed with woods (agricultural areas, grasslands, woodlands, meadows). They roost in thick conifers and nest in large conifer snags often in the tallest tree on the edge of the timber. They feed mainly on small rodents (mice, squirrels) but eat larger mammals (skunks, rabbits), birds, reptiles, and insects. (Jackman and Scott 1975).

Past harvest activities have produced habitat conditions favorable for red-tailed hawks by clear-cutting stands adjacent to mature and late successional stands. This has provided open areas for foraging adjacent to potential roosting and nesting habitat. However, before the fire many of these stands were dominated by snowbrush and manzanita, which limits the foraging habitat of red-tailed hawks. As a result of the Eyerly fire, foraging opportunities have increased with more open areas with fewer shrubs and forbs. There are also many newly created fire hardened snags that could serve as potential nest sites.

There are no known nests within the project area, however no formal surveys have been conducted.

Waterfowl: Open lakes, ponds, streams, rivers, and wet/dry meadows provide foraging habitat for most waterfowl species. Some species utilize large snags for nesting, while others utilize open grassy areas near the water's edge. Most waterfowl diets consist primarily of vegetation although some animal matter (caddisflies, crustaceans, and mollusks) may be consumed. (Csuti et. al 1997).

Six waterfowl species, excluding the species mentioned elsewhere in this section, have been documented in the project area (mallard, Canada goose, common goldeneye, bufflehead, hooded merganser, common merganser). Most sitings have occurred along the Metolius River and Lake Billy Chinook (district files) where potential habitat exists.

Mammals

The **American Marten** is associated with mixed conifer and high elevation hemlock/lodgepole pine late-successional habitats, and is a focal species for climatic climax habitats. Marten habitat is generally dense-canopied (greater than 40% canopy cover) and supports significant amounts of large down logs (>20" at rest sites and > 30" at den sites, 8-20/acre) and snags (2-3/acre) >20" dbh. Moist forests where marten are usually found have down woody densities as high as 39 pieces per acre with 40% of the pieces >20" dbh. Especially significant are riparian areas, ridgetops, and areas where a high concentration of down logs and snags occur. (USDA(a) 1994).

The best suitable habitat for marten occurs in the mixed conifer wet stands and along the riparian reserves on the western portion of the project boundary. Marten probably avoid the ponderosa pine and mixed conifer dry PAGs due to the more open nature of the stands and their tendency to avoid openings. These stands also lack complex horizontal structure typically found in more mesic forest conditions and along riparian reserves. Systematic surveys have not been completed for the area.

Bats: Most bat species are associated with foraging within forested areas with a few other species closely associated with foraging in and adjacent to riparian areas. See *Table 3.6-14* for a breakdown of the potential bat species that could be found in the Eyerly Fire Salvage project area and their habitat characteristics. (Csuti et. al 1997).

Table 3.6-14. Potential bat species and habitat requirements for the Eyerly Fire Salvage

Species	Forage Substrate	Roost Site	Main Prey Species	Comments
California Myotis	Forest edges and over water	Cliff faces, tree crevices, caves and structures	Butterflies and small flies	
Western Small-footed bat	Ponderosa pine and mixed conifer forests	Rock crevices, under boulders, and beneath bark	Small insects	Will also forage over rocks
Yuma Myotis	Riparian, moist woodlands, and open forests	Buildings, caves, and bridges	Moths, midges, flies, and termites	Closely associated with water and very sensitive to disturbance
Little Brown Myotis	Moist forests and riparian areas		Flying insects	Closely associated with water
Long-legged Myotis	Coniferous forests and riparian areas	Crevices, buildings, and caves	Moths	Closely associated with forests
Long-eared Myotis	Forested habitats and forested edges		Moths	
Silver-haired bat	Forested areas and over ponds and streams	Under bark	Soft-bodied prey	Deforestation and loss of snags is a threat
Big Brown Bat	More common in deciduous versus coniferous forests	Structures	Beetles	Forages over open areas and uses hollow trees
Hoary Bat	Riparian and brushy areas	Trees	Moths	Solitary forest dwelling
Pallid Bat	Arid regions and open forest types	Cliff faces, caves, and buildings	Flightless arthropods	Forages on ground and very intolerant to disturbance
Western big-eared Bat		Buildings, caves, and bridges	Moths	Presence of roost sites more important than veg type; very sensitive to disturbance

Mark Perkins (Pacific Northwest Bat Research Team) conducted a bat survey on the Pelton Round Butte Project in 1998 for PGE. Within the Pelton Round Butte Study area five survey sites were within two miles of the Eyerly fire perimeter. The results of the survey are located in Table 3.6-15.

Table 3.6-15. Results of the 1998 bat survey conducted by Mark Perkins

Survey Site	Location to the Fire Perimeter	Ownership	Bat Species Located
Box Canyon	0.21 miles north of the Eyerly fire perimeter	Warm Springs Reservation	Big Brown Bat Silver-haired Bat California Myotis Western Small-footed Bat Long-eared Myotis Little Brown Myotis Western Pipistrelle
Eyerly Place	Within the Eyerly fire	Private	Little Brown Myotis
Fly Creek	Within the Eyerly fire	Private	Big Brown Bat Silver-haired Bat Little Brown Myotis Yuma Myotis
Fly Lake	1.22 miles south of the Eyerly fire perimeter	Private	California Myotis Western Small-footed Bat Long-eared Myotis Yuma Myotis
Street Creek	Within fire	Private	Little Brown Myotis Yuma Myotis

Many of the bat species, such as the hoary and silver-haired bat use green forests as primary habitat. Therefore, much of the area that experienced stand replacement fire are not considered suitable habitat for these two species. For species of bats that use more open areas to forage like the big brown bat potential foraging habitat exists. There is an abundant amount of snag habitat available for roost sites, but many of the snags are fire hardened and may not be usable by bats for a long period of time.

Big Game

Deer: Biological deer habitat was developed during the Integrated Fuels Strategy process (1998) in concert with Oregon Department of Fish and Wildlife (ODFW) and consists of winter, transition, and summer range. It is not considered an allocation in the Deschutes Forest Plan, however, it is recognized by ODFW as an important area for mule deer. 7,768 acres of winter range is located within the project area. The winter range occurring in the fire perimeter is part of the Metolius winter range which hosts some of the highest deer per acre numbers in the state. See *Table 3.6-16* for a breakdown of deer habitat.

The project area also consists of 5,353 acres of Management Area 7 (MA-7)-Deer Habitat (LRMP). The goal of MA-7 is to manage vegetation to provide optimum habitat conditions on deer winter and transition ranges while still providing some wood products, visual quality, and recreation opportunities. Herbaceous vegetation is to be managed to provide a vigorous forage base with a variety of forage species. Cover and forage areas should be in close proximity to each other for optimum use by big game, with cover making up 40% of the land area. Approximately three-quarters of this area should be thermal cover with the remainder being hiding cover.

Table 3.6-16. Deer habitat acres within the Eyerly Project Area

Deer Habitat Type	Acres of Habitat
Winter Range	7,768 acres
Summer Range	13,856 acres
Transition Range	4,574 acres
Management Area 7	5,353 acres

Ecological types were mapped for the project area using information on soil types and the potential natural vegetation. The potential natural vegetation may differ from the what currently exists, however the ecotype has the potential to produce the climax vegetation if disturbance events were to occur naturally.

The eight ecotypes within the Eyerly Fire Salvage project are: mixed conifer wet, mixed conifer dry, ponderosa pine dry, Wyoming big sage/grassland, juniper dry, juniper moist, ponderosa pine/juniper wet, and wet meadow. Each area shows differences in site productivity, fire risks, expected shrub recovery times, seral stages, and conversion potential to less desirable species.

Bitterbrush is a major component of the potential natural vegetation, which is an important food source for big game during the winter months. The wintering area receives moderate use by deer, while most of the Metolius wintering deer herd continues east and winters on the Crooked River National Grassland and private lands.

The entire winter range consists of the ponderosa pine dry, juniper moist, and ponderosa pine/juniper wet conifer moist ecotypes, which can all support bitterbrush to varying degrees. The percent of bitterbrush that each ecotype could potentially produce is located in *Table 3.6-17*.

Table 3.6-17. Potential bitterbrush produced in each ecotype within the Eyerly Project area

Ecotype Name	Ecotype Group	% Bitterbrush
Ponderosa Pine Dry	PPD	3 to 43
Juniper Moist	JUOC moist	10
Ponderosa Pine/Juniper Wet	PP-JUOC wet	15

The remainder of the project area is considered transition and summer range. The transition range is a narrow strip occurring in the middle portion of the project area. Big game does not spend any significant time in this strip, but during spring-fall migrations they move through the area. Ponderosa pine types dominate this area where bitterbrush constitutes a large proportion of the potential natural vegetation. The summer range is dominated by the mixed conifer ecotype.

Hiding cover: The Deschutes National Forest LRMP (1990) states, hiding areas must be present over at least 30% of national forest land and will be dispersed throughout implementation units. Hiding cover must meet one of the following guidelines outside of black bark pine stands:

- Six acre or larger stand capable of hiding 90% of a standing adult deer from view of a human at a distance of 200 feet.
- Six acre or larger stand with an average height of 6 feet and which has not been thinned in 15 years.
- Residual clumps of one half acre or larger within units with advanced regeneration and at least 12 greater than 7 inch trees per acre remaining after harvest.
- Hiding cover is determined differently within black bark pine stands. Hiding cover must be present in approximately 10% of the treated stands where clumps will provide visual screening throughout the area. Cover must meet the following conditions:
- Cover patches must be at least ½ acre in size and must not have been thinned or harvested in the past 20 years. Small clumps will be suitable in dense stands but larger patches (4 to 5 acres) may be needed in more open stands.
- Clumps must be dispersed throughout the unit so that visual screening is provided.

Hiding cover is present in denser stands, ponderosa pine thickets, and along riparian reserves where stand replacement fire did not occur. Mixed conifer stands provide both hiding and thermal cover in general. The project area lies within a Late-Successional Reserve. Standards and guidelines for the LSR will take precedent over big game standards and guidelines. However, every attempt will be made to try and incorporate S&G's into unit design to try and meet these wherever possible.

Road Densities: Open road density within the LRMP S&G's is 2.5 miles per square mile unless specified in management area direction. The total open road densities within the Eyerly project area are within LRMP S&G's (*Table 3.6-18*). Target open road densities as described within MA-7 LRMP S&G's densities will average 1.0 to 2.5 miles per square mile in each unit. The open road densities within Eyerly MA-7 are also within LRMP S&G's.

Table 3.6-18. Eyerly project area road densities within deer habitat

Allocation	Road density (includes inactivated roads)	Open road density
MA7 Deer Habitat	4.45 miles/miles ²	1.81 miles/miles ²
Biological (Summer)	4.11 miles/miles ²	2.99 miles/miles ²
Biological (Transition)	4.53 miles/miles ²	2.24 miles/miles ²
Biological (Winter)	3.53 miles/miles ²	1.29 miles/miles ²
Eyerly Total	4.01 miles/miles²	2.35 miles/miles²

Elk: One hundred and twelve acres of the Eyerly project area is within the Metolius Key Elk Area (total acres in the Key Elk Area is 6,125). The project area also consists of biological elk winter range (7,768 acres). It is not considered an allocation in the

Deschutes LRMP, however, it is recognized as an important area for elk. See *Table 3.6-19* for a breakdown of elk habitat.

Table 3.6-19. Elk habitat acres within the Eyerly Project Area

Elk Habitat Type	Acres of Habitat
Winter Range	1,544 acres
Key Elk Area	112 acres

Hiding Cover: Within Key Elk Areas, the Deschutes National Forest LRMP (1990) states, “hiding areas must be present over at least 30% of national forest land and will be dispersed throughout implementation units.” Hiding cover must meet one of the following guidelines outside of black bark pine stands:

- Six acre or larger stand capable of hiding 90% of a standing adult elk from view of a human at a distance of 200 feet.
- Six acre or larger stand with an average height of 10 feet and which has not been thinned in 20 years.
- Residual clumps of two acres or larger stands within units with advanced regeneration (trees including “whips” up to 7 inch dbh) and at least 12 greater than 7 inch trees per acre remaining after harvest.
- Hiding cover is determined differently within black bark pine stands. Hiding cover must be present in approximately 10% of the treated stands where clumps will provide visual screening throughout the area. Cover must meet the following conditions:
 - Cover patches must be at least ½ acre in size and must not have been thinned or harvested in the past 20 years. Small clumps will be suitable in dense stands but larger patches (4 to 5 acres) may be needed in more open stands.
 - Clumps must be dispersed throughout the unit so that visual screening is provided.

Hiding cover is present in denser stands, ponderosa pine thickets, and along riparian reserves where stand replacement fire did not occur. Mixed conifer stands provide both hiding and thermal cover in general. The project area lies within a Late-Successional Reserve. Standards and guidelines for the LSR will take precedent over big game standards and guidelines. However, every attempt will be made to try and incorporate S&G’s into unit design to try and meet these wherever possible.

Road Densities: The total open road densities within the Eyerly project area are within the LRMP S&G’s (*Table 3.6-20*). The open road densities within key elk areas are also within LRMP S&G’s.

Table 3.6-20. Eyerly project area road densities within elk habitat

Allocation	Road density (includes inactivated roads)	Open road density
Key Elk Area	0.51 miles/miles ²	0.00 miles/miles ²
Biological (Winter)	2.28 miles/miles ²	0.48 miles/miles ²
Eyerly Total	4.01 miles/miles²	2.35 miles/miles²

Survey and Manage Species

Survey and Manage Species are currently being reviewed and an update of Regional Forester's Sensitive Species List is expected.

Mollusks

Crater Lake Tightcoil: One terrestrial mollusk, the Crater Lake Tightcoil (*Pristiloma arcticum crateris*), has been identified as needing surveys under the ROD and S&G's for Amendments to the Survey and Manage, Protection Buffer, and other Mitigation Measures Standards and Guidelines (USDA, 2001). This species falls into Category B (Rare, Pre-disturbance Surveys not Practical). Within this category, strategic surveys are to be conducted and all known sites are to be managed until further notice. This species is considered to be rare and identification of specimens is difficult because of its small size and cryptic habits. Expert identification is required.

"The Crater Lake Tightcoil may be found in perennially wet situations in mature conifer forests, among rushes, mosses and other surface vegetation or under rocks and woody debris within 10 m. of open water in wetlands, springs, seeps and riparian areas, generally in areas which remain under snow for long periods during the winter. Riparian habitats in the Eastern Oregon Cascades may be limited to the extent of permanent surface moisture, which is often less than 10 m. from open water" (Duncan et al 2003).

Threats to the species include activities that compact soils, reduce litter and/or vegetative cover, or impact potential food sources (i.e. livestock grazing, heavy equipment use, ORV's, and camping on occupied habitats). Fluctuations from removal of ground vegetation on ground temperature and humidity may be less extreme at higher elevations and on wetter sites, but no studies have been conducted to evaluate such a theory. These snails appear to occur on wetter sites than general forest conditions, so activities that would lower the water table or reduce soil moisture would degrade habitat (Burke et. al 1999).

Surveys were conducted to protocol using Version 2.0 during the fall of 2002 (Furnish et al 1997). These surveys occurred in riparian areas that suffered low severity burns as well as unburned areas within the project boundary. Approximately 122 acres were surveyed. No *Pristiloma arcticum crateris* were located during the effort, however *Pristiloma chersinella* were located at several locations. The new survey protocol (Version 3.0) was introduced in February of 2003, therefore spring 2003 survey efforts were modified to meet requirements in the new protocol. Version 3.0 states that surveys are required only in perennial wet areas (Duncan et al 2003). During the spring 2003 surveys only one *Pristiloma arcticum crateris* was located along the Metolius River (T. 11S, R. 09E, Section 11).

Neotropical Migratory Birds (NTMBS)

In the past few years, attention has increasingly focused on the downward population trends of many bird species. Neotropical migratory birds are of particular concern. While reasons for the declines are complex, factors believed to be responsible include habitat loss and fragmentation on wintering and breeding grounds, predation, cowbird parasitism, and pesticide use. The Deschutes National Forest is following guidelines from the

“Conservation Strategy for Landbirds of the East-Slope of the Cascade Mountains in Oregon and Washington” (Altman 2000) document which outlines conservation measures, goals and objectives for specific habitat types found on the east-slope of the Cascades and the focal species associated for each habitat type. See *Table 3.6-21* or specific habitat types highlighted in the document, the habitat features needing a conservation focus and the focal bird species for each.

Table 3.6-21. Priority habitat features and associated focal species for Central Oregon

Habitat	Habitat Feature	Focal Species for Central Oregon
Ponderosa Pine	Large patches of old forest with large snags	White-headed woodpecker
	Large trees	Pygmy nuthatch
	Open understory with regenerating pines	Chipping sparrow
	Patches of burned old forest	Lewis' woodpecker
Mixed Conifer (Late-Successional)	Large trees	Brown creeper
	Large snags	Williamson's sapsucker
	Interspersion grassy openings and dense thickets	Flammulated owl
	Multi-layered/dense canopy	Hermit thrush
	Edges and openings created by wildfire	Olive-sided flycatcher
Lodgepole Pine	Old growth	Black-backed woodpecker
Meadows	Wet/dry	Sandhill Crane
Aspen	Large trees with regeneration	Red-naped sapsucker
Subalpine fir	Patchy presence	Blue grouse

Another publication became available in 2002 from the U.S. Fish and Wildlife Service entitled “Birds of Conservation Concern 2002” (BCC) which identifies species, subspecies, and populations of all migratory nongame birds that, without additional conservation actions, are likely to become candidates for listing under the Endangered Species Act (ESA) of 1973. Bird species considered for inclusion on lists in this report include nongame birds, gamebirds without hunting seasons, subsistence-hunted nongame species in Alaska, and Endangered Species Act candidate, proposed endangered or threatened, and recently delisted species. While all of the bird species included in BCC 2002 are priorities for conservation action, the list makes no finding with regard to whether they warrant consideration for ESA listing. The goal is to prevent or remove the need for additional ESA bird listings by implementing proactive management and conservations actions (USFWS 2002).

Bird Conservation Regions (BCRs) were developed based on similar geographic parameters. Two BCRs encompass the Sisters Ranger District – BCR 5, Northern Pacific Rainforest and BCR 9, Great Basin. See *Tables 3.6-22* and *3.6-23* for a list of the bird species of concern for each area, the preferred habitat for each species, and whether there is potential habitat for each species within the Eyerly Fire Salvage project area.

Table 3.6-22 Bird Conservation Region 5 (Northern Pacific Rainforest) BCC 2002 list

Bird Species	Preferred Habitat	Habitat within the Eyerly Fire Salvage Area (Y or N)
Yellow-billed Loon	Tundra Lakes	No
Black-footed Albatross	Off-shore Islands	No
Northern Goshawk	Mature Coniferous Forests	Yes
Peregrine Falcon	Cliffs	No
Black Oystercatcher	Coastal Mudflats	No
Whimbrel	Marsh/Mudflats	No
Long-billed Curlew	Meadows	No
Marbled Godwit	Marsh/Wet Meadow	No
Black Turnstone	Coastal salt Grass Tundra	No
Surfbird	Open Rocky Habitat	No
Red Knot	Wet Low Tundra	No
Rock Sandpiper	Tundra	No
Short-billed Dowitcher	Wet Meadows in Boreal Forests	No
Caspian Tern	Sand or Gravel Beaches	No
Arctic Tern	Inland Lakes and Rivers	No
Aleutian Tern	Grassy Coastal Flats	No
Marbled Murrelet	Conifer Forest near Coast	No
Kittlitz's Murrelet	Coastal Mountains near Glaciers	No
Yellow-billed Cuckoo	Dense riparian/cottonwoods	No
Flammulated Owl	Ponderosa pine forests	Yes
Black Swift	Cliffs associated with waterfalls	No
Rufous Hummingbird	Forest edges near meadows/rip	Yes
Lewis's Woodpecker	Ponderosa pine forests	Yes
White-headed Woodpecker	Ponderosa pine forests	Yes
Olive-sided Flycatcher	Open coniferous forests	Yes
Horned Lark	Open Habitat	No
Vesper Sparrow	Open habitats/meadow	Yes

Table 3.6-23 Bird Conservation Region 9 (Great Basin) BCC 2002 list

Bird Species	Preferred Habitat	Habitat within the Eyerly Fire Salvage Area (Y or N)
Swainson's Hawk	Open lands with scattered trees	No
Ferruginous Hawk	Elevated Nest Sites in Open Country	No
Golden Eagle	Elevated Nest Sites in Open Country	Yes
Peregrine Falcon	Cliffs	No
Prairie Falcon	Cliffs in open country	No
Greater Sage Grouse	Sagebrush Dominated Rangelands	No
Yellow Rail	Dense Marsh Habitat	No
American Golden-Plover	Burned Meadows/Mudflats	No
Snowy Plover	Dry sandy beaches	No
American Avocet	Wet Meadow	No
Solitary Sandpiper	Meadow/Marsh	No
Whimbrel	Marsh/Mudflats	No
Long-billed Curlew	Meadow/Marsh	No
Marbled Godwit	Marsh/Wet Meadow	No
Sanderling	Sandbars and beaches	No
Wilson's Phalarope	Meadow/Marsh	No
Yellow-billed Cuckoo	Dense riparian/cottonwoods	No
Flammulated Owl	Ponderosa pine forests	Yes
Burrowing Owl	Non-forested grasslands	No
Black Swift	Cliffs associated with waterfalls	No
Lewis's Woodpecker	Ponderosa pine forests	Yes
Williamson's Sapsucker	Ponderosa pine forests	Yes
White-headed Woodpecker	Ponderosa pine forests	Yes
Loggerhead Shrike	Open country with scattered shrubs or small trees	No
Gray Vireo	Arid scrub habitat	No
Virginia's Warbler	Scrubby vegetation within arid montane woodlands	No
Brewer's Sparrow	Sagebrush clearings in coniferous forests/bitterbrush	Yes
Sage Sparrow	Sagebrush	No
Tricolored Blackbird	Cattails or Tules	No

❖ 3.6.3 Wildlife Environmental Consequences

Introduction

The environmental consequences of the alternatives included in the Eyerly EIS are initially described as the effects to landscape relationships that contribute to broad scale wildlife habitat. It is followed by the effects of the alternatives to threatened, endangered, and sensitive species; management indicator species; survey and management species, and finally neotropical birds.

Landscape Relationships

Effects of Alternative 1 – No Action

Snags: Snags are discussed here as a habitat component. This section will describe the effects of the alternatives on the snags within the planning area. Cavity nesters and a variety of other species that use snags can be affected by the number of snags on the landscape. Species-specific discussion, where applicable, is found throughout this section.

This alternative would not harvest snags except those proposing a hazard to public safety and as a result will not have a significant affect on current snags numbers. Existing snags will be maintained and the alternative will be consistent with Metolius LSRA snag standards (USDA 1996b).

Under Alternative 1, trees that pose a hazard to public safety would continue to be monitored and felled when identified. *Table 3.6-24* outlines the 2004 hazard trees under the No Action Alternative, however it is predicted that hazard trees will need to continue to be removed in these locations for several years. Hazard trees will be felled and left in place within Riparian Reserves, except within campgrounds.

Table 3.6-24. Estimated number of hazard trees identified for removal along highway safety act roads and within Perry South Campground for 2004.

Location	Tree Species	8 – 15" dbh	15 – 21" dbh	21" + dbh
64 Road from Forest boundary to Monty Campground	Ponderosa Pine	290	110	50
	Douglas-fir	180	75	35
	Incense Cedar/Juniper	55		10
Perry South Campground	Ponderosa Pine and Douglas-fir	140		25
1170 Road from the 1180 Road to the 64 Road	Ponderosa Pine	395	215	55
	Douglas-fir	55	30	5
	Incense Cedar/Juniper	45		1
Totals		1,590		181

The current snag densities in the project area are described under the existing condition and are a result of wildfire. It is unlikely that without an uncharacteristic fire event the ponderosa pine and mixed conifer dry sites could produce the number of snags exist on them now. It is also unlikely that if higher snag levels existed, they would persist due to the fire regime (high fire frequency). Therefore, areas that currently have large snag densities per acre (50 and 80% tolerance levels in *Table 3.6-2*) are not sustainable.

It is estimated that about 75% of the snags may fall within 20 years (Parks et al. 1999, Dahms 1949, Keen 1950, Haggard and Gaines 2001). Through time, no treatment may result in increased fuel loadings when snags begin to litter the forest floor. The higher fuel loading may result in the suppression of regeneration, which may prolong the establishment of late successional habitat conditions. Increased fuel loadings may also put remaining habitat at risk from disturbance (i.e. fire).

Down Wood: The no action alternative may result in increased fuel loadings when snags begin to litter the forest floor. The higher fuel loading may result in the suppression of regeneration, which may prolong the establishment of late successional habitat conditions. Increased fuel loadings may also put remaining habitat at risk from disturbance (i.e. fire).

Along the 64 road and within Perry South Campground, hazard trees are going to be felled for safety reasons. One hundred and seventy-six trees over 21 inches will be felled (*Table 3.6-21*). Hazard trees within riparian reserves will be left as down wood.

Connectivity and Old and Late Structure: Currently there are 449 acres of ponderosa pine and 1,418 acres of mixed conifer that exhibit old and late structural stand characteristics. That makes up about 7% of the project area within USFS boundaries. No treatment activities will take place in old and late structural stands.

Connectivity will remain the same as currently exists. There is no harvest proposed in green stands along the top of Green Ridge. Overall, 16% of the area (within USFS boundaries) meets 30% canopy closure or greater. Movement across the project area could be accomplished using unburned denser patches or individual live white fir trees through the ponderosa pine area. However, a large portion of the project area is burned or is comprised of the ponderosa pine PAG, which does not provide desirable dispersal habitat due to the openness of stands and patches that do exist are usually very dense making movement through them difficult. Dispersal could occur along unburned riparian reserves where stand densities are greater. Movement would probably be concentrated along both the west edge of the project area where there are more mixed conifer stands facilitating primarily north/south movement. Alternative 1 will not affect any of the existing old and late structure stands.

Effects of Alternative 2

Snags: This alternative will harvest snags in proposed units and result in consistency with Metolius LSRA snag standards (USDA 1996b). The number of snags and green trees per acre by size class and PAG were prescribed (*Table 3.6-2*). Additional snag guidelines are addressed in the ROD (USDA 1994), pages C-41 and 42 (general) and pages 33-35 in the Final SEIS (USDA 2001).

Hazard trees along the highway safety act roads and within Perry South Campground, will be felled for public safety. An estimated one hundred and eighty snags over 21 inches will be removed unless they are within a riparian reserve (See *Table 3.6-24*). Other hazard trees may be included in salvage operations along haul routes in order to provide for safe operations.

Also, 4,846 acres are proposed to be harvested in this alternative. *Table 3.6-25* identifies proposed treatments. HSV salvage would remove dead or severely damaged trees. Minimum diameter of salvage trees would be 12 inches. SPF salvage would utilize small diameter products such as posts, rails, house logs, chips, or firewood.

Table 3.6-25. Proposed treatments and acres for Alternative 2

Treatment	Acres
HSV – Stand Replacement	3,918
HSV – Mixed Severity	376
SPF – Stand Replacement	513
SPF – Mixed Severity	39
Total	4,846

Tables 3.6-26 and 3.6-27 compare the Metolius LSRA numbers against the appropriate habitat types from DecAID.

Table 3.6-26 Metolius LSRA snag retention levels for trees 9 inches dbh and above compared to DecAID numbers for small and medium trees.

PAG	LSRA Snag Retention Levels	30% TL for snags $\geq$ 9 inches	50% TL for snags $\geq$ 9 inches	80% TL for snags $\geq$ 9 inches
MCW (Climatic)	12.92	6.7	12.6	25.3
MCD (Fire Climax)	6.51	6.7	12.6	25.3
PPW (Fire Climax)	4.37	1.3	2.7	7.2
PPD (Fire Climax)	2.48	1.3	2.7	7.2

Table 3.6-27 Metolius LSRA snag retention levels for trees 20 inches dbh and above compared to DecAID numbers for small and medium trees.

PAG	LSRA Snag Retention Levels	30% TL for snags $\geq$ 20 inches	50% TL for snags $\geq$ 20 inches	80% TL for snags $\geq$ 20 inches
MCW (Climatic)	8.0	2.7	4.3	8.6
MCD (Fire Climax)	4.4	2.7	4.3	8.6
PPW (Fire Climax)	2.37	1.1	1.1	2.5
PPD (Fire Climax)	1.74	1.1	1.1	2.5

Table 3.6-28 shows the distribution of snags based on tolerance levels from DecAID for Alternative 2, and Alternative.

Table 3.6-28. Alternative 2 distribution of snags on the project area (within USFS lands)

Alternative 2								
Tolerance Level	0-29 %		30-49 %		50-79 %		$\geq$ 80 %	
DBH	$\geq$ 9	$\geq$ 21	$\geq$ 9	$\geq$ 21	$\geq$ 9	$\geq$ 21	$\geq$ 9	$\geq$ 21
Ponderosa Pine (Acres)	2,188	4,630	3,422	0	933	7,666	8,824	3,072
Mixed Conifer (Acres)	3,570	8,239	3,753	506	1,819	1,084	932	246

Habitat for 7 post-fire species that require a minimum of 7.2 snags per acre greater than 9 inches (see MIS – Primary Cavity excavators) will be provided under Alternative 2 because:

Within the ponderosa pine type, 8,824 acres exceed 7.2 snags per acre greater than or equal to 9 inches dbh and 3,072 acres exceed 2.5 snags per acre greater than or equal to 21 inches dbh.

In the mixed conifer type, 1,819 acres have 12.6 to 25.3 snags per acre greater than or equal to 9 inches dbh and 1,519 acres have 4.3 to 8.6 snags per acre greater than or equal to 21 inches dbh.

In the mixed conifer type, 932 acres exceed 25.3 snags per acre greater than or equal to 9 inches dbh and 247 acres exceed 8.6 snags per acre greater than or equal to 21 inches dbh.

Again, the snag densities throughout the project area are a result of wildfire and it is unlikely that in the ponderosa pine and mixed conifer dry sites that the number of trees needed to produce the number of snags exist now. It is also unlikely that if higher snag levels existed, they would persist due to the fire regime (high fire frequency). Therefore, areas that currently have large snag densities per acre (50 and 80% tolerance levels in *Table 3.6-2*) are not sustainable. It is estimated that about 75% of the snags may fall within 20 years (Parks et al. 1999, Dahms 1949, Keen 1950, Haggard and Gaines 2001).

Within the HSV stand replacement salvage, live canopy cover remains in small isolated patches. Removal of snags and down wood in these areas will reduce the potential nesting habitat for cavity nesters in the short term. Although long term it is estimated that about 75% of the snags may fall within 20 years (Parks et al. 1999, Dahms 1949, Keen 1950, Haggard and Gaines 2001).

Within the HSV mixed severity salvage, canopy cover remains in patches. In the short term this salvage will decrease the amount of snags and down wood. However, without treatment to the mixed severity stands, the remaining large live trees (greater than 21 inches dbh) in these stands may suffer mortality due to insects and disease. The loss of large trees in the next few years will decrease the available replacement snags for several decades.

Alternative 2 will result in a decrease in structure, primarily material greater than 12". Loss of structure will change available habitat conditions favoring species that prefer snags in a more open landscape. Current species abundance may decrease or species may be displaced into adjacent areas or into marginal habitat. However, species that prefer more open stands will benefit from this treatment. Some large snags may be lost due to safety concerns and structure may be consumed during post harvest activities, primarily underburning.

Fuel treatments will have varying impacts on snags (as well as down woody material). Underburning usually results in smaller material being consumed while retaining larger structure if burning occurs in the spring. However, advanced decay class material may be at risk in any season. Handpiling would result in larger snags (and down woody material) being retained, which maintains potential nesting structure for cavity nesters.

Machine piling or machine piling in trails is preferred where snag densities are low. Piles can be located away from snags and down logs to reduce impacts to potential habitat. Underburning and mowing would result in the greatest reduction in risk to residual stands, however there is also a greater risk of loss to existing snags (and down woody material) degrading habitat.

Outside of treatment areas there may be increased fuel loadings when snags begin to litter the forest floor. The higher fuel loading may result in the suppression of regeneration, which may prolong the establishment of late successional habitat conditions. Increased fuel loadings may also put remaining habitat at risk from disturbance (i.e. fire).

Down Wood: In all units down wood will represent the species composition of the stand. Down woody material that existed pre-fire should be retained and protected to the greatest extent possible from disturbance during treatment (e.g. fuels treatments and yarding) which might otherwise destroy the integrity of the substrate (ROD C-40).

Approximately, 4,846 acres or 27% of USFS land within the fire area will be treated. Within those 4,846 acres, 1,426 acres are within the LSR. Tons per acre of down wood are consistent with the Metolius LSR guidelines, and will be retained as outlined in the Eyerly Biological Assessment and Wildlife specialist report. In the 3,420 acres outside of the LSR, a minimum of 120 linear feet of logs per acre greater than or equal to 16" in diameter and 16 feet long in decay classes 1 and 2 will be retained.

Fuel treatments will have varying impacts on down woody material. Underburning usually results in smaller material being consumed while retaining larger structure if burning occurs in the spring. However, advanced decay class material may be at risk in any season. Handpiling would result in larger down woody material being retained, which maintains potential nesting structure. Machine piling or machine piling in trails is preferred where as piles can be located away from down logs to reduce impacts to potential habitat. Underburning and mowing would result in the greatest reduction in risk to residual stands, however there is also a greater risk of loss to existing down woody material degrading habitat.

HSV salvage would remove dead or severely damaged trees. Minimum diameter of salvage trees would be 12 inches. SPF salvage would utilize small diameter products such as posts, rails, house logs, chips, or firewood.

Within the HSV stand replacement salvage, live canopy cover remains in small isolated patches. Removal of snags and down wood in these areas will reduce potential down wood habitat. However, residual snags will be providing down wood habitat within the next 20 years.

Within the HSV mixed severity salvage, canopy cover remains in patches. In the short term this salvage will decrease the amount of down wood. However, without treatment to the mixed severity stands, the remaining large live trees (greater than 21 inches dbh) in these stands may suffer mortality due to insects and disease. The loss of large trees in the next few years will decrease the available replacement down wood for several decades.

Connectivity, and Old and Late Structure: No treatment will occur in old and late structural forests. However, there are 376 acres proposed for treatment within the HSV mixed severity salvage stands where large trees and canopy cover remains in patches. The stands that are identified for mixed severity do not meet the definition of old and late structural stands. The stands proposed for treatment were identified to reduce the risk of insects and disease to remaining live trees. No trees expected to live will be removed in the mixed severity stands. Snag numbers would follow guidelines outlined in *Table 3.6-2*. In the short term, salvage will decrease the level of snags and down wood. However, without treatment in mixed severity stands, remaining large live trees (greater than 21 inches dbh) in these stands may suffer mortality due to increased levels of insects and disease. The loss of large trees will decrease the available old and late structure but may not reduce connectivity. These stands do not meet the 30% canopy closure criteria for providing spotted owl dispersal habitat.

Because no harvest is proposed along the green stands along the top of Green Ridge, this Alternative is not expected to have any impact on the connectivity corridor. Under Alternative 2, the old and late structure stands in mixed severity stands would result in the removal of snags in the short-term, however this treatment would improve the resilience of the remaining large green trees and avoid future insect mortality.

Designation of New Old-Growth Blocks: During the Eyerly Fire that occurred July 2002 two old growth management areas (MA- 15) within the Deschutes National Forest LRMP suffered stand replacement events. As required by the LRMP two new blocks of old growth will be designated for replacement.

The goal of Management Area 15 (Old Growth), as described in the Deschutes National Forest LRMP is to provide naturally evolved old growth forest ecosystems for:

1. Habitat for plant and animal species associated with Old Growth forest ecosystems.
2. Representations of landscape ecology.
3. Public Enjoyment of large, old-tree environments.
4. The needs of the public from an aesthetic spiritual sense.

The general theme and objectives for Management Area 15 state that old growth will be managed to provide for:

1. Large trees.
2. Abundant standing and down dead trees.
3. Vertical structure (multiple vegetative canopy heights).

The distribution and minimum size of old growth areas were based upon the habitat requirements of the northern goshawk for ponderosa pine and marten for mixed conifer. Below are criteria that will be used in trying to find suitable new old growth stands.

Ponderosa Pine

Eyerly Fire Old growth.

- At least 208 acres
- Ponderosa Pine Dry PAG.

New Old-growth filters.

- At least 13 trees greater than or equal to 21" dbh.

Goshawk Habitat Variables

- Greater than or equal to 40% canopy closure.
- Nesting sites should be available with micro sites having at least 60% canopy closure and should be multi-storied.

Mixed Conifer

Eyerly Fire Old growth.

- At least 145 acres
- Mixed Conifer Wet and Dry PAGs.

New Old-growth filters.

- At least 15 trees greater than or equal to 21" dbh.
- Mutli-storied.
- Would prefer to be in a LSR is possible.

Marten Habitat Variables

- Greater than or equal to 40% canopy closure.
- Denning sites on the west side exhibited 8 to 20 pieces of down wood per acre of at least 30" dbh.
- Denning sites also exhibited 2 to 3 snags per acres greater than or equal to 20" dbh.
- We have very limited acres of forest that meet the denning site variables stated above. However, it is assumed that the more large down wood, the better the chance for marten use. After finding 40% CC and at least 15 trees greater than or equal to 21" dbh, stands will be chosen that exhibit high levels of down wood and high levels of snags that could eventually contribute to down wood numbers.

On November 7, 2003 Rob Schantz (Silviculturist) and Kris Hennings (Wildlife Biologist) scouted for old growth stands within the Eyerly project area. The following areas were observed following a query performed for possible old growth. The query was based on large trees per acre from the photo interpretation layer. The areas looked at are located in *Table 3.6-29*.

Table 3.6-29. Possible Old Growth Stands observed on November 7, 2003

Location	Plant Association	Legal
1190 rd near the 930 spur	Ponderosa Pine	T 11S, R 10E, Sections 4 and 5
1149 rd near the 700 spur	Mixed Conifer	T 11S, R 10E, Sections 30 and 31
1149 rd near the 800 spur	Mixed Conifer	T 11S, R 10E, Section 8
64 rd near the 950 spur	Mixed Conifer	T 10S, R 10E, Section s 33 and 34

The best possible replacement old growth stands were located and recorded. On November 19, 2003 Schantz and Hennings reassembled and designated stands. The new old growth stands suggested as replacement areas for the Eyerly fire are located in *Table 3.6-30* represent the best stands available.

Table 3.6-30. New stands to be designated as Old Growth Management Areas

Plant Association	Stand Number ID	Acres
Ponderosa Pine	60495	230.60
	60497	
	60499	
	60502	
	60503	
	60509	
	60510	
	60511	
	60512	
	60513	
	60514	
Mixed Conifer	59958	182.82
	59969	
	59970	
	60537	
	60539	
	60540	

The proposed ponderosa pine old growth stands meets most of the criteria described in the above section. However, 13 trees greater than 21 inches dbh and 40 % canopy closure are not met on every acre of the stand.

The mixed conifer old growth stands meet most of the criteria described in the above section. However, 15 trees greater than 21 inches dbh and 40 % canopy closure are not met on every acre of the stand. The marten variables listed above include large quantities of down wood and high numbers of snags. The stands identified in the above table are the best available to replace the mixed conifer old growth management area. During the field reconnaissance most large trees encountered were ponderosa pine with some Douglas-fir.

Effects of Alternative 3

Snags: The Lewis' Woodpecker has been selected as the focal species for the Eyerly project because of its relationship in Central Oregon within ponderosa pine Plant Association Group. This alternative will harvest snags in designated units to the 30 % and 50 % tolerance levels for the Lewis' woodpecker indicated by DecAID. Alternative 3 includes design elements to leave snags at a higher level than those described in the Metolius LSRA (USDA 1996b). Snag levels are located in *Table 2.8-2* in Chapter 2.

As under Alternative 2, hazard trees along highway safety act roads and within Perry South Campground will be felled for safety reasons. Hazard trees along the highway safety act roads and within Perry South Campground, will be felled for public safety. An estimated one hundred and eighty snags over 21 inches will be removed unless they are within a riparian reserve (See *Table 3.6-22*). Other hazard trees may be included in salvage operations along haul routes to provide for the safety of the operations.

Also, 2,893 acres are proposed to be harvested within this alternative. *Table 3.6-30* identifies the treatments. HSV salvage would remove dead or severely damaged trees. Minimum diameter of salvage trees would be 12 inches. SPF salvage would utilize small diameter products such as posts, rails, house logs, chips, or firewood.

Table 3.6-31. Proposed Treatments and acres for Alternative 3

Treatment	Acres
HSV – Stand Replacement	2,532
HSV – Mixed Severity	0
SPF – Stand Replacement	361
SPF – Mixed Severity	0
Total	2,893

Table 3.6-32 shows the distribution of snags based on tolerance levels from DecAID for Alternative 3.

Table 3.6-32. Alternative 3 distribution of snags on the project area (within USFS lands)

Alternative 3								
Tolerance Level	0-29 %		30-49 %		50-79 %		≥ 80 %	
DBH	≥ 9	≥21	≥ 9	≥21	≥ 9	≥21	≥ 9	≥21
Ponderosa Pine (Acres)	1,745	4,628	795	0	1,025	7,082	11,801	3,655
Mixed Conifer (Acres)	2,182	8,239	4,706	506	1,930	1,028	1,257	302

Within the HSV stand replacement salvage, live canopy cover remains in small isolated patches. Removal of snags and down wood in these areas will reduce the potential nesting habitat for cavity nesters. Again, it is estimated that about 75% of the snags may fall within 20 years (Parks et al. 1999, Dahms 1949, Keen 1950, Haggard and Gaines 2001).

Alternative 3 will result in a decrease in structure, primarily material greater than 12" dbh. Loss of structure will change available habitat conditions favoring species that prefer snags in a more open landscape. Current species abundance may decrease or species may be displaced into adjacent areas or into marginal habitat. However, species that prefer more open stands will benefit from this treatment. Some large snags may be lost due to safety concerns and structure may be consumed during post harvest activities, primarily underburning.

Fuel treatments will have varying impacts on snags and down woody material.

Underburning usually results in smaller material being consumed while retaining larger structure if burning occurs in the spring. However, advanced decay class material may be at risk in any season. Handpiling would result in larger down woody material and snags being retained, which maintains potential nesting structure for cavity nesters. Machine piling or machine piling in trails is preferred where snag densities are low. Piles can be located away from snags and down logs to reduce impacts to potential habitat.

Underburning and mowing would result in the greatest reduction in risk to residual stands, however there is also a greater risk of loss to existing snags and down woody material degrading habitat.

In areas not identified for treatment, no treatment may result in increased fuel loadings when snags begin to litter the forest floor. The higher fuel loading may result in the suppression of regeneration, which may prolong the establishment of late successional habitat conditions. Increased fuel loadings may also put remaining habitat at risk from disturbance (i.e. fire).

Down Wood: Similar to Alternative 2, the down wood in all units would represent the species composition of the stand. Down woody material that existed pre-fire should be retained and protected to the greatest extent possible from disturbance during treatment (e.g. fuels treatments and yarding) which might otherwise destroy the integrity of the substrate (ROD C-40).

Fuel treatments will have varying impacts on down woody material. Underburning usually results in smaller material being consumed while retaining larger structure if burning occurs in the spring. However, advanced decay class material may be at risk in any season. Handpiling would result in larger down woody material and snags being retained, which maintains potential nesting structure. Machine piling or machine piling in trails is preferred where snag densities are low. Piles can be located away from snags and down logs to reduce impacts to potential habitat. Underburning and mowing would result in the greatest reduction in risk to residual stands, however there is also a greater risk of loss to existing snags and down woody material degrading habitat.

Approximately, 2,893 acres or 16% of USFS land within the fire area will be treated. Within those 2,893 acres, 1,049 acres are within the LSR. Tons per acre of down wood are consistent with the Metolius LSR guidelines, and will be retained as outlined in the Eyerly Biological Assessment and Wildlife specialist report. In the 1,844 acres outside of the LSR, a minimum of 120 linear feet of logs per acre greater than or equal to 16" in diameter and 16 feet long in decay classes 1 and 2 will be retained.

Table 3.6-8 identifies the treatments prescribed for the 2,893 acres that would be harvested within this alternative. HSV salvage would remove dead or severely damaged trees. Minimum diameter of salvage trees would be 12 inches. SPF salvage would utilize small diameter products such as posts, rails, house logs, chips, or firewood.

Within the HSV stand replacement salvage, live canopy cover remains in small isolated patches. Removal of snags and down wood in these areas will reduce potential down wood habitat. However, residual snags will be providing down wood habitat within the next 20 years.

Connectivity and Old and Late Structure: Unlike Alternative 2, this alternative does not propose harvest within mixed severity salvage stands where large trees and canopy cover remains in patches. No treatments would occur in these stands to reduce the risk of insects and disease to remaining live trees. However, without treatment in mixed severity stands, remaining large live trees (greater than 21 inches dbh) in these stands may suffer mortality due to increased levels of insects and disease. The loss of large trees will decrease the available old and late structure but may not reduce connectivity. Alternative 3 treatments will not alter the existing connectivity or old and late structural stage stands. Treatments will only occur in stands that are classified as stand replacement. Overall, Alternative 3 will not affect connectivity as there is no harvest proposed in any alternative in green stands along the top of Green Ridge, nor will it affect existing old and late structure.

Designation of New Old-Growth Blocks: During the Eyerly Fire two old growth management areas (MA- 15) within the Deschutes National Forest LRMP suffered stand replacement events. As required by the LRMP two new blocks of old growth will be designated for replacement. The new old growth blocks proposed under Alternative 3 are the same as presented under Alternative 2. A complete discussion of this new designation can be found under Alternative 2.

Comparison of Alternatives

Snags: Figures 3.6-3 through 3.6-6 show a comparison of distributions of snag densities of all the Alternatives along with DecAID numbers.

Figure 3.6-3 Eyerly Fire Salvage Snag Distribution (9 Inches or Greater) for Ponderosa Pine

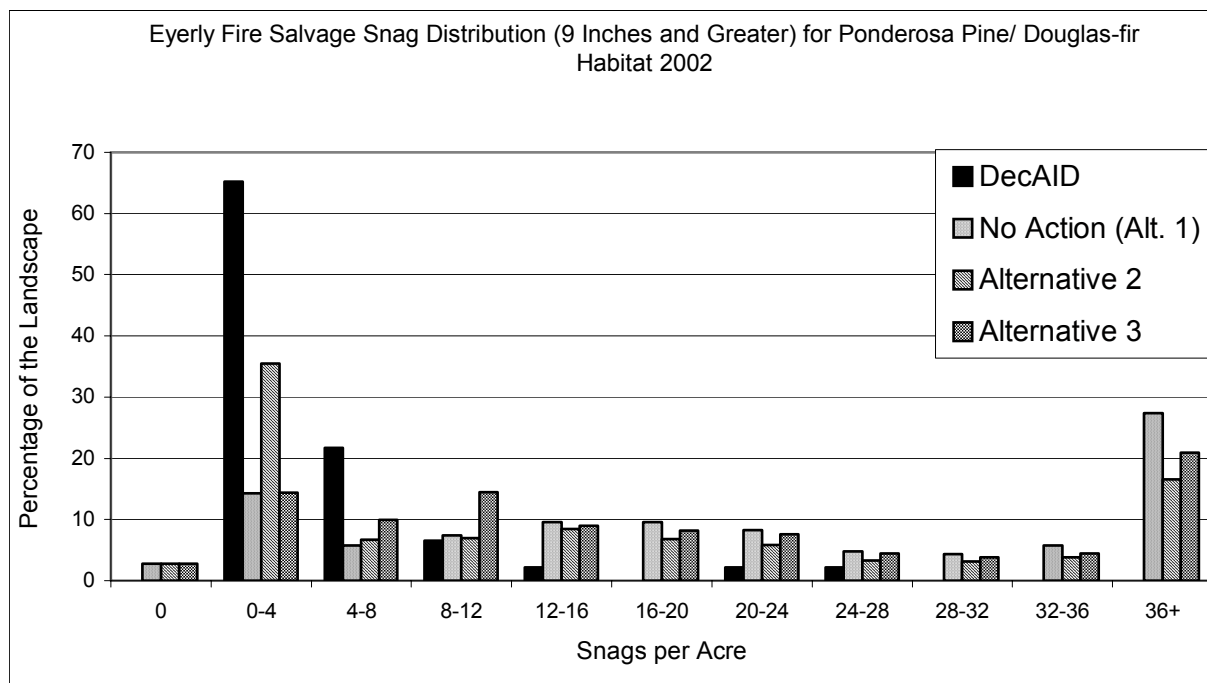


Figure 3.6-4 Eyerly Fire Salvage Snag Distribution (21 Inches or Greater) for Ponderosa Pine

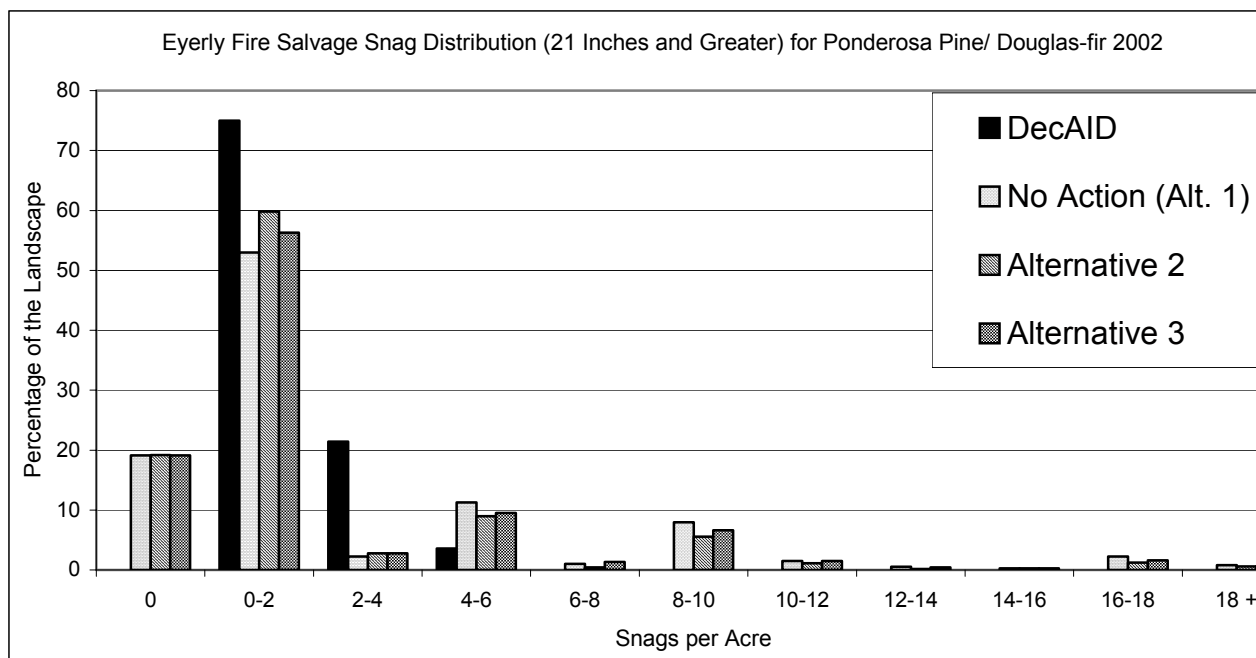


Figure 3.6-5 Eyerly Fire Salvage Snag Distribution (9 Inches or Greater) for Mixed Conifer

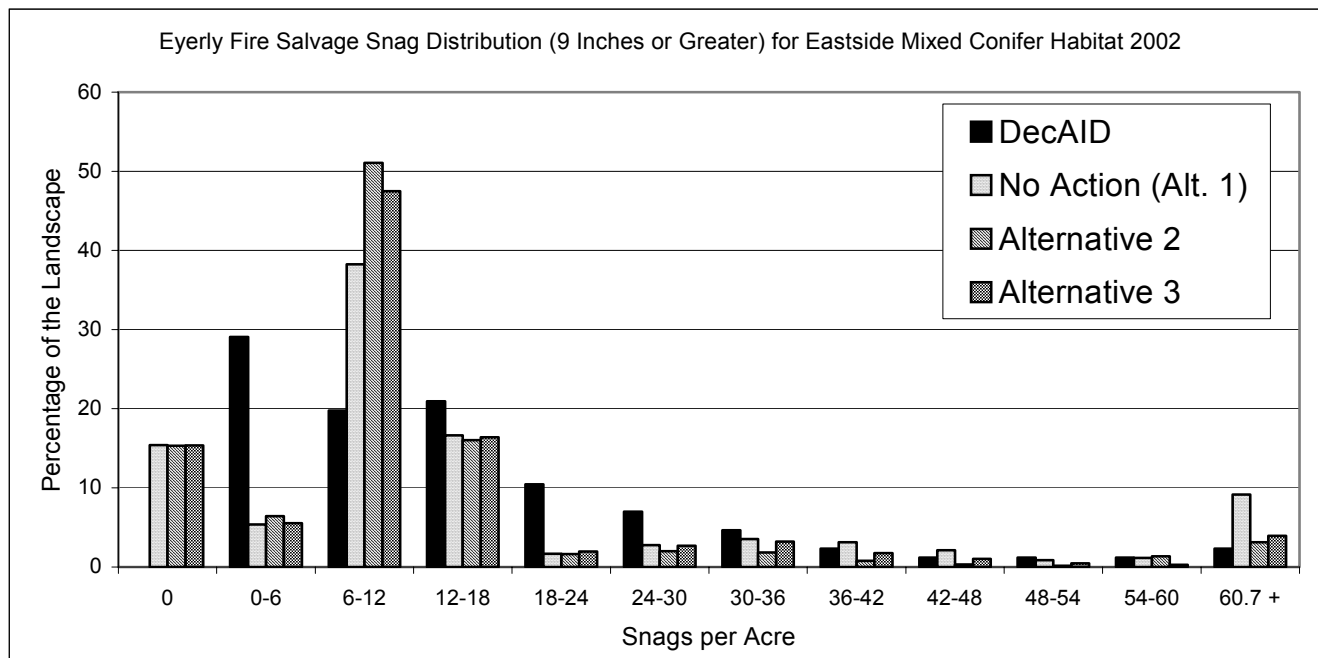
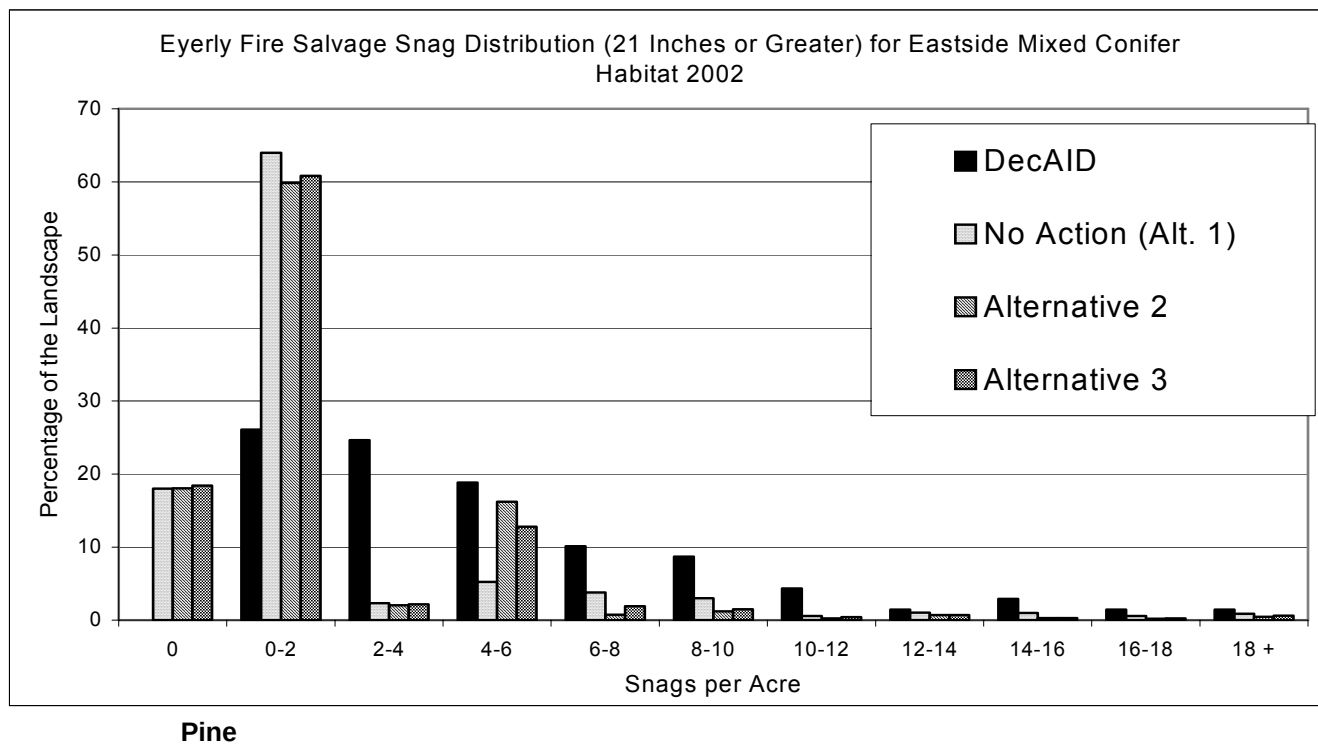


Figure 3.6-6 Eyerly Fire Salvage Snag Distribution (21 Inches or Greater) for Ponderosa



Utilizing the Eyerly FVS-FFE model runs and some projections snags dynamics overtime can be projected. See the wildlife report for a detailed account of how the analysis was completed. Figures 3.6-7 through 3.6-10 show estimated snag projections on the landscape over time.

Figure 3.6-7 Eyerly Fire Salvage Snag Distribution (10" or Greater) for Ponderosa Pine Over Time

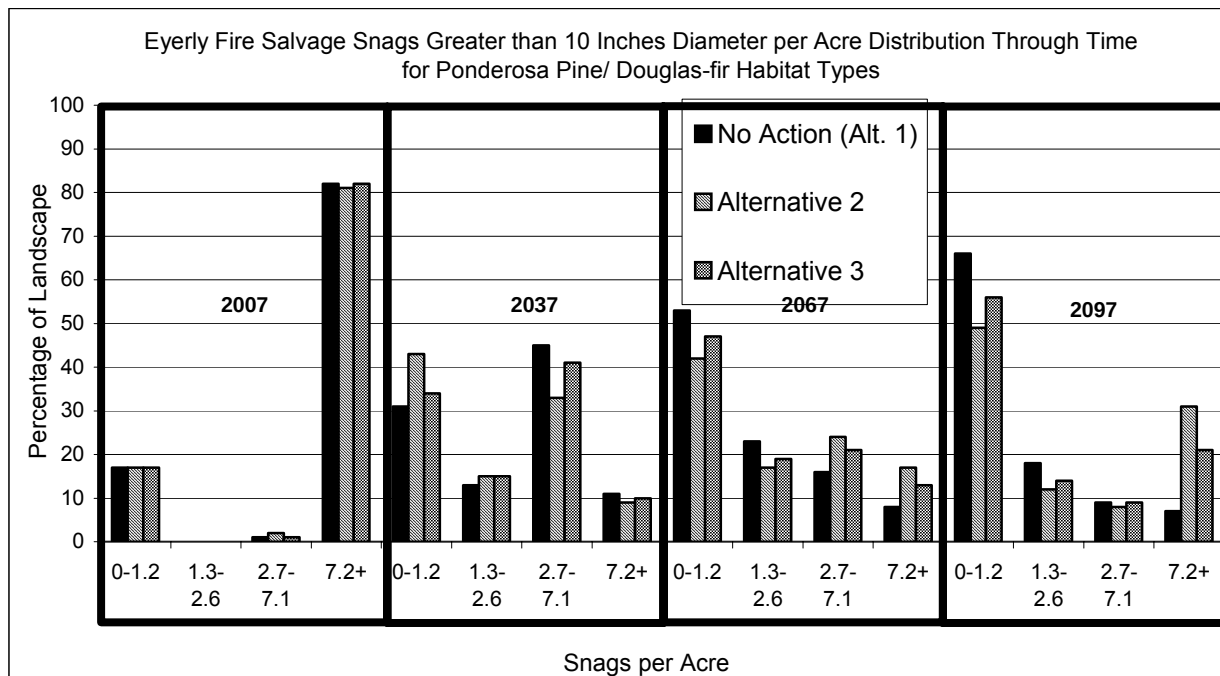


Figure 3.6-8 Eyerly Fire Salvage Snag Distribution (20" or Greater) for Ponderosa Pine Over Time

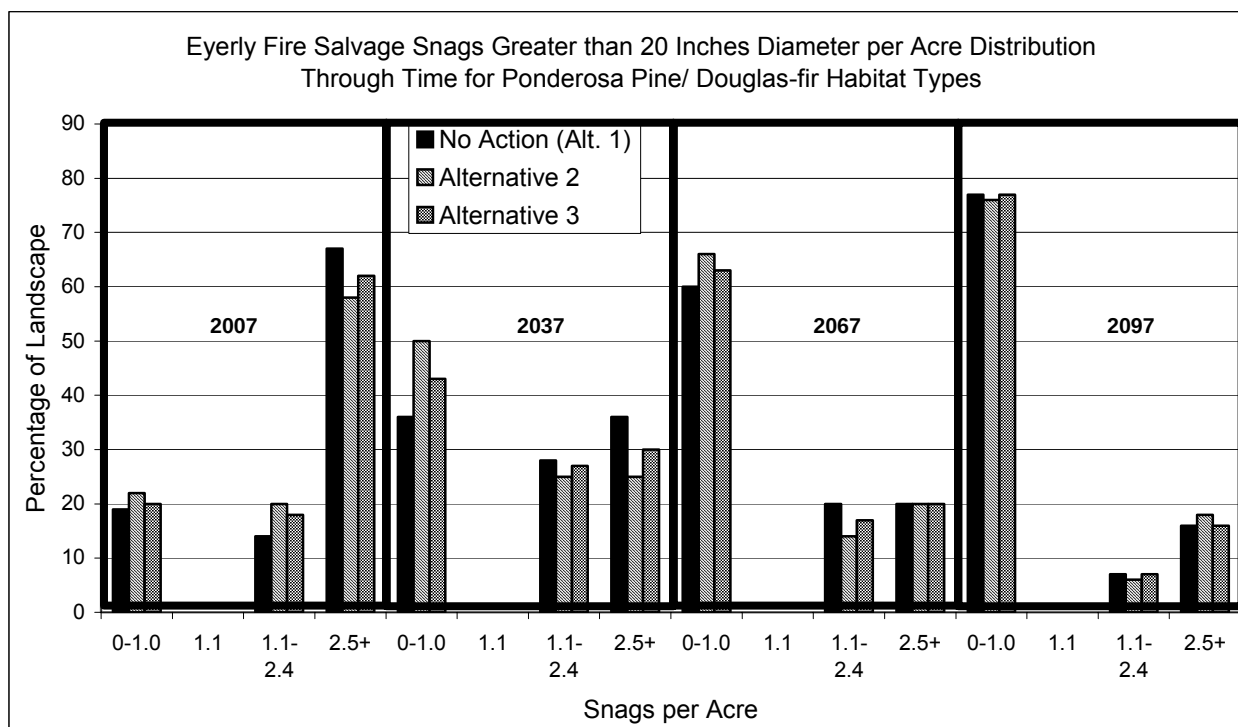


Figure 3.6-9 Eyerly Fire Salvage Snag Distribution (10" or Greater) for Mixed Conifer Over Time

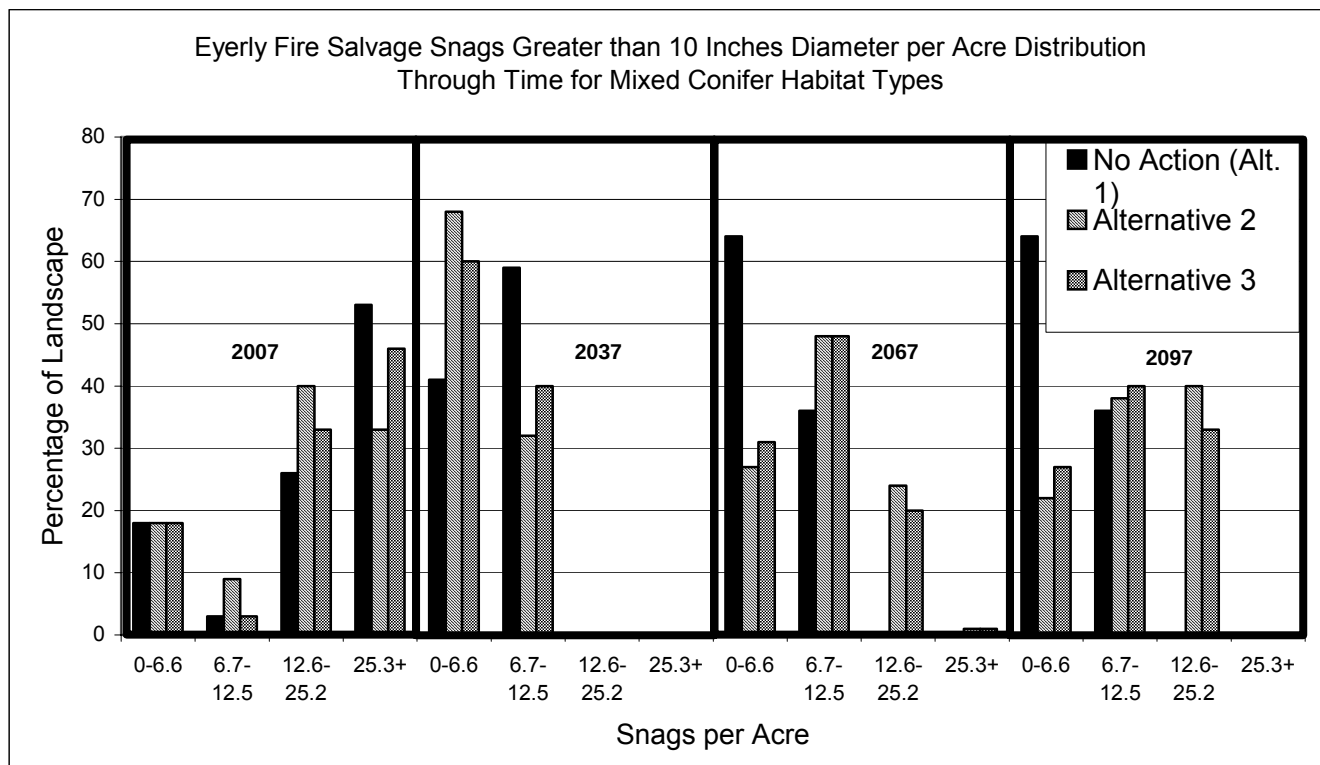
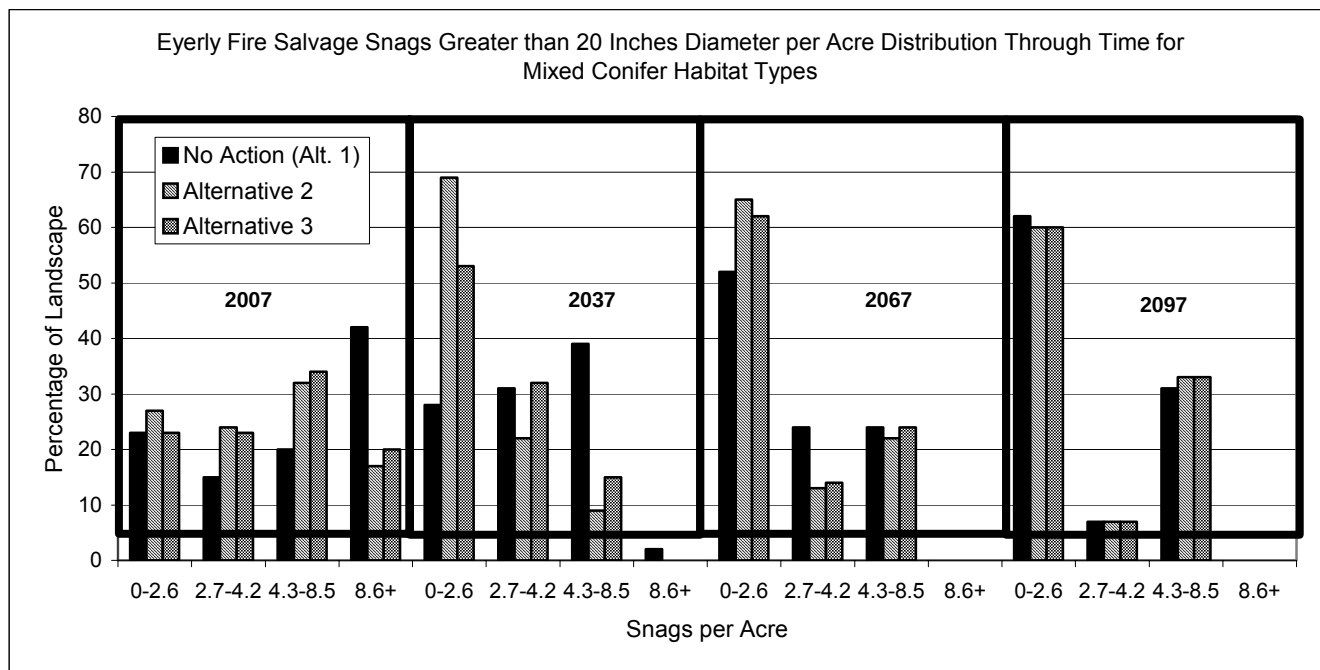


Figure 3.6-10 Eyerly Fire Salvage Snag Distribution (20" or Greater) for Mixed Conifer Over Time



Down Wood: Utilizing the Eyerly FVS-FFE model runs and some projections snags dynamics overtime were projected. See the wildlife report for a detailed account of how the analysis was completed. The years 2002 and 2032 were chosen to illustrate the rate of down wood recruitment from snags. Figures 3.6-11 through 3.6-14 show estimated projections of down wood on the landscape.

Figure 3.6-11 Eyerly Fire Salvage Percent Down Wood Distribution for Ponderosa Pine 2002

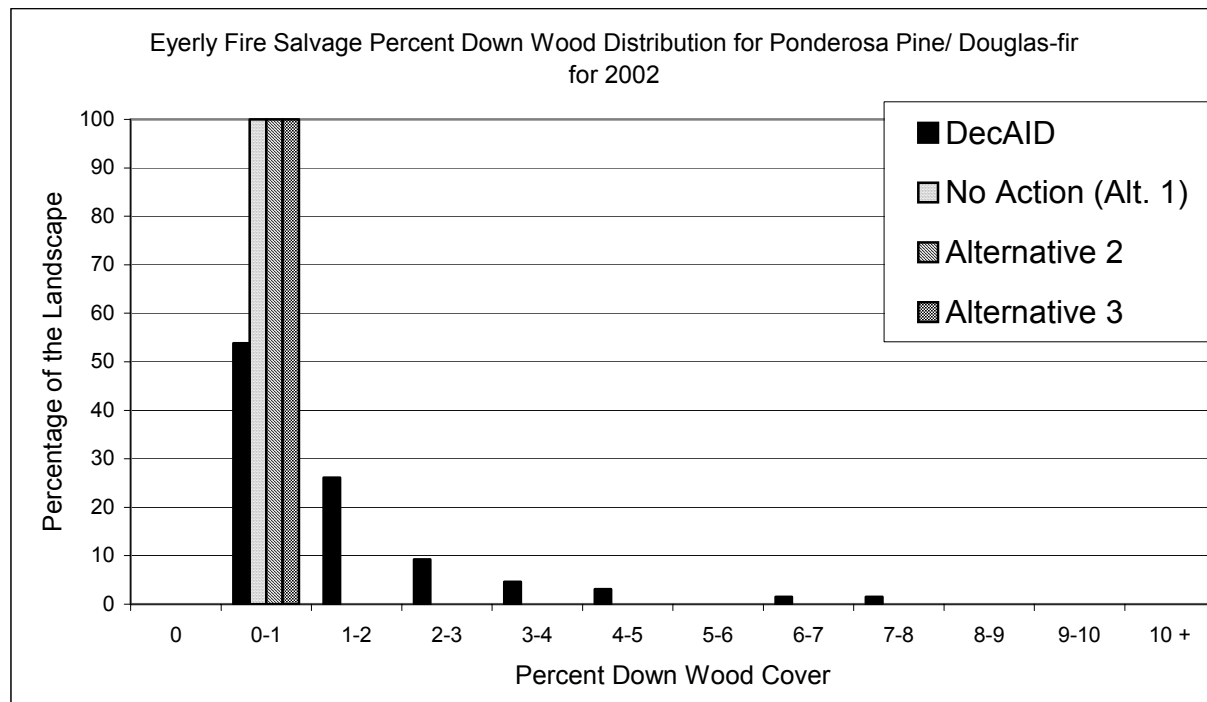


Figure 3.6-12 Eyerly Fire Salvage Percent Down Wood Distribution for Ponderosa Pine 2032

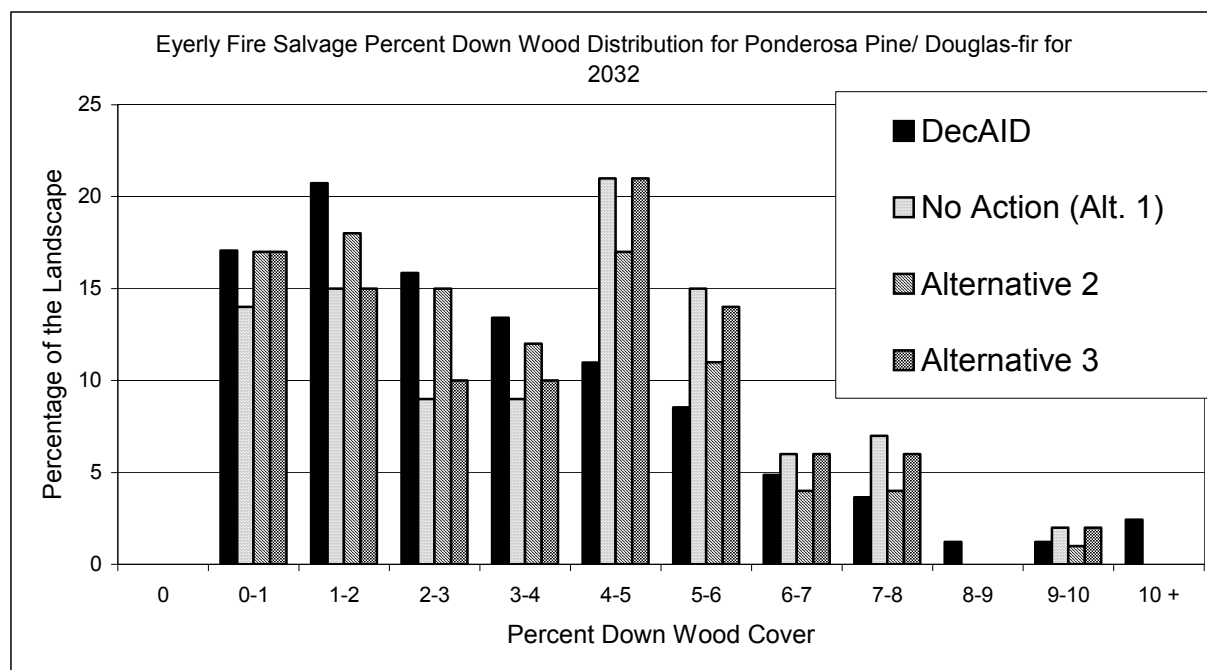


Figure 3.6-13 Eyerly Fire Salvage Percent Down Wood Distribution for Mixed Conifer 2002

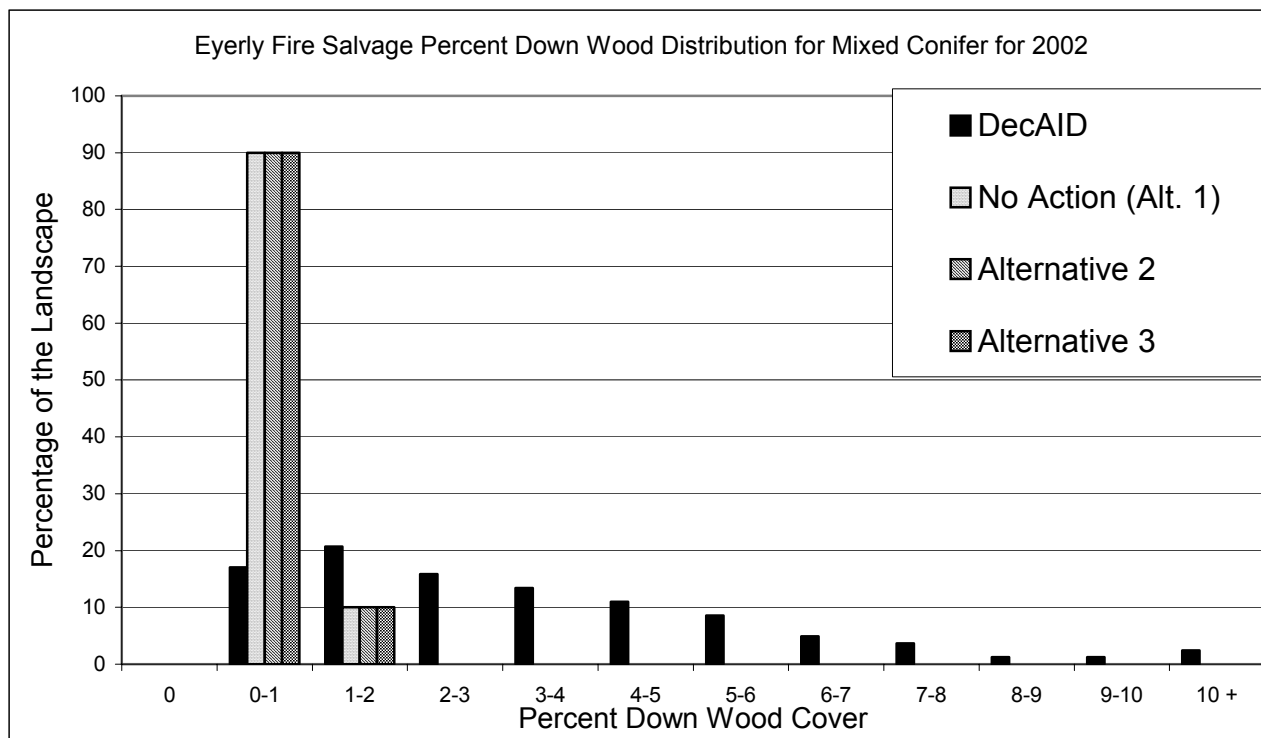
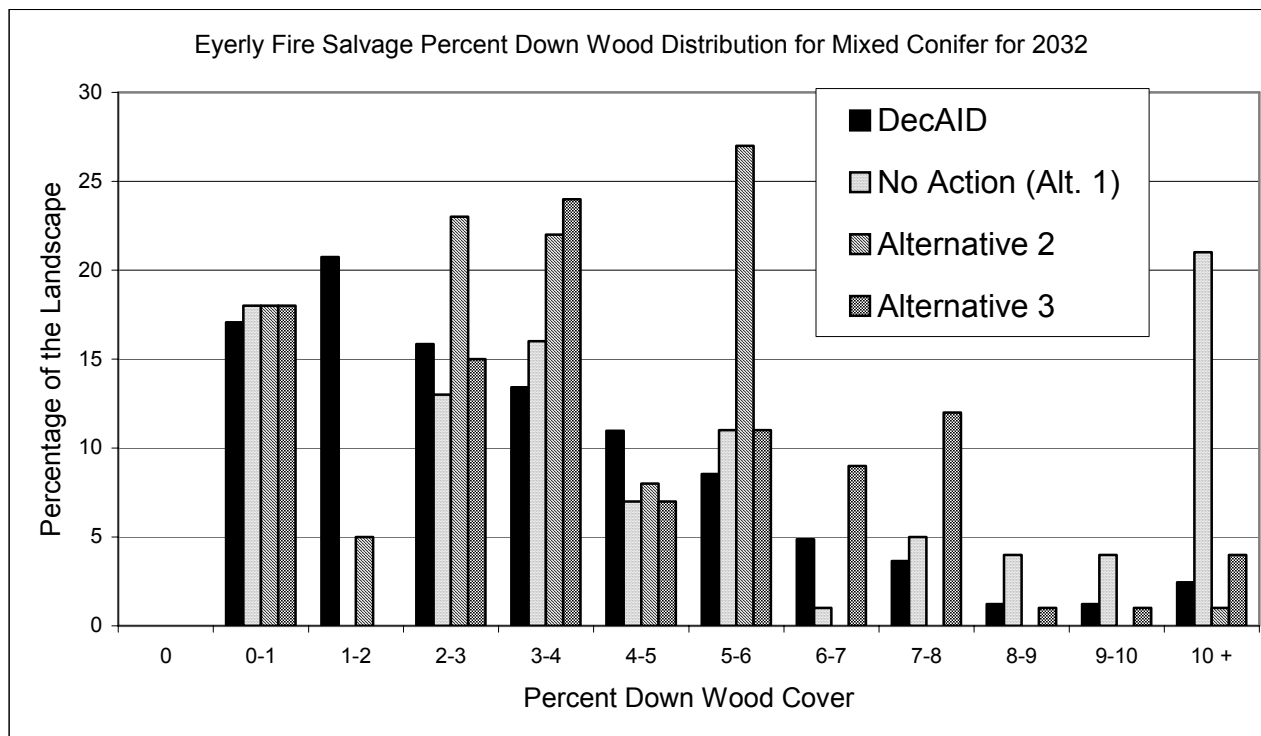


Figure 3.6-14 Eyerly Fire Salvage Percent Down Wood Distribution for Mixed Conifer 2032



Utilizing the Eyerly FVS-FFE model runs and some projections down wood dynamics overtime can be projected. See the wildlife report for a detailed account of how the

analysis was completed. Figures 3.6-15 through 3.6-18 show estimated percent down wood projections on the landscape over time.

Figure 3.6-15 Eyerly Fire Salvage Percent Down Wood Distribution Over Time for Ponderosa Pine

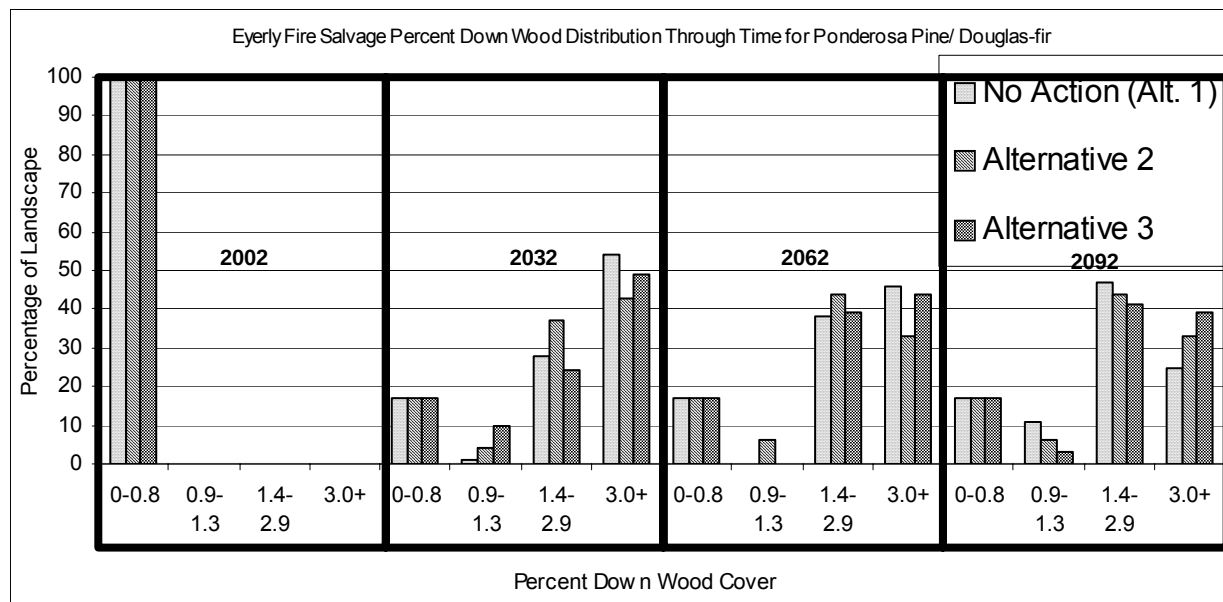
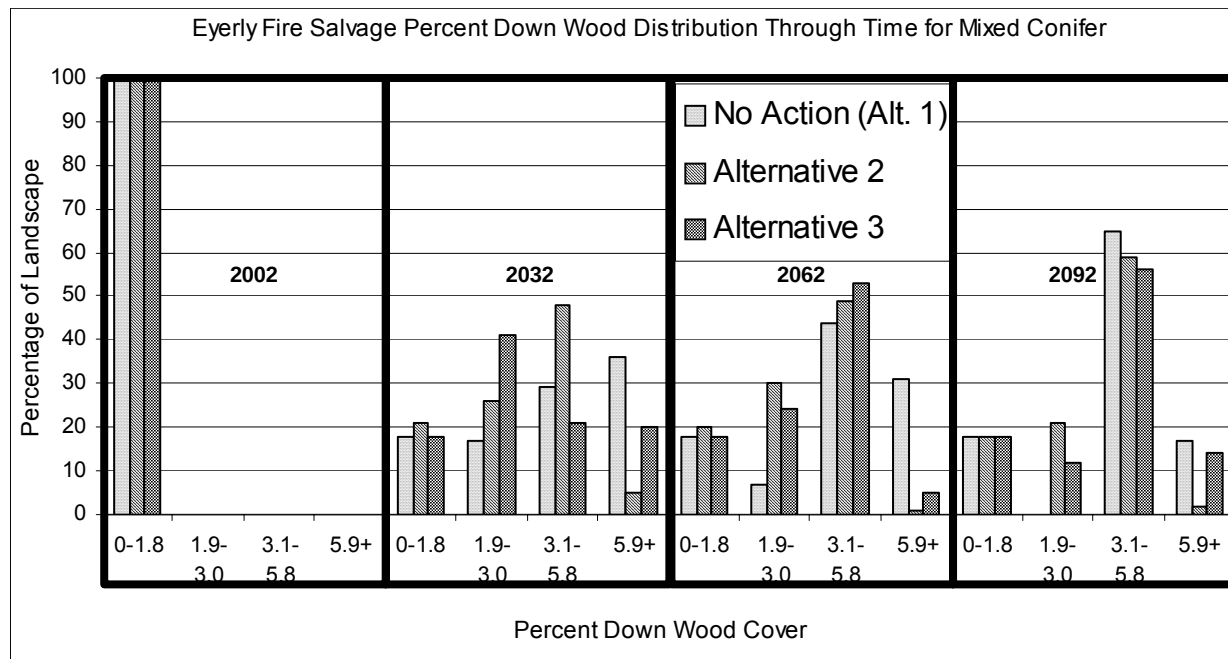


Figure 3.6-16 Eyerly Fire Salvage Percent Down Wood Distribution for Mixed Conifer Over Time



Cumulative Effects

Snags and Down Wood: Approximately, 12,821 acres of the Eyerly fire resulted in stand replacement (*Table 3.6-33*). Within the stand replacement areas most of the down wood was consumed during the fire. Since the fire many snags have fallen. Many new snags were also created during the fire. These newly created snags are fire hardened so it may take some time for the new snags to become soft enough for cavities to be created. Most of the softer snags that were used by primary and secondary cavity nesters were lost during the fire in the stand replacement areas. Most green trees were killed in the stand replacement areas, so future snags and down wood (for several decades) of all size classes will be relatively low until green trees can be recruited.

Table 3.6-33. Fire Intensity within the Eyerly Fire

Fire Intensity (Stand Effects)	Acres
No Data	466
Non-Lethal (<25% Mortality)	3,541
Mixed (25-75% Mortality)	768
Stand Replacement (>75% Mortality)	12,821

CVS plot data regarding snags was used to compare averages found for the Eyerly project area with landscape averages. All CVS plots located on the Sisters Ranger District with available plot data were analyzed to determine snag averages by PAG for the district. These plots are placed on a grid system and reflect what is occurring at a landscape level across all PAGs.

Using the unharvested inventory plots from DecAID, *Table 3.6-34* shows that post fire snag levels within Eyerly exceed the unharvested forest inventory plots. Current snag levels are also above CVS plot averages for the District. The individual PAGs were compared with the most appropriate habitat types from DecAID (see Existing Condition – Snags). The DecAID 50 % tolerance level is the mean for the population of snags within the inventory plots. *Table 3.6-32* shows that even though treatments will remove snags from the landscape, Alternatives 2 and 3 will both retain snags at higher levels than the mean of CVS and unharvested inventory plots from DecAID.

Table 3.6-34. Comparison of Alternative snag levels for the Eyerly project area*

PAG	Snag Size	DecAID at 50% TL	District CVS	Existing	Alternative 2	Alternative 3
Mixed Conifer Dry	9 – 15.9 "	4.7	8.2	25.3	14.9	19.0
	16 – 20.9 "	4.7	4.3	5.1	3.1	4.3
	≥ 21 "	3.4	1.3	4.1	3.4	3.7
	Total	12.7	13.8	34.5	21.4	27.0
Mixed Conifer Wet	9 – 15.9 "	4.7	6.1	28.5	8.6	11.7
	16 – 20.9 "	4.7	4.3	6.4	3.1	3.7
	≥ 21 "	3.4	1.6	4.8	4.5	4.5
	Total	12.7	12.0	39.7	16.2	19.9
Ponderosa Pine Dry and Wet	9 – 15.9 "	1.0	0.4	21.4	12.9	17.1
	16 – 20.9 "	1.0	0.5	5.4	3.4	4.8
	≥ 21 "	0.7	0.2	3.7	2.9	3.1
	Total	2.7	1.1	30.5	19.2	25.0

The 4,200 acre Cache Mountain, the 3600 acre Link, and the 90,680 acre B&B Complex fires have also led to an increase in snag numbers across the larger landscape outside the project area. These snags, along with those remaining within Eyerly, will contribute to future down woody material. There will be a long lag period due to the lack of replacement trees where fire severity was high to moderate. Species that use snags and down wood within green forests may not benefit by the increase in habitat.

The Cache Mountain and Eyerly fires supplied an influx of snags and down wood in the summer of 2002. An additional influx of snags and down wood occurred in the summer of 2003 on the Deschutes National Forest with the Link (3,597 acres) B & B Complex (90,680,) 18 (3,962 acres), and Davis (21,100 acres) Fires. As large intense fires continue to occur throughout the Northwest burnt snag habitat will continue to be created.

The Sisters Ranger District has been experiencing increasing levels of snags and down woody material since the early 1990's primarily from insect and disease outbreaks due to fire suppression. This was occurring primarily in the mixed conifer habitats prior to the fires. Vegetation treatments were designed to reduce fuel loadings and fire risk so within units, lower dead wood levels were present than found in the surrounding landscapes. However, retention levels were based on the most current information at the time and snags were being retained at higher than historic management levels throughout the watershed.

The fires of 2002 and 2003 created a large influx of dead material over the landscape. This material will be existing on the landscape for some time. However about 75% of the snags may fall within 20 years (Parks et al. 1999, Dahms 1949, Keen 1950, Haggard and Gaines 2001), much of the material will be present as down wood. There will be a very long lag time before snag recruitment will be at natural levels. Also, within the Sisters Ranger District several factors influence snag and down wood habitat including campgrounds, summer home tracts, private lands, major roads, and past harvest activities. Snag habitat is limited in certain areas like campgrounds, travel routes, etc. but there is ample levels elsewhere.

There is also an increased risk of loss of large snag habitat by fire suppression activities. As stands continue to develop they result in increased stocking levels and competition between trees results in competition induced stressed that leads to smaller trees. Therefore, the number of large replacement trees for snags continue to decrease in numbers over time.

Connectivity and Old and Late Structure: Connectivity was analyzed for the project area and viewed in the larger landscape context in order to provide connectivity across the landscape. Due to a large portion of the project area consisting of more open ponderosa pine stands, connectivity was located in more sustainable plant associations and has the ability to connect to Black Butte and the Confederated Tribes Lands. With Black Butte and the Confederated Tribes lands as focal points, a corridor was developed that runs south to north along the scarp of Green Ridge connecting the north face of Black Butte continuing around connecting to the face of Green Ridge running to the Forest Boundary adjacent to the Confederated Tribes land. A minimum of 30% canopy closure should be maintained within the corridor to facilitate movement from Black Butte to the Confederated Tribes Land.

Since the fires of 2002 and 2003, north/south connectivity has been reduced due to the high burn intensity. Large areas of the watershed experienced stand replacement. Much

of the wilderness was also included within the fire perimeter reducing the potential for movement in this area as well. Green Ridge is still intact and may provide the only north/south corridor available at this time.

Prior to the fires of 2002 and 2003 adequate north/south connectivity existed along the east slope of the Cascades even with the increased mortality levels. It was marginal in some areas like the Santiam Corridor project area around Suttle Lake but the wilderness provided an additional avenue for movement north and south. Green Ridge also provided a north/south route although this area was more open than other areas.

Federally Threatened and Endangered, and Region 6 Sensitive Species (TES)

Effects of Alternative 1

Federally Threatened and Candidate Species

Canada Lynx: No effect to Canada lynx or its habitat is expected. This determination was based on the following information.

Verified Canada Lynx Records in Oregon and Their Correlation with Population Cycles in Canada and Alaska: “There have been twelve verified⁶ Canada lynx records in Oregon from 1897 (1), 1916 (3), 1920 (2), 1927 (3), 1964 (1), 1974 (1), and 1993 (1) (McKelvey et al., 2000). One specimen was collected in the Willamette Valley, two were collected from the Oregon Cascades (including one from the DNF near Lava Lake about 35 miles west/southwest of Bend, Oregon), one from the Steens Mountains (about 75 miles southeast of the ONF), one from the Stinkingwater Mountains (about 60 miles east of the ONF), six from the Blue Mountains, and one from the Wallowa Mountains (Verts and Carraway 1998). The specimen collected from Lava Lake on October 7, 1916, remains the only verifiable record of lynx having occurred on the DNF, ONF or the CRNG.

Verts and Carraway (1998), suggest that the occurrence of lynx in Oregon is directly related to cycles in snowshoe hare (*Lepus americanus*) populations in Alaska and Canada. A decline in snowshoe hare numbers following a peak in lynx populations in Alaska and Canada likely contributes to lynx dispersal south. Peak lynx populations in Canada occurred in 1896 (MacLulich 1937) and in Alaska in 1914-1916, 1916-1918, 1926-1928, 1963-1966, and 1974-1975 (Quinn and Parker 1987). McKelvey et al. (2000) reported that the three most recent specimens in Oregon were collected from anomalous habitats and were within several years of population peaks in western Canada. Thus, most of the verified lynx records in Oregon were collected during peaks in lynx populations in Alaska and Canada. Self-maintaining lynx populations in Oregon have not existed historically, and their occurrence here is likely the result of dispersal from occupied areas with declining prey populations (Verts and Carraway 1998, McKelvey and Aubry 2001). Like Oregon, verified records of lynx in North Dakota (16), South Dakota (10), and Nebraska (13) appear to be correlated with lynx population cycles in Canada (McKelvey et al., 2000).” (USDA 2003).

⁶ “Verified” records are described by McKelvey et al. (2000) as “...a museum specimen or written account in which a lynx was either in someone’s possession or observed closely, i.e., where a lynx was killed, photographed, trapped and released, or treed by dogs.”

No verified sightings exist within the Eyerly Fire Salvage project area.

Resident, Reproducing Lynx in Oregon: “Extensive, standardized surveys have been conducted throughout the Pacific Northwest using remote cameras and hair-snag pads. No detections of lynx have resulted from these efforts outside of northeastern Washington. In 1999, 2000, and 2001 the DNF and ONF conducted lynx surveys designed to attract lynx to a “cheek rub” on a carpet pad, leaving hair which was later collected for DNA testing (McKelvey et al. 1999). In 1999, three additional sites were surveyed by the US Fish and Wildlife Service on the ONF using the “Weaver” survey design. None of these surveys resulted in lynx detections. Likewise, the USDA Animal and Plant Health Inspection Service (APHIS) has no record of a lynx ever being taken by wildlife services during predator control activities in the State of Oregon (Wagner 2003). The Lynx Biology Team reported that the Oregon Department of Fish and Wildlife (ODFW) had conducted aerial detection and snow tracking surveys on over 800 miles in the Cascade Region between the early 1970s and the middle 1990s to detect carnivores. In addition, ODFW was reported to have monitored 160 baited camera sites on National Forest System lands in the middle 1990s. No lynx were reported as a result of these surveys.

The Final Rule published in the Federal Register on March 24, 2000 (50 CFR Part 17) states: “...we cannot substantiate the historic or current presence of a resident lynx population in Oregon.” In their response to a paper prepared by the US Fish and Wildlife Service, McKelvey and Aubry (2001) state that “...as our assessment of available lynx data...indicate, there is no compelling body of verifiable evidence to suggest that resident populations of lynx have ever occurred in Oregon or Western Washington.” Furthermore, they describe the conclusion reached by Verts and Carraway (1998) that in Oregon, “...no evidence of self-maintaining populations of lynxes in the state exists.”

Habitat Mapping: The Lynx Biology Team describe the history and rationale for modifications in lynx habitat mapping advice and guidance since 1999 (Claar et al. 2001). In 1999, mapping was designed “...in order to: 1) include all potential areas within which to direct lynx survey efforts; and 2) provide an inclusive outer lynx habitat map boundary within which to begin further refinements.” By 2000, guidance for mapping lynx habitat incorporated historical and current distribution information contained in Ruggerio et al. (2000). Guidance was “...based on literature related to lynx habitat and home ranges, discussions with the Lynx Science Team, Biology Team, and biologists from the Boise, Portland, and Lacey U.S. Fish and Wildlife Service offices.” Lynx habitat mapping on the DNF, ONF and the CRNG in 2000 and 2001 reflect the advice and guidance provided by the Lynx Biology Team in 1999 and 2000, respectively.

The Lynx Biology Team concluded in October of 2001 that “The best scientific information available suggests that the conditions that provide some minimum density of snowshoe hares combined with adequate distribution of those hares across the landscape create conditions that support lynx.” They stated that those conditions were “...best expressed in the Subalpine Fir Series...” which is “...a reasonable surrogate for describing lynx habitat conditions...” and that “Early seral vegetation in the subalpine fir series is an important component of lynx habitat because of its relationship to snowshoe hare density” (Claar et al. 2001). The team also reported that all investigations into habitat used by lynx in the southern portion of its range showed an association between lynx and lodgepole pine cover types within the subalpine fir series. Therefore, the most recent advice and guidance and the best scientific information available suggest that subalpine fir plant associations capable of supporting some “minimum density” of snowshoe hare are a reasonable surrogate for describing lynx habitat conditions (primary

vegetation to support survival and reproduction and constitute a Lynx Analysis Unit [LAU]).

On the DNF, one plant association (subalpine fir-englemann spruce) is considered primary vegetation that could contribute to lynx habitat. If enough primary vegetation is present (about 6,400 acres) then other cool moist habitat types may contribute to lynx habitat if they are intermixed with primary vegetation. Only 3,650 acres of subalpine fir plant associations occur across the entire Deschutes National Forest. Three other alpine parkland plant associations (alpine parkland sedge, alpine parkland woodrush, and alpine parkland sagebrush) are capable of producing some clumps of subalpine fir forest but, based on observations of local biologists, they are not capable of supporting adequate snowshoe hare populations to support resident lynx. Likewise, Naney (pers. comm. 2003) reported that Franklin and Dyrness (1973) classify the subalpine parkland as a transitional area where “tree dominance is gradually giving way under the increasingly harsh alpine environment” and suspect that deep late snow packs are the reason for the forest/meadow ecotone. Naney (pers. comm. 2003) agreed that subalpine parklands do not appear to provide the necessary conditions to support snowshoe hare that prefer denser more closed canopy forests. About 3,500 acres of alpine parklands occur on the DNF. Two other plant associations (mountain hemlock subalpine parks and lodgepole-whitebark pine-alpine) included in earlier, more inclusive mapping efforts, are not considered primary vegetation that could contribute to lynx habitat.

The Lynx Conservation Assessment and Strategy (LCAS) (Ruediger et al., 2000) identified the need for at least 10 square miles (6400 acres) of primary vegetation to support survival and reproduction and constitute a LAU. The basis for recommending 10 square miles of primary vegetation was derived from Koelher (1990). Based on our analysis the ONF, DNF, nor the CRNG, have adequate primary vegetation to develop an LAU or support lynx survival and reproduction; therefore we have no mapped lynx habitat on the Forests or any LAUs within which to apply the LCAS habitat objectives.

No lynx habitat is currently mapped in the Cascade Mountains of Oregon. The nearest mapped lynx habitat in the Cascade Mountains lies several hundred miles north of the DNF on the Mt. Baker-Snoqualmie National Forest in Washington. No habitat has been identified south of the DNF in the Cascade Mountains. It is, therefore, unlikely that the ONF, DNF, nor the CRNG are important for maintaining connectivity between lynx populations and/or habitat.”(USDA 2003).

The Eyerly Salvage project area does not occur within a designated Lynx Management Unit (LAU) or Key Linkage Area (KLA). The very western portion of the project area was defined as an LAU under more liberal assessments of habitat during the first mapping effort. The Eyerly Salvage project area consists primarily of ponderosa pine plant associations, which do not equate to suitable lynx habitat.

Northern Bald Eagle: Potential Northern Bald Eagle roost and perch trees located along the 64 Road to Monty, and Perry South areas have been identified as hazard trees and will be felled (*Table 3.6-35*).

Table 3.6-35. Estimated number of hazard trees identified for removal along highway safety act roads and within Perry South Campground for the 2004 season within bald eagle essential habitat.

Location	Tree Species	8 – 15" dbh	15 – 21" dbh	21"+ dbh
64 Road from Forest boundary to Monty Campground	Ponderosa Pine	290	110	50
	Douglas-fir	180	75	35
	Incense Cedar/Juniper	55		10
Perry South Campground	Ponderosa Pine and Douglas-fir	140		25
Totals		850		120

In addition to the above hazard trees, potential habitat identified in Table 3.6-23 along Lake Billy Chinook and the Metolius River will be removed. Removal of habitat may alter roosting and foraging behavior.

The No Action Alternative may result in increased fuel loadings when snags begin to litter the forest floor. The higher fuel loading may result in the suppression of regeneration, which may prolong the establishment of habitat. Increased fuel loadings may also put remaining habitat at risk from disturbance (i.e. fire).

Northern Spotted Owl: No suitable spotted owl habitat (NRF) will be treated under the No Action Alternative. Approximately 1,314 acres of suitable spotted owl habitat will remain for the short term. In remaining suitable habitat (assuming the absence of future catastrophic occurrences), habitat will continue to increase with the development of canopy layers, canopy cover, structure, down woody material, snags, and connectivity. Mixed conifer stands will continue to lose large ponderosa pine and Douglas-fir components being replaced by white fir and other less fire tolerant species. Suitable habitat will continue to exist with white fir providing the majority of the nesting, roosting, and foraging component. This habitat would be short-lived due to white fir longevity.

In remaining NRF patches increased stand densities due to fire suppression is allowing white fir to out compete or put added stress on existing large ponderosa pine and Douglas-fir which is resulting in large trees declining at an accelerated rate in the mixed conifer PAG. No treatment within these stands will only allow NRF conditions to exist in the short term. Increases in fragmentation due to further degradation of habitat may increase the risk of predation on adult and juvenile spotted owls, increased competition with other raptors for habitat, decrease foraging habitat, and alter the microclimate (Miller, Small, and Meslow 1997).

The No Action Alternative may result in increased fuel loadings when snags begin to litter the forest floor. The higher fuel loading may result in the suppression of regeneration, which may prolong the establishment of late successional habitat conditions. Increased fuel loadings may also put remaining habitat at risk from disturbance (i.e. fire).

Connectivity is addressed in the Programmatic Biological Assessment as an important constituent element of habitat where habitats are protected from disturbances or are representative of the historical, geographical, and ecological distributions of the species it is designed for. Functional connectivity, according to Noss and Cooperrider (1994) is measured according to the potential for movement and population interchange of the

target species. For spotted owls, connectivity is affected more by the suitability of the overall landscape than by the presence or absence of discrete corridors because spotted owls disperse randomly (USDA 1990). Corridors have become an important tactic for preserving biological diversity however. Rosenberg et al. (1997) defined corridors as “a linear landscape element that provides for movement between habitat patches, but not necessarily for reproduction. Thus, not all life history requirements of a species may be met in a corridor.”

Connectivity will remain the same as currently exists. 21% of the area (within USFS lands) meets the definition of eastside or westside dispersal habitat. Movement across the project area could be accomplished using unburned denser patches or individual live white fir trees through the ponderosa pine area. However, a large portion of the project area is burned or is comprised of the ponderosa pine PAG, which does not provide desirable dispersal habitat due to the openness of stands and patches that do exist are usually very dense making movement through them difficult. Dispersal could occur along unburned riparian reserves where stand densities are greater. Movement would probably be concentrated along the west edge of the project area where there are more mixed conifer stands facilitating primarily north/south movement.

Oregon Spotted Frog: No activities will occur within riparian reserves and minimal suitable habitat exists within the project area; therefore Alternative 1 will have no direct or indirect effect on the spotted frog.

USFS Region 6 Sensitive Species

Bufflehead: Under the No Action Alternative, there are no direct effects to buffleheads because there will be no removal of any known nests. Indirect effects include the hazard tree removal project along two highway safety act roads (64 and 1170 rd) and two campgrounds: which would result in the loss of large snag habitat for safety reasons. This limits the available nesting sites along the Metolius River and Lake Billy Chinook.

California Wolverine: Alternative 1 would have no direct or indirect effects to California Wolverine populations. Transportation systems, winter recreation, and landscape patterns would remain the same.

Harlequin Duck: Alternative 1 would have no direct or indirect effects to Harlequin ducks because there are no treatments within potential harlequin duck habitat.

Pacific Fisher: No direct effects would occur under the No Action alternative. In areas that did not burn, the quality and quantity of habitat may continue to increase for the short term with increased canopy layers, canopy cover, structure, down woody material, snags, and increased connectivity. Mixed conifer stands would continue to lose large ponderosa pine and Douglas-fir components being replaced by white fir and other less tolerant species. Suitable habitat would continue to exist due to the structure the large wood would provide. However, this habitat would be short-lived due to white fir longevity. The lack of ponderosa pine and Douglas-fir in the understory due to being out-competed by white fir will eventually render these stands unsuitable due to the lack of large structure.

There is an increased risk of loss of the remaining suitable habitat by a stand replacing fire event or further degradation by insects and disease. If such an event were to occur, it would prolong the development of suitable habitat within the project area and may destroy critical habitat components like large snags and down woody material. However, some snags and down woody material would be created with these events. This may lead to reduced numbers of fishers occupying the project area due to less available suitable habitat.

The No Action Alternative may result in increased fuel loadings when snags begin to litter the forest floor. The higher fuel loading may result in suppression of regeneration, which may prolong the establishment of late successional habitat conditions. Increased fuel loadings may also put remaining habitat at risk from disturbance (i.e. fire).

Effects of Alternative 2

Federally Threatened and Candidate Species

Canada Lynx: Since no verified lynx sightings or designated habitat exists within the Eyerly Fire Salvage project area, the project area does not occur within a designated Lynx Management Unit (LAU) or Key Linkage Area (KLA), and the Eyerly Fire Salvage project area consists primarily of ponderosa pine plant association (not suitable lynx habitat), there would be no direct or indirect effects to lynx habitat associated with the implementation of any of the Eyerly Fire Salvage project alternatives.

Northern Bald Eagle: Proposed salvage units for the Eyerly project are not located in suitable eagle habitat. However, within the project area there are two highway safety act roads (64 and 1170 rd) and two campgrounds. A large hazard tree removal project associated with the safety act roads and campgrounds is planned. The result will be the loss of large snag habitat for safety reasons. An estimated 120 hazard trees (snags) over 21 inches dbh will be removed in 2004 within suitable bald eagle habitat (*Table 3.6-36*). *Table 3.6-26* is the entire number of estimated hazard trees that will be removed. *Table 3.6-36* is a subset of that number of estimated hazard trees that occur within essential eagle habitat. This limits available nesting, roosting, and perch sites along the Metolius River and Lake Billy Chinook. Therefore, large snag habitat outside of designated areas is very important to retain since a large portion of the large snag habitat will be lost in the recreation sites and along the highway safety act roads due to safety concerns.

In areas that are not being treated, the Action Alternatives may result in increased fuel loadings when snags begin to litter the forest floor. The higher fuel loading may result in the suppression of regeneration, which may prolong the establishment of habitat. Increased fuel loadings may also put remaining habitat at risk from disturbance (i.e. fire).

Northern Spotted Owl: No suitable spotted owl habitat (NRF) or dispersal habitat will be harvested under Alternative 2. Approximately 1,314 acres of suitable spotted owl habitat will remain for the short term. Roughly, 4,846 acres will be harvested within this alternative. *Table 3.6-36* identifies the treatments. HSV salvage will remove dead or severely damaged trees. Minimum diameter of salvaged trees will be 16 inches for

ponderosa pine and 12 inches for Douglas-fir. SPF salvage will utilize small diameter products such as posts, rails, house logs, chips, or firewood.

Table 3.6-36. Treatments and acres for Alternative 2

Treatment	Acres
HSV – Stand Replacement	3,918
HSV – Mixed Severity	376
SPF – Stand Replacement	513
SPF – Mixed Severity	39
Total	4,846

Most treatments are proposed for stands that experienced stand replacement fire. Live canopy cover remains in small isolated patches. Proposed treatments include salvage of dead or severely damaged trees. No NRF will be treated, however 430 acres of CHU OR-3 and 125 acres within the Castle Rocks home range are proposed for treatment. The acres proposed for treatment within CHU OR-3 and the Castle Rocks home range occur in stand replacement areas.

Removal of snags and down wood in proposed treatment units will decrease the amount of structure retained throughout approximately the first 150 years of the stand. Down wood and snags that exist in NRF (old-growth stands) are products of competition after large trees have been established (Maffei, personal comm. 07-21-03). Therefore, the removal of snags during salvage operations will not be removing constituent elements of spotted owl habitat, due to the fact that by the time the stand is re-established as NRF the snag and down wood that exists on the landscape now will have completely decomposed. However snags and down wood will be retained at ROD and LSRA levels. Figures 3.6-8 and 3.6-10 show how large snags will remain on the landscape and by 2097 most of the landscape will have relatively low numbers of large snags (i.e. greater than 20 inches).

Within the HSV mixed severity salvage, canopy cover remains in small isolated patches. Removal of snags or severely damaged trees and down wood will occur outside of NRF and dispersal habitat. In the short term treatment will decrease the amount of snags and down wood, which may decrease available prey habitat. However, without treatment to the mixed severity stands the remaining large live trees (greater than 21 inches dbh) may suffer mortality due to insects and disease. The loss of large trees in these stands will decrease the available future NRF habitat within the project area.

The proposed hazard tree project is not within suitable NRF habitat.

Oregon Spotted Frog: No activities will occur within riparian reserves and minimal suitable habitat exists within the project area; therefore Alternative 2 will have no direct or indirect effect on the spotted frog.

USFS Region 6 Sensitive Species

Bufflehead: Alternative 2 would have no direct effect to buffleheads because there will be no removal of any known nests. Indirect effects include the hazard tree removal project along two highway safety act roads (64 and 1170 rd) and two campgrounds, which would result in the loss of large snag habitat for safety reasons. This limits the available nesting sites along the Metolius River and Lake Billy Chinook.

California Wolverine: Alternative 2 would have no direct or indirect effects to California Wolverine populations. Transportation systems, winter recreation, and landscape patterns would remain the same.

Harlequin Duck: Alternative 2 would have no direct or indirect effects to Harlequin ducks because there are no treatments within potential harlequin duck habitat.

Pacific Fisher: No suitable fisher habitat will be harvested with this alternative. 1,314 acres of suitable habitat will remain for the short term. Removal of snags and down wood in proposed treatment units will decrease the amount of structure retained throughout approximately the first 150 years of the stand. Down wood and snags that exist in old-growth stands are products of competition after large trees have been established (Maffei, pers. comm. 07-21-03). Therefore, the removal of snags during salvage operations will not be removing constituent elements of habitat, due to the fact that by the time the stand is re-established as habitat the snag and down wood that exists on the landscape now will have completely decomposed. However snags and down wood still will be retained at Northwest Forest Plan ROD and LSRA levels. *Figures 3.6-8 and 3.6-10* show how large snags will remain on the landscape and by 2097 most of the landscape will have relatively low numbers of large snags (i.e. greater than 20 inches).

Within the HSV mixed severity salvage canopy cover remains in patches. Removal of snags or severely damaged trees and down wood would occur outside of fisher habitat. In the short term this salvage will decrease the amount of snags and down wood, which may decrease available prey items. However, without treatment to the mixed severity stands the remaining large live trees (greater than 21 inches dbh) may suffer mortality due to insects and disease. The loss of large trees in these stands will decrease the available future habitat within the project area.

Effects of Alternative 3

Federally Threatened and Candidate Species:

Canada Lynx: Since no verified lynx sightings or designated habitat exists within the Eyerly Fire Salvage project area, the project area does not occur within a designated Lynx Management Unit (LAU) or Key Linkage Area (KLA), and the Eyerly Fire Salvage project area consists primarily of ponderosa pine plant association (not suitable lynx habitat), there would be no direct or indirect effects to lynx habitat associated with the implementation of any of the Eyerly Fire Salvage project alternatives.

Northern Bald Eagle: The Alternative 3 effect on eagles is the same as Alternative 2. Proposed salvage units for the Eyerly project are not located in suitable eagle habitat. However, within the project area there are two highway safety act roads (64 and 1170 rd) and two campgrounds. A large hazard tree removal project associated with the safety act roads and campgrounds is planned. The result will be the loss of large snag habitat for safety reasons. An estimated 120 snags over 21 inches dbh will be removed in 2004 within suitable bald eagle habitat (*Table 3.6-36*). *Table 3.6-26* is the entire number of estimated hazard trees that will be removed. *Table 3.6-36* is a subset of that number of

estimated hazard trees that occur within essential eagle habitat. This limits available nesting, roosting, and perch sites along the Metolius River and Lake Billy Chinook. Therefore, large snag habitat outside of designated areas is very important to retain since a large portion of the large snag habitat will be lost in the recreation sites and along the highway safety act roads due to safety concerns.

In areas that are not being treated, the Action Alternatives may result in increased fuel loadings when snags begin to litter the forest floor. The higher fuel loading may result in the suppression of regeneration, which may prolong the establishment of habitat. Increased fuel loadings may also put remaining habitat at risk from disturbance (i.e. fire).

Northern Spotted Owl: No suitable spotted owl habitat (NRF) or dispersal habitat will be harvested under Alternative 3. Approximately 1,314 acres of suitable spotted owl habitat will remain for the short term. Under Alternative 3, 2,893 acres will be harvested. *Table 3.6-37* identifies the treatments. HSV salvage will remove dead or severely damaged trees. Minimum diameter of salvaged trees will be 16 inches for ponderosa pine and 12 inches for Douglas-fir. SPF salvage will utilize small diameter products such as posts, rails, house logs, chips, or firewood.

Table 3.6-37 Treatments and acres for Alternative 3.

Treatment	Acres
HSV – Stand Replacement	2,532
HSV – Mixed Severity	0
SPF – Stand Replacement	361
SPF – Mixed Severity	0
Total	2,893

Most treatments are proposed for stands that experienced stand replacement fire. Live canopy cover remains in small isolated patches. Proposed treatments include salvage of dead or severely damaged trees. No NRF will be treated, however 378 acres of CHU OR-3 and 122 acres within the Castle Rocks home range are proposed for treatment. Removal of snags and down wood in proposed treatment units will decrease the amount of structure retained throughout the life of the new stand.

This alternative will harvest snags in designated units to meet the 30 % and 50 % tolerance levels for the Lewis' woodpecker indicated by DecAID. Alternative 3 includes design elements to leave snags at a higher level than those described in the Forest Plan. Snags would be left at levels shown in *Table 3.6-2* where snag exist at or above these levels.

Removal of snags and down wood in proposed treatment units will decrease the amount of structure retained throughout the first 150 years of the stand. Down wood and snags that exist in old-growth stands are products of competition after large trees have been established (Maffei, pers. comm. 07-21-03). Therefore, the removal of snags during salvage operations will not be removing constituent elements of spotted owl habitat, due to the fact that by the time the stand is re-established as NRF the snag and down wood that exists on the landscape now will have completed decomposed. However snags and down wood still will be retained at ROD and LSRA levels. Figures 3.6-8 and 3.6-10 show how large snags will remain on the landscape and by 2097 most of the landscape will have relatively low numbers of large snags (i.e. greater than 20 inches).

The proposed hazard tree project is not within suitable NRF habitat.

Oregon Spotted Frog: No activities will occur within riparian reserves and minimal suitable habitat exists within the project area; therefore Alternative 3 will have no direct or indirect effect on the spotted frog.

USFS Region 6 Sensitive Species

Bufflehead: Alternative 3 would have no direct effects to buffleheads because there will be no removal of any known nests. Indirect effects include the hazard tree removal project along two highway safety act roads (64 and 1170 rd) and two campgrounds: which would result in the loss of large snag habitat for safety reasons. This limits the available nesting sites along the Metolius River and Lake Billy Chinook.

California Wolverine: Alternative 3 would have no direct or indirect effects to California Wolverine populations. Transportation systems, winter recreation, and landscape patterns would remain the same.

Harlequin Duck: Alternative 3 would have no direct or indirect effects to Harlequin ducks because there are no treatments within potential harlequin duck habitat.

Pacific Fisher: Similar to Alternative 2, no suitable fisher habitat will be harvested with this alternative. 1,314 acres of suitable habitat will remain for the short term. Removal of snags and down wood in proposed treatment units will decrease the amount of structure retained throughout approximately the first 150 years of the stand. Down wood and snags that exist in old-growth stands are products of competition after large trees have been established (Maffei, pers. comm. 07-21-03). Therefore, the removal of snags during salvage operations will not be removing constituent elements of habitat, due to the fact that by the time the stand is re-established as habitat the snag and down wood that exists on the landscape now will have completely decomposed. However snags and down wood still will be retained at ROD and LSRA levels. Figures 3.6-8 and 3.6-10 show how large snags will remain on the landscape and by 2097 most of the landscape will have relatively low numbers of large snags (i.e. greater than 20 inches).

Cumulative Effects

Federally Threatened and Candidate Species

Canada Lynx: Cumulatively, none of the alternatives are likely to lead to the reduced survivorship of the lynx population as a whole or to individuals that may occur in the area.

Northern Bald Eagle: The Eyerly fire burned very hot along the lower stretches of the Metolius River and along Lake Billy Chinook resulting in the loss of large trees, green trees, and some snags in the area. Some existing roost and perch trees were either consumed or heavily charred as a result of the fire. Due to high fire severity, many replacement trees were also lost prolonging the establishment of future habitat for several decades. Also, within the project area there are two campgrounds, two highway safety act roads (64 and 1170 rd), and small tracts of private land with houses along the river and reservoir. Bald eagle use may be limited in these locations, especially during the summer months, due to the heavy amount of human use. Another concern associated with these areas is the loss of large snag habitat for safety reasons. This limits the available nesting and perch sites along the river. Therefore, large snag habitat outside of designated areas is very important to retain since a large portion of the large snag habitat will be lost in the recreation sites and along major travel routes due to safety concerns.

Northern Spotted Owl: Table 3.6-38 describes the burn intensity information within the NWFP area.

Table 3.6-38. Burn Intensity for NWFP allocations within the Eyerly fire area

Allocation	Burn Severity	Acres	Percent of Allocation
LSR	High	403	8
	Moderate	1,366	27
	Low	599	12
	Underburn	2,214	44
	No Data	433	9
	Total	5,015	100
AWD	High	853	38
	Moderate	1,158	52
	Low	161	7
	Underburn	62	3
	No Data	0	0
	Total	2,234	100
Matrix	High	898	28
	Moderate	1,150	37
	Low	375	12
	Underburn	735	23
	No Data	6	0
	Total	3,164	100
Total NWFP	High	2,154	21
	Moderate	3,675	35
	Low	1,135	11
	Underburn	3,012	29
	No Data	439	4
	Total	10,415	100

Approximately 923 acres of CHU OR-3 was contained within the fire perimeter and 263 acres of NRF were lost within the CHU as a result of the fire.

The fire entered part of the historic Castle Rocks spotted owl home range. Approximately 228 acres of the home range occurred within the fire perimeter, of which 65 acres are classified as NRF. The fire resulted in a 4% decrease in available suitable habitat acres for this pair. The USFWS established a minimum threshold of 40% (1,182 acres) of the home range contain suitable habitat in order to be above “take” standards. The Castle Rocks pair is currently below the threshold for “take”.

NRF lost due to the fire was located near the edge of the 1.2 mile radius circle, therefore, on the edge of the home range. The fire was also on the other side of the ridge than the nest so the loss will have less affect to the pair than if NRF habitat closer to the activity center was impacted.

Wildfire effects on suitable spotted owl habitat include the loss of suitable NRF habitat both within the known spotted owl home range and within areas where there are no known spotted owls, loss or degradation of dispersal habitat (unknown amount), loss of prey species habitat, loss or degradation of constituent elements of habitat including canopy cover, multi-storied stands, and down woody material, and the prolonged establishment of future suitable habitat.

Within the Metolius Watershed there were 21 known spotted owl sites. However, due to the recent wildfires, that number has been reduced to 7 known sites that may still be viable (Suttle South, Obsidian, Davis, Canyon Creek, Jefferson Creek, Candle Creek, and Castle Rocks).

Results of the 2002 and 2003 wildfires reduced suitable habitat across the watershed. An update to the Forest NRF GIS layer was completed.

Suitable NRF habitat has declined within the Metolius watershed, primarily due to the fires of 2002 and 2003. See *Table 3.6-39* for pre and post fire NRF acres. NOTE: Since most of the fires occurred near each other or overlapped, it will not be broken down by fire but shown as a total watershed figure.

Table 3.6-39. Pre and post-fire NRF acres within the Metolius watershed.

Habitat	Pre-fire NRF Acres	Post-fire NRF Acres	NRF Acres Lost
NRF	26,901	16,610	11,562*
% of watershed	18%	11%	7%
Notes: *Acres do not directly correspond due to mapping errors. Total watershed acres = 148,926 acres			

Additional project areas have been analyzed or are being analyzed to reduce risk to the existing Cache/Trout LSRs. No NRF habitat will be removed from the McCache project area but existing dispersal habitat will be treated to reduce stand densities (1,245 acres total proposed). More open stand conditions will result from treatments. The South Trout project area is still under analysis. Reduced stand densities will occur along the Cascade crest reducing the quality of dispersal habitat and some NRF stands to function properly. This may be a time when low numbers of spotted owls are sustained on the landscape until stands recover. However, the landscape may be more resilient to large-scale events due to past and future treatments in these areas.

Connectivity was reduced within the LSR on Forest Service lands to adjacent lands on the Warm Springs Reservation. However, adequate connectivity exists along the west side of Green Ridge and through the Metolius Basin to areas outside the district boundary.

Since the fires of 2002 and 2003, north/south connectivity has been compromised due to the high burn intensity. Large areas of the watershed experienced stand replacement. Much of the wilderness was also included within the fire perimeter reducing the potential for movement in this area as well. Green Ridge is still intact and may provide the only north/south corridor available at this time.

Oregon Spotted Frog: There is very limited suitable habitat for Oregon spotted frogs in the project area, however there may be isolated areas along the Metolius River. The Eyerly Fire burned along the Metolius River approximately 1.5 miles upstream of Monty Campground to Lake Billy Chinook. Within the fire area any spotted frog habitat that existed was affected differently, depending on the burn intensity, but was most likely degraded due to the consumption of riparian vegetation along the river. These locations will continue to improve, as riparian vegetation is re-established.

Currently, little suitable habitat for spotted frogs exists on the Sisters Ranger District. Populations that may become established in future years may be isolated due to fragmentation of habitat/connectivity from one area of suitable habitat to another. Road development, OHV use, increased recreation pressure along riparian reserves, and past harvest practices have all contributed to degradation of habitat. However, several projects are proposing road closures and riparian restoration work that should aid in providing connectivity.

USFS Region 6 Sensitive Species

Bufflehead: The fire burned along the lower stretches of the Metolius River and along Lake Billy Chinook resulting in the loss of many green trees and some of the snags in the area. Existing potential nest trees were either consumed or heavily charred as a result of the fire. The fire did create some new snag habitat for buffleheads. However, most of the snags created are fire-hardened and will have to decay before any cavity excavators can produce nesting habitat for buffleheads. Due to high fire severity, many replacement trees were also lost prolonging the establishment of future habitat for several decades.

Within the Metolius Basin, campgrounds and several summer home tracts occur along the Metolius River. Loss of snag habitat in and adjacent to these areas is a concern due to the limited amount of nesting structures available along potentially suitable habitat. However, high use recreation areas may not be preferred nest sites due to the increased disturbance levels. Snag habitat along the river between campgrounds and summer home tracts is important to retain due to the loss of this habitat component elsewhere.

Continued loss of large snag habitat around lakes, ponds, and streams continues to decrease available large structure on the landscape. Snag habitat is routinely removed around popular water bodies for safety reasons and for firewood use. Increased recreation pressure around and adjacent to water bodies may further decrease habitat suitability. This, coupled with the widespread mortality caused from the spruce budworm outbreak and loss of structure due to recent wildfires, has further reduced future snag habitat. A lag time will exist before stands recover and can provide adequate snag habitat around and adjacent to suitable habitat.

California Wolverine: The quality of wolverine habitat in the project area was further reduced as result of the Eyerly fire. A total of approximately 100 miles of bulldozer line (the line was rehabbed), on the Sisters Ranger District, was constructed during suppression activities. Many roads that had overgrown with brush were also reopened. The dozer line and reopened roads may contribute to more available access throughout the fire. Along with suppression activities the fire reduced canopy structure and consumed the majority of existing downed wood. However, the effects of the fire may be offset by the increase in big game carrying capacity due to increased forage production for big

game. An increase in big game populations could provide an increased winter carrion source.

A reasonably foreseeable action would be road management work resulting from a roads analysis recommendation to close an additional 35.28 miles of road and decommissioning 43.52 miles of road within the project area. These closures and decommissioning will decrease fragmentation throughout potential habitat.

Within the project area recreation pressure continues to increase. OHV is also increasing throughout the Sisters Ranger District. The reopened roads may also contribute to more available access throughout the fire. Wolverines may use the area and the additional amounts of human disturbance related recreation use may alter their movement patterns. The amount of wolverine use in the area is expected to be low to non-existent because the project area contains only marginal habitat due to high road densities, recreational use, and the lack of denning habitat. Along with increased harvest activities adjacent to wilderness areas, both summer and winter recreation use seems to be increasing with more powerful snow machines, more use of wilderness areas and increasing OHV use.

To better analyze cumulative effects, an area running north and south from the Cascade crest approximately 5-8 miles wide will be analyzed. Past harvest activities have been concentrated along the east slope of the Cascades, primarily in the highest mortality areas with the Jack Canyon, Santiam Restoration, and Santiam Corridor project areas. Fuels reduction is also proposed within the Metolius Basin. Conditions existed in these areas with heavy mortality and increased risk of loss of habitat. Trade-offs were made to reduce risk of further loss and to create fuel break areas where a large fire event may be stopped or contained.

Two additional project areas are proposed or have not been implemented (McCache and South Trout). Again, these projects address the impacts from the insect and disease activity and increased fire risk. Therefore, a large area running almost the entire length of the district has received or is currently planning on harvest and fuels treatments to reduce risk. These activities have reduced overhead cover potentially impacting dispersal from wilderness areas. However, forage potential for big game may have increased, allowing more foraging opportunities for wolverines.

Four large wildfires have occurred in the past 5 years along the eastside of the Cascades that have resulted in additional openings. The B&B Fire burned a large majority of the Mt. Jefferson wilderness. However, these areas have provided increased forage for resident deer and elk, which may also aid in increasing foraging opportunities for wolverine.

Several projects have proposed road closures including Metolius Basin, McCache, South Trout, and Jack Canyon. This, along with Eyerly roads analysis recommendations, will aid in reducing overall road densities and lessen fragmentation over time across the district.

Harlequin Duck: The Eyerly Fire burned along the Metolius River approximately 1.5 miles upstream of Monty Campground to Lake Billy Chinook. Within the fire area harlequin duck habitat was affected differently, depending on the burn intensity, but was most likely degraded due to the consumption of riparian vegetation along the river. Impacts to the harlequin are likely to be short term as riparian vegetation will return in the next few years. The quality of habitat will improve as vegetation within riparian reserves that was lost during the fire is replaced. The Metolius River from Monty Campground

west will continue to provide potential habitat for harlequins. East of Monty Campground has substantial human use and may deter use.

Along the Metolius River, several factors influence harlequin duck habitat including campgrounds, summer home tracts, private lands, vegetation treatments, and fisheries projects. Hazard trees are routinely removed from recreation facilities. Continued loss of large snag habitat in and adjacent to the campgrounds and summer home tracts along the Metolius River due to safety reasons limits the available nesting and loafing sites.

However, where feasible some hazards have been felled into the river to enhance fish habitat. This has been occurring opportunistically but is benefiting harlequin habitat by providing loafing sites in areas of low down wood. Several parcels of private lands occur adjacent to the river. These sections of private lands are not managed for harlequin duck habitat. Therefore, it is assumed that any habitat provided by these parcels is incidental and may not be long term.

One large vegetation management project has been planned along the upper stretches of the Metolius River (approximately 4.5 miles). Treatments were designed to reduce the risk of wildfire and facilitate the development of late-successional habitat. Treatments will benefit harlequin habitat by reducing risk to existing habitat and opening up stands to allow riparian vegetation to grow.

Pacific Fisher: Wildfire effects on suitable fisher habitat include the loss of suitable habitat, loss of prey species habitat, loss or degradation of constituent elements of habitat including canopy cover, snags and down woody material, and the prolonged establishment of future suitable habitat. The Eyerly, Cache Mountain, Link, and B&B Complex fires have resulted in a reduction of the remaining suitable habitat within the fire's perimeter. As a result, the fires will prolong the development of suitable habitat within the area and destroyed critical habitat components. However, some snags and down woody material were created with these events.

A large portion of the Sisters Ranger District landscape has experienced stand replacement wildfire and large tracts of late-successional forests have been impacted by recent insect and disease events reducing habitat quality due to more open stand conditions. More open stand conditions also result in greater snow accumulations, which may result in lowered habitat quality over large areas.

Further degradation from insects and disease may occur in areas containing green residual trees. Damaged green trees and dead wood (habitat for Douglas-fir beetles) has increased and may increase mortality, by increased outbreaks of beetles, in the remaining live trees that provide canopy layers, canopy cover, structure, and increased connectivity for fisher habitat. Residual large green tree habitats are very important to retain since a large portion of the large green trees were lost during the fires. Within stands that suffered stand replacement and mixed burn severity many of the smaller trees (i.e. less than 21" dbh) were lost. The loss of these smaller trees set back large green tree replacement and may result in several decades before large green trees occur within the stand replacement areas.

Harvest activities have been concentrated to the east of project area and include the Metolius Basin, Santiam Corridor, Santiam Restoration, McCache, and Jack Canyon project areas. However, the Santiam Corridor, Santiam Restoration, and Jack Canyon projects were within the B&B Complex. Within McCache and the Metolius Basin conditions exist in these areas with heavy mortality and increased risk of loss of habitat. However, the quality of habitat varied across the landscape due to mortality from insects

and disease. Trade-offs were made to reduce risk of further loss and to create fuel break areas where a large fire event may be stopped or contained.

Additional project areas have been analyzed or are being analyzed for treatment to reduce risk to the existing Cache/Trout LSRs. No habitat will be removed from the McCache project area. The South Trout project area is still under analysis. Reduced stand densities will occur along the Cascade crest reducing the quality of habitat. However, the landscape may be more resilient to large-scale events due to past and future treatments in these areas.

Continued loss of large structure across the landscape due to competition with white fir and increased loss from disturbance events (wildfire, insects, and disease) may lead to reduced survivorship of fishers until conditions are restored. Large tracts of late-successional forests have been impacted by recent insect and disease events reducing habitat quality due to more open stand conditions and increased risk. More open stand conditions also result in greater snow accumulations, which may result in lowered habitat quality over large areas.

Reasonably foreseeable actions such as the analysis and implementation of road management recommendations from the Eyerly roads analysis include the closing of an additional 35.28 miles of road and decommissioning 43.52 miles of road within the project area. These closures and decommissioning will decrease fragmentation throughout potential habitat.

Management Indicator Species (MIS)

Effects of Alternative 1

Birds

Primary Cavity Excavators: The effects that the alternatives would have on snags were disclosed previously under Landscape Relationships – Snags. Here the emphasis is on the effects to species that use snags. Specifically, Lewis woodpecker, black-backed woodpeckers, hairy woodpeckers, white-headed woodpeckers, northern flickers, mountain bluebirds and western bluebirds are addressed.

Using calculations from the DecAID advisory tool (*Tables 3.6-7 and 3.6-8*) and estimates of average snags per acre by size class, the project area acres of existing habitat were calculated. Acres outside of the fire perimeter were not used in this analysis because habitat values were used to represent recent post-fire habitats. *Table 3.6-40* indicates acres of potential habitat for seven post-fire species.

Table 3.6-40. Existing acres of habitat for cavity nesters (within NF boundary)

Species	0 - 29 % tolerance (acres)	30 - 49 % tolerance (acres)	50 - 79 % tolerance (acres)	80 % + tolerance (acres)
Lewis' Woodpecker	4,117	12,051	2,089	415
Black-backed Woodpecker	15,515	1,705	1,122	331
Hairy Woodpecker	5,449	8,197	3,462	1,565
White-headed Woodpecker	8,462	5,944	3,034	1,232
Northern Flicker	12,569	5,842	260	0
Mountain Bluebird	3,126	14,783	763	0
Western Bluebird	4,028	7,618	4,141	2,886

Notes:
Existing acres of habitat were derived from synthesized data which utilized cumulative species curves by habitat for snag size ≥ 9.85 and ≥ 19.7 .
DecAID predicts the following species will use recently burned ponderosa pine/Douglas-fir and Eastside Mixed Conifer E. Cascades/Blue Mountains vegetation: Black-backed woodpecker (BBWO), Hairy woodpecker (HAWO), Lewis woodpecker (LEWO), Mountain bluebird (MOBL), Northern flicker (NOFL), White-headed woodpecker (WHWO), and Western bluebird (WEBL).
Snags by species ranges from a low of 5.4 snags/acre ≥ 9.85 " at the 30 % tolerance level for the Northern flicker to a high of 126.1 snags/acre ≥ 9.85 " at an 80 % tolerance level for black-backed woodpecker.
Northern flicker, hairy woodpecker, and Lewis' woodpecker have been documented in the project area. However, no formal surveys have been conducted to determine the extent that each species is present on the landscape and all sitings have been incidental.

Currently there are an estimated 2,089 acres of Lewis' woodpecker habitat within the 50 to 79% tolerance level and 415 acres in the 80% plus. That means 2,089 acres of habitat meets the criteria of at least 24.8 snags per acre greater than or equal to 9 inches dbh and has at least 6.2 snags per acre greater than or equal to 21 inches dbh and 415 acres of habitat meets the criteria of at least 48.1 snags per acre greater than or equal to 9 inches dbh and has at least 16.2 snags per acre greater than or equal to 21 inches dbh (criteria identified in DecAID from empirical studies {Mellen et al. 2002}). However, it is estimated that most snags will be on the ground within 15 years (USDA 1994c; Parks et al. 1999).

Coopers and Sharp-Shinned Hawks: Further degradation from insects and disease may occur in areas containing green residual trees. Damaged green trees and dead wood (habitat for Douglas-fir beetles) has increased and may increase mortality, by increased outbreaks of beetles, in the remaining live trees that provide canopy cover, structure, snags and down wood, and prey habitat. Residual large green tree habitats are very important to retain since a large portion of the large green trees were lost during the fire. Within stands that suffered stand replacement and mixed burn severity, many of the smaller trees (i.e. less than 21" dbh) were killed. The loss of these smaller trees set back large green tree replacement and may result in several decades before large green trees occur within the stand replacement areas.

In areas that did not burn, habitat trends should increase with canopy layers, canopy cover, structure, down woody material, snags, and increased connectivity. Mixed conifer stands may continue to lose large ponderosa pine and Douglas-fir components being replaced by white fir and other less fire tolerant species. Suitable habitat would continue to exist with

white fir providing the nesting and foraging component. This habitat would be short-lived due to white fir longevity and be more susceptible to wildfire.

The no action alternative may result in increased fuel loadings when snags begin to litter the forest floor. The higher fuel loading may result in the suppression of regeneration, which may prolong the establishment of late successional habitat conditions. Increased fuel loadings may also put remaining habitat at risk from disturbance (i.e. fire).

Flammulated Owl: The flammulated owl is a focal species for fire climax ponderosa pine and mixed conifer dry habitats. Preferred habitat is typically a mosaic of open forests containing mature and old growth ponderosa pine and Douglas-fir trees, interspersed with dense patches of second growth providing roosting areas. The Eyerly fire has led to unsuitable conditions for this species due to the loss of mature and old growth pine. In areas that did not burn, shrub layers are likely to persist. This limits the available forage base for the owl by decreasing the diversity of forest floor plants, which may discourage some arthropods and other insects from occupying these sites. It also hinders foraging attempts due to the somewhat limited maneuverability of the owls with increased shrub structure (USDA(b) 1994).

Increased stand densities perpetuates the problem of losing large structure over time, which the species requires for suitable nesting and foraging. It allows for less available nest sites which could lead to more competition for existing sites between species. Increased stand densities may increase the risk of loss from fire. The species requires snags for nesting and utilizes softer snags that have moderate decay. The No Action Alternative will cut hazard trees along the highway safety act road and within campgrounds. A total of 176 snags over 21 inches will be cut. Most of the softer snags were lost in the fire, leaving snags that are fire hardened. As snags decay, cavity nesters will be able to construct cavities that the owl can use.

Great Blue Heron: Great blue herons have been observed foraging both on the Metolius River and on the shores of Lake Billy Chinook. There are no known nesting sites located within the project area.

Within the project area there are two campgrounds and small tracts of private land with houses along the Metolius River and Lake Billy Chinook. Great blue herons use may be limited in these locations, especially during the summer months, due to the heavy amount of human use. Another concern associated with these areas is the loss of snag habitat for safety reasons. This limits the available nesting sites along the river. Therefore, snag habitat outside of designated areas is very important to retain since a large portion of snag habitat will be lost in the recreation sites. One hundred and seventeen snags over 21 inches dbh will be removed within suitable great blue heron habitat.

Great Gray Owl: Within the Eyerly fire's perimeter there is limited suitable habitat. Outside of the fire's perimeter, but within the project area habitat trends would increase with canopy layers, canopy cover, down woody material, and snags. However, in many mixed conifer and ponderosa pine stands, large ponderosa pine and Douglas-fir are being replaced by white fir and other less tolerant or short-lived species. Loss of future large structure may render large areas unsuitable for great grays by decreasing potential nesting structure. Where high stand densities exist, there is an increased risk of fire. Foraging

opportunities will continue to decrease in man-made areas (previous clear-cuts) as the stands continue toward climax conditions.

Northern Goshawk: Further degradation from insects and disease may occur in areas containing green residual trees. Damaged green trees and dead wood (habitat for Douglas-fir beetles) has increased and may increase mortality, by increased outbreaks of beetles, in the remaining live trees that provide canopy cover, structure, snags and down wood, and prey habitat. Residual large green tree habitats are very important to retain since a large portion of the large green trees were lost during the fire. Within stands that contained stand replacement and mixed burn severity, many of the smaller trees (i.e. less than 21" dbh) were killed. The loss of these smaller trees set back large green tree replacement and may result in several decades before large green trees occur within the stand replacement areas.

In areas that did not burn, habitat trends should increase with canopy layers, canopy cover, structure, down woody material, snags, and increased connectivity. Mixed conifer stands may continue to lose large ponderosa pine and Douglas-fir components being replaced by white fir and other less fire tolerant species. Suitable habitat would continue to exist with white fir providing the nesting and foraging component. This habitat would be short-lived due to white fir longevity and be more susceptible to wildfire.

The no action alternative may result in increased fuel loadings when snags begin to litter the forest floor. The higher fuel loading may result in the suppression of regeneration, which may prolong the establishment of late successional habitat conditions. Increased fuel loadings may also put remaining habitat at risk from disturbance (i.e. fire).

Osprey: The Metolius River and Lake Billy Chinook provide suitable habitat for ospreys for both nesting and foraging. Loss of large snag habitat within campgrounds, along private lands, and adjacent to highway safety act roads is a concern due to the limited amount of large snags available. Competition for nesting structure occurs between osprey and other raptor species so retention of snag habitat outside of these areas is important. The No Action Alternative will remove an estimated 120 snags over 21 inches during 2004 within suitable osprey habitat in order to provide for public health and safety (*Table 3.6-36*).

Red-tail Hawk: As a result of the Eyerly fire, foraging opportunities have increased with more open areas with fewer shrubs and forbs. There are also many newly created fire hardened snags that could serve as potential nest sites.

Outside of the fire suitable habitat would be maintained for the short-term until past harvest units begin to grow, which will reduce foraging opportunities. Large snags and trees will remain on the landscape; however, stand densities will continue to increase with white fir out-competing ponderosa pine and Douglas fir. Over time, large trees may become limited due to white fir encroachment. Increased stand densities also increases the risk of a large scale fire event occurring, which may result in a loss of large snags and structure.

Waterfowl: The quality of habitat will improve as vegetation within the riparian reserves that was lost during the Eyerly fire is reestablished. Two campgrounds and private home

tracts occur along the Metolius River and Lake Billy Chinook. Loss of snag habitat for nesting in and adjacent to these areas is a concern due to the limited amount of nesting structures available along potentially suitable habitat. However, high use recreation areas may not be preferred nest sites due to the increased disturbance levels. Snag habitat along the river in between campgrounds and private home tracts is important to retain due to the loss of this habitat component elsewhere. Along the 64 road and within Perry South Campground hazard trees will be removed for safety reasons. An estimated 120 snags over 21 inches will be removed near the Metolius River and Lake Billy Chinook (*Table 3.6-36*).

Mammals

American Marten: Further degradation from insects and disease may occur in areas containing green residual trees, especially those stands adjacent to stands that were severely burned in the Eyerly fire. Damaged green trees and dead wood (habitat for Douglas-fir beetles) has increased and may increase mortality, by beetles, in the remaining live trees that provide canopy layers, canopy cover, structure, and increased connectivity. Residual large green tree habitat is very important to retain since a large portion of the large green trees were lost during the Eyerly fire. Within stands that suffered stand replacement and mixed severity burns, many of the smaller trees (i.e. less than 21" dbh) were lost. The loss of these smaller trees set back large green tree replacement. It will take several decades before large green trees occur within the stand replacement areas.

In the areas that did not burn, habitat trends should increase with canopy layers, canopy cover, structure, down woody material, snags, and increased connectivity. Mixed conifer stands may continue to lose large ponderosa pine and Douglas-fir components being replaced by white fir and other less fire tolerant species. Suitable habitat would continue to exist with white fir providing key elements for the marten. This habitat would be short-lived due to white fir longevity and be more susceptible to wildfire.

The no action alternative may result in increased fuel loadings when snags begin to litter the forest floor. The higher fuel loading may result in the suppression of regeneration, which may prolong the establishment of late successional habitat conditions. Increased fuel loadings may also put remaining habitat at risk from disturbance (i.e. fire).

The proposed hazard tree project is not within suitable habitat.

Bats: Many of the bat species, such as the hoary and silver-haired bat use green forests as primary habitat. Therefore, much of the area that experienced stand replacement fire is not considered suitable habitat for these two species. For species of bats that use more open areas to forage like the big brown bat potential foraging habitat exists. There is an abundant amount of snag habitat available for roost sites, but many of the snags are fire hardened and may not be usable by bats for a long period of time.

Further degradation from insects and disease may occur in areas containing green residual trees, especially those stands adjacent to stands that were severely burned. Damaged green trees and dead wood (habitat for Douglas-fir beetles) has increased and may increase mortality, by beetles, in the remaining live trees that provide canopy layers, canopy cover, structure, and increased connectivity. Residual large green tree habitat is very important to retain since a large portion of the large green trees were killed during

the fire. Within stands that suffered stand replacement and mixed severity many of the smaller trees (i.e. less than 21" dbh) were killed. The loss of these smaller trees set back large green tree replacement. It will take several decades before large green trees occur within the stand replacement areas.

In the areas that did not burn, habitat trends should increase with canopy layers, canopy cover, structure, down woody material, snags, and increased connectivity. Mixed conifer stands may continue to lose large ponderosa pine and Douglas-fir components being replaced by white fir and other less fire tolerant species. Suitable habitat would continue to exist with white fir providing key elements for the bats. This habitat would be short-lived due to white fir longevity and be more susceptible to wildfire.

Trees that pose a hazard to public safety would continue to be monitored and felled when identified. An estimated 180 hazard trees over 21 inches dbh are planned to be felled along the highway safety act roads and within Perry South Campground during 2004 (*Table 3.6-26*).

Continued hazard tree removal also limits the availability of snag habitat, especially near the Metolius River and Lake Billy Chinook. Increased human use of the project area may also lead to increased disturbance of day and night roosts, maternity sites, and winter hibernaculum's.

Big Game

Deer: Hiding cover is present in denser stands, ponderosa pine thickets, and along riparian reserves where stand replacement fire did not occur. Mixed conifer stands provide both hiding and thermal cover in general. In areas that did not burn, stands will continue to increase in canopy cover, which may limit growth of forage species. However, hiding and thermal cover should increase in quantity and quality.

Thermal and hiding cover will be virtually non-existent within the moderate to severe burn intensity areas. Dead trees will still provide minimal amounts of thermal and hiding cover until the majority of dead trees have fallen. However, about 75% of the snags may fall within 20 years (Parks et al. 1999, Dahms 1949, Keen 1950, Haggard and Gaines 2001) Hiding cover, which may be more critical within the fire area, would also decrease as dead trees fall. Regeneration of trees would occur slowly from the fire perimeter toward the center, reducing sight distance as they attain 5-10 feet in height over 15-30 years. Regeneration of trees to provide thermal cover, which is defined as 30 feet tall providing 40% crown closure, is expected to take in excess of 60 years.

Summer forage values for deer are expected to increase both in the short and long term. Removal of forest canopies through wild or prescribed fire stimulates forest floor vegetation and provides nutrient rich forage to ungulates. Forage values are expected to remain improved until crowns of regenerating conifers start reaching 40% percent crown closure in 60 years.

Within the winter range, large portions of bitterbrush were consumed, which will prolong the establishment of winter forage. The lack of cover may also displace deer that used wintering grounds within the Eyerly fire area to the east onto the Crooked River National Grasslands and private property and to the north to the Confederated Tribes of Warm Springs land.

Elk: Hiding cover is present in denser stands, ponderosa pine thickets, and along riparian reserves where stand replacement fire did not occur. Mixed conifer stands provide both hiding and thermal cover in general. In areas that did not burn stands will continue to increase in canopy cover, which may limit growth of forage species. However, hiding and thermal cover should increase in quantity and quality.

Thermal and hiding cover will be virtually non-existent within the moderate to severe burn intensity areas. Dead trees will still provide minimal amounts of thermal and hiding cover until the majority of dead trees have fallen. Within the first decade post fire, the majority of dead trees are expected to fall. Hiding cover, which may be more critical within the fire area, would also decrease as dead trees fall, reaching a maximum effect by about year 10. Regeneration of trees would occur slowly from the fire perimeters toward their centers, reducing sight distance as they attain 5-10 feet in height in 15-30 years. Regeneration of trees to provide thermal cover, which is defined as at least 10 acres that are 40 feet tall providing 40% crown closure, is expected to take in excess of 70 years.

Forage values to elk are expected to increase both in the short and long term. Removal of forest canopies through wild or prescribed fire stimulates forest floor vegetation and provides nutrient rich forage to ungulates. Forage values are expected to remain improved until crowns of regenerating conifers start reaching 40% percent closure in 70 years.

Effects of Alternative 2

Birds

Primary Cavity Excavators: Alternative 2 would harvest snags in proposed units and provide for snag numbers consistent with the Metolius LSRA snag standards (USDA 1996b). The number of snags and green trees per acre by size class and PAG were prescribed (Table 4). Additional snag guidelines are addressed in the ROD (USDA 1994), pages C-41 and 42 (general) and pages 33-35 in the Final SEIS (USDA 2001).

The seven post fire species analyzed require snags levels at or above 7.2 snags per acre greater than or equal to 9 inches dbh and there are 12,061 acres within the project area that meet that criteria. Alternative 2 will provide habitat at varying levels for these species. Average snags per acre are derived from the DecAID advisory tool and estimates of average snags per acre by size class, the project area acres of habitat for Alternative 2 were calculated. *Table 3.6-41* shows the acres of habitat within the different tolerance levels for Alternative 2. The acres within the project area that were outside of the Eyerly Fire were not included in the table because they do not meet the definition of recent post-fire habitat.

Table 3.6-41. Alternative Comparison of habitat for cavity nesters (within USFS boundary)

Species	0 - 29 % tolerance (acres)			30 - 49 % tolerance (acres)			50 - 79 % tolerance (acres)			≥ 80 % tolerance (acres)		
	Alt 1	Alt 2	Alt 3	Alt 1	Alt 2	Alt 3	Alt 1	Alt 2	Alt 3	Alt 1	Alt 2	Alt 3
Lewis Woodpecker	4109	8865	4091	12051	8553	12835	2090	1038	1469	415	218	277
Black-backed Woodpecker	15507	16709	16397	1705	864	1112	1122	844	895	331	258	269
Hairy Woodpecker	5441	10120	8119	8197	5807	7108	3462	1584	2201	1565	1163	1244
White-headed Woodpecker	8455	12507	10814	5944	3716	4869	3034	1456	1947	1232	997	1043
Northern Flicker	12562	13397	12852	5843	5127	5645	260	151	176	0	0	0
Mountain Bluebird	3118	7921	3105	14783	10393	15101	763	360	467	0	0	0
Western Bluebird	4020	8783	4004	7618	6021	9782	4141	2082	2821	2886	1788	2066

In Alternative 2 there are an estimated 1,038 acres of Lewis' woodpecker habitat within the 50 to 79% tolerance level and 218 acres in the 80% plus. That means 1,038 acres of habitat meets the criteria of at least 24.8 snags per acre greater than or equal to 9 inches dbh and has at least 6.2 snags per acre greater than or equal to 21 inches dbh and 218 acres of habitat meets the criteria of at least 48.1 snags per acre greater than or equal to 9 inches dbh and has at least 16.2 snags per acre greater than or equal to 21 inches dbh (criteria identified in DecAID from empirical studies {Mellen et al. 2002}).

Three studies conducted on recent post-fire habitat revealed that most species of cavity nesters selected larger than average trees for nesting (Hitchcock 1996, Hejl & McFadzen 1998, and Sabb & Dudley 1998). The only post-fire large tree habitat that will be altered in Alternative 2 in the 12,909 acres outside of designated units are hazard trees along roads. Within designated units snag retention levels outlined in *Table 3.6-2* show that within proposed units, a large portion of snags that will be retained are large snags (i.e. 15 inches plus dbh).

Removal of snags for Alternative 2 will have varying effects on cavity nesters that use recent post-fire habitat. Black-backed woodpeckers prefer unlogged post-fire habitat (Hitchcock 1996, Hejl & McFadzen 1998, and Sabb & Dudley 1998). Studies conducted by Hitchcock (1996) found that three-toed woodpeckers, red-naped sapsuckers, and Williamson's sapsuckers were only found in unlogged sites that still contained some live trees. Hejl and McFadzen (1998) also found that brown creepers and three-toed woodpeckers prefer unlogged sites. Saab and Dudley (1998) found that hairy woodpeckers and mountain bluebird nest densities were highest in unlogged sites. The only post-fire, large tree habitat in the 12,909 acres outside of designated units that would be altered is from the hazard trees along roads.

Several species of cavity nesters showed no preference to logged or unlogged sites. Hejl and McFadzen (1998) found hairy woodpeckers, northern flickers, mountain bluebirds, and red-breasted nuthatches showed no preference to logged or unlogged areas.

Two studies conducted in recent post-fire habitat revealed that Lewis' woodpeckers preferred logged sites (Hejl & McFadzen 1998 and Sabb & Dudley 1998). Lewis' woodpeckers need open spaces to forage, because unlike most species of woodpeckers, the Lewis' woodpecker flycatches. Hejl & McFadzen (1998) also found that Williamson's sapsucker preferred logged sites, while Sabb & Dudley (1998) found that western bluebirds preferred logged sites as well. The 4,846 acres that would be treated may be beneficial to species of cavity nesters like the Lewis' woodpecker that prefer more open areas.

The majority of the fire is located in ponderosa pine and the Lewis' Woodpecker is identified as the focal species for Central Oregon. The Lewis' Woodpecker is also identified as one of the BCC birds. Therefore snags will be left in clumps based on the patch size and home range requirements of the Lewis' Woodpecker, which is 15 acres (Thomas et al. 1979). Saab and Dudley (1998) also showed that leaving clumped snags is preferred over even distribution for cavity nesters for salvage logging.

Within the HSV stand replacement salvage, live canopy cover remains in small isolated patches. Removal of snags and down wood in these areas will reduce the potential nesting habitat for cavity nesters. However about 75% of the snags may fall within 20 years (Parks et al. 1999, Dahms 1949, Keen 1950, Haggard and Gaines 2001). Alternative 2 will result in a decrease in structure, primarily material greater than 12" dbh. This will impact species like mountain bluebirds that prefer larger material for nesting and foraging the most. Loss of structure will change available habitat conditions favoring species that prefer snags in a more open landscape. Current species abundance may decrease or species may be displaced into adjacent areas or into marginal habitat. However, species that prefer more open stands will benefit from this treatment. Some large snags may be lost due to safety concerns and structure may be consumed during post harvest activities, primarily underburning. However about 75% of the snags may fall within 20 years (Parks et al. 1999, Dahms 1949, Keen 1950, Haggard and Gaines 2001) See Figures 3.6-6 through 3.6-10 for estimated fall rates on snags.

Handpiling as a fuels treatment, would result in larger down woody material and snags being retained, which maintains potential nesting structure for cavity nesters. Milne and Hejl (1989) have found that white-headed woodpeckers will use leaning or down logs as nesting substrate where habitat conditions are marginal or snag levels are reduced. Machine piling or machine piling in trails is preferred where snag densities are low. Piles can be located away from snags and down logs to reduce impacts to potential habitat. Underburning and mowing would result in the greatest reduction in risk to residual stands, however there is also a greater risk of loss to existing snags and down woody material degrading habitat.

Coopers and Sharp-Shinned Hawks: No Cooper's or sharp-shinned hawk habitat will be harvested with this alternative. Approximately 1,023 acres of habitat will remain for the short term. The proposed hazard tree project is not within suitable Cooper's or sharp-shinned hawk habitat. There are 4,431 acres of treatment within stand replacement areas and there is no nesting or foraging habitat.

There are 376 acres proposed for treatment within the HSV mixed severity salvage. Currently, large trees and canopy cover remains in patches. The stands proposed for treatment were identified to reduce the risk of insects and disease to remaining live trees. Snag numbers and green trees would follow guidelines outlined in Chapter 2 (*Table 2.6-3*). In the short term salvage will decrease the level of snags and down wood. However, without treatment in mixed severity stands, remaining large live trees (greater than 21 inches dbh) in these stands may suffer mortality due to increased levels of insects and disease. The loss of large trees will decrease the available old and late structure within the project area.

Removal of snags and down wood in proposed treatment units will decrease the amount of structure retained throughout approximately the first 150 years of the stand. This may decrease foraging habitat by decreasing prey populations dependent on dead wood structure. However snags and down wood will still be retained at ROD and LSRA levels.

Figures 3.6-8 and 3.6-10 show how large snags will remain on the landscape and by 2097 most of the landscape will have relatively low numbers of large snags (i.e. greater than 20 inches).

In the remaining suitable habitat with the absence of catastrophic occurrences, habitat trends will continue to increase with canopy layers, canopy cover, structure, down woody material, snags, and increased connectivity. Mixed conifer stands will continue to lose large ponderosa pine and Douglas-fir components being replaced by white fir and other less fire tolerant species. Suitable habitat will continue to exist with white fir providing the majority of the nesting and foraging component. This habitat would be short-lived due to white fir longevity.

There is an increased risk of loss of the remaining suitable habitat by a stand replacing fire event or degradation by insects and disease. If such an event were to occur, it would prolong the development of suitable habitat within the project area and may destroy critical habitat components like large snags and down woody material. However, some snags and down woody material would be created with the onset of these events.

In areas not identified for treatment, no treatment may result in increased fuel loadings when snags begin to litter the forest floor. The higher fuel loading may result in the suppression of regeneration, which may prolong the establishment of late successional habitat conditions. Increased fuel loadings may also put remaining habitat at risk from disturbance (i.e. fire).

Flammulated Owl: Along the highway safety act roads and within Perry South Campground, hazard trees will be felled for safety reasons. An estimated 180 snags over 21 inches will be removed (*Table 3.6-26*). Approximately, 4,846 acres will be harvested within this alternative. HSV salvage will remove dead or severely damaged trees. Minimum diameter of salvaged trees will be 16 inches for ponderosa pine and 12 inches for Douglas-fir. SPF salvage will utilize small diameter products such as posts, rails, house logs, chips, or firewood.

Most treatments are proposed for stands that experienced stand replacement fire and does not include suitable habitat. Live canopy cover remains in small isolated patches. Minimal habitat will be treated, assuming that adjacent green trees are located near the stands. Proposed treatments include salvage of dead or severely damaged trees.

Removal of snags and down wood in proposed treatment units will decrease the amount of structure retained throughout approximately the first 150 years of the stand. This may decrease foraging habitat by decreasing prey populations dependent on dead wood structure. However, snags that exist in nesting habitat are products of competition after large trees have been established (Maffei, pers. comm. 07-21-03). Therefore, the removal of snags during salvage operations will not be removing nesting habitat, due to the fact that by the time the stand is re-established as nesting habitat the snag and down wood that exists on the landscape now will have completely decomposed. However snags and down wood will still be retained at ROD and LSRA levels. Figures 3.6-8 and 3.6-10 show how large snags will remain on the landscape and by 2097 most of the landscape will have relatively low numbers of large snags (i.e. greater than 20 inches).

There are 376 acres proposed for treatment within the HSV mixed severity salvage. Currently, large trees and canopy cover remain in patches. The stands proposed for treatment were identified to reduce the risk of insects and disease to remaining live trees.

In the short term salvage will decrease the level of snags and down wood. However, without treatment in mixed severity stands, remaining large live trees (greater than 21 inches dbh) in these stands may suffer mortality due to increased levels of insects and disease. The loss of large trees will decrease the available old and late structure within the project area.

Great Blue Heron: Along the 64 road and within Perry South Campground hazard trees will be removed for safety reasons. An estimated one hundred and twenty snags over 21 inches will be removed near the Metolius River and Lake Billy Chinook (*Table 3.6-36*). Within the project area there are two highway safety act roads (64 and 1170 rd) and two campgrounds. A large hazard tree removal project associated with the safety roads and campgrounds is planned. The result is the loss of large snag habitat for safety reasons. This limits the available nesting sites along the Metolius River and Lake Billy Chinook. Therefore, large snag habitat outside of designated areas, but within 200 yards of water, is very important to retain since a large portion of the large snag habitat will be lost in the recreation sites and along the highway safety act roads due to safety concerns.

The treatment units for Alternative 2 occur outside of potential blue heron habitat.

Great Gray Owl: The openings created by the salvage operations, adjacent to underburned stands may create suitable great gray habitat, assuming the underburned stands meet nesting habitat described above. No suitable great gray owl habitat will be harvested with this alternative.

The proposed hazard tree project is not within suitable habitat. 4,846 acres will be harvested within this alternative. HSV salvage will remove dead or severely damaged trees. Minimum diameter of salvaged trees will be 12 inches. SPF salvage will utilize small diameter products such as posts, rails, house logs, chips, or firewood.

Most treatments are proposed for stands that experienced stand replacement fire and are not considered habitat. Live canopy cover remains in small isolated patches and will not be impacted. Proposed treatments include salvage of dead or severely damaged trees. No great gray habitat will be treated.

Removal of snags and down wood in proposed treatment units will decrease the amount of structure retained throughout approximately the first 150 years of the stand. Down wood and snags that exist in old-growth stands are products of competition after large trees have been established (Maffei, pers. comm. 07-21-03). Therefore, the removal of snags during salvage operations will not be removing elements of great gray owl habitat, due to the fact that by the time the stand is re-established as nesting habitat, the snag and down wood that exists on the landscape now will have completely decomposed. However snags and down wood will be retained at ROD and LSRA levels.

Within the HSV mixed severity salvage, canopy cover remains in patches. Removal of snags or severely damaged trees and down wood will occur outside of habitat. In the short term treatment will decrease the amount of snags and down wood, which may decrease available prey habitat. However, without treatment to the mixed severity stands the remaining large live trees (greater than 21 inches dbh) may suffer mortality due to insects and disease. The loss of large trees in these stands will decrease the available future habitat within the project area.

Northern Goshawk: Hazard trees located in *Table 3.6-26* will be removed. Also 4,846 acres will be harvested within this alternative. HSV salvage will remove dead or severely damaged trees. Minimum diameter of salvaged trees will be 12. SPF salvage will utilize small diameter products such as posts, rails, house logs, chips, or firewood.

No goshawk habitat (nesting or foraging) will be harvested with this alternative. Approximately 681 acres of foraging and 248 acres of nesting goshawk habitat will remain for the short term. Approximately 1% of the project area (within USFS lands) is currently identified as nesting habitat, while 3% of the project area is foraging habitat (within USFS lands). Most of the existing goshawk habitat is found in the MCW, MCD, and PPD PAG's located to the west of the 1190 road within the project area.

The proposed hazard tree project is not within suitable goshawk habitat. 4,431 acres of treatment are stand replacement where there is no nesting or foraging habitat.

There are 376 acres proposed for treatment within the HSV mixed severity salvage. Currently, large trees and canopy cover remains in patches. The stands proposed for treatment outside the LSR were identified to reduce the risk of insects and disease to remaining live trees. Snag numbers would follow guidelines outlined in *Chapter 2, Table 2.6-3*. In the short term salvage will decrease the level of snags and down wood. However, without treatment in mixed severity stands, remaining large live trees (greater than 21 inches dbh) in these stands may suffer mortality due to increased levels of insects and disease. The loss of large trees will decrease the available old and late structure within the project area.

Removal of snags and down wood in proposed treatment units will decrease the amount of structure retained throughout approximately the first 150 years of the stand. This may decrease foraging habitat by decreasing prey populations dependent on dead wood structure. However, down wood and snags that exist in nesting habitat are products of competition after large trees have been established (Maffei, pers. comm. 07-21-03). Therefore, the removal of snags during salvage operations will not be removing constituent elements of nesting habitat, due to the fact that by the time the stand is re-established as nesting habitat the snag and down wood that exists on the landscape now will have completely decomposed. However snags and down wood will still be retained at ROD and LSRA levels. Figures 3.6-8 and 3.6-10 show how large snags will remain on the landscape and by 2097 most of the landscape will have relatively low numbers of large snags (i.e. greater than 20 inches).

In the remaining suitable habitat with the absence of catastrophic occurrences, habitat trends will continue to increase with canopy layers, canopy cover, structure, down woody material, snags, and increased connectivity. Mixed conifer stands will continue to lose large ponderosa pine and Douglas-fir components being replaced by white fir and other less fire tolerant species. Suitable habitat will continue to exist with white fir providing the majority of the nesting and foraging component. This habitat would be short-lived due to white fir longevity.

There is an increased risk of loss of the remaining suitable habitat by a stand replacing fire event or degradation by insects and disease. If such an event were to occur, it would prolong the development of suitable habitat within the project area and may destroy critical habitat components like large snags and down woody material. However, some snags and down woody material would be created with the onset of these events.

In areas not identified for treatment, no treatment may result in increased fuel loadings when snags begin to litter the forest floor. The higher fuel loading may result in the suppression of regeneration, which may prolong the establishment of late successional

habitat conditions. Increased fuel loadings may also put remaining habitat at risk from disturbance (i.e. fire).

Osprey: Proposed salvage units for the Eyerly project are not located in suitable osprey habitat. However, along the 64 road and within Perry South Campground hazard trees will be removed for safety reasons. An estimated one hundred and twenty snags over 21 inches dbh will be removed within suitable osprey habitat (*Table 3.6-36*). The result will be the loss of large snag habitat for safety reasons. This limits available nesting, roosting, and perch sites along the Metolius River and Lake Billy Chinook. Therefore, large snag habitat outside of designated areas is very important to retain since a large portion of the large snag habitat will be lost in the recreation sites and along the highway safety act roads due to safety concerns.

Red-tail Hawk: Removal of snags and down wood in proposed treatment units will increase the amount of habitat available for red-tailed hawks. Openings will either be enlarged or created during operations, which will increase foraging habitat. The large snags will provide nesting sites and will be interspersed with openings that may serve as foraging habitat. Under Alternative 2, 4,846 acres will be harvested within this alternative, but no known nest trees will be harvested so there will be no direct effects. Indirect effects will be minor and include harvest of potential nest sites, but adequate levels of large snags for nest sites will be retained. HSV salvage will remove dead or severely damaged trees. Minimum diameter of salvaged trees will be 12 inches. SPF salvage will utilize small diameter products such as posts, rails, house logs, chips, or firewood.

Waterfowl: Along the 64 road and within Perry South Campground hazard trees will be removed for safety reasons. An estimated one hundred and twenty snags over 21 inches will be removed near the Metolius River and Lake Billy Chinook.

The project area provides potential habitat for the following species: mallard, canvasback, common merganser, Canada goose, wood duck, northern pintail, blue-winged teal, cinnamon teal, northern shoveler, American wigeon, redhead, and hooded merganser. There are no proposed salvage units within riparian reserves. However, the hazard tree project may result in the loss of snags from riparian reserves, which would decrease nesting habitat for species like wood ducks and hooded mergansers. However, the trees that will be removed will occur in habitat that may already be unsuitable due to the recreation that occurs. Therefore, impacts will be minor. There are no meadows adjacent to the Metolius River or Lake Billy Chinook so nesting habitat for many waterfowl species is lacking in the project area.

Mammals

American Marten: No suitable marten habitat will be harvested with this alternative. 4,846 acres will be harvested within this alternative. HSV salvage will remove dead or severely damaged trees. Minimum diameter of salvaged trees will be 12 inches. SPF salvage will utilize small diameter products such as posts, rails, house logs, chips, or firewood.

Removal of snags and down wood in proposed treatment units will decrease the amount of structure retained throughout approximately the first 150 years of the stand. Down wood and snags that exist in old-growth stands are products of competition after large trees have been established (Maffei, pers. comm. 07-21-03). Therefore, the removal of snags during salvage operations will not be removing elements of habitat, due to the fact that by the time the stand is re-established as habitat the snag and down wood that exists on the landscape now will have completely decomposed. However snags and down wood will be retained at ROD and LSRA levels. Figures 3.6-15 and 3.6-16 show down wood will remain on the landscape and by 2092 most of the landscape will have relatively large percent down wood cover.

Within the HSV mixed severity salvage, canopy cover remains in patches. Removal of snags or severely damaged trees and down wood will occur outside of suitable habitat. In the short term treatment will decrease the amount of snags and down wood, which may decrease available prey habitat. However, without treatment to the mixed severity stands the remaining large live trees (greater than 21 inches dbh) may suffer mortality due to insects and disease. The loss of large trees in these stands will decrease the available future habitat within the project area.

Existing suitable habitat is minor in the project area and fragmented. Most of the existing habitat is found in the MCW and MCD PAG's located to the west of the 1190 road within the project area. These patches of habitat are located within the MCD PAG and are unlikely to be sustained over the long term.

In the remaining suitable habitat with the absence of catastrophic occurrences, habitat trends will continue to increase with canopy layers, canopy cover, structure, down woody material, snags, and increased connectivity. Mixed conifer stands will continue to lose large ponderosa pine and Douglas-fir components being replaced by white fir and other less fire tolerant species. Suitable habitat will continue to exist with white fir providing the majority of the nesting, roosting, and foraging component. This habitat would be short-lived due to white fir longevity.

There is an increased risk of loss of the remaining suitable habitat by a stand replacing fire event or degradation by insects and disease. If such an event were to occur, it would prolong the development of suitable habitat within the project area and may destroy critical habitat components like large snags and down woody material. However, some snags and down woody material would be created with the onset of these events.

In areas not identified for treatment, no treatment may result in increased fuel loadings when snags begin to litter the forest floor. The higher fuel loading may result in the suppression of regeneration, which may prolong the establishment of late successional habitat conditions. Increased fuel loadings may also put remaining habitat at risk from disturbance (i.e. fire).

Fuels treatments associated with harvest treatments may have impacts to marten and their prey species. Treatments propose to handpile, machine pile, machine pile in trails, underburn or underburn and mow in proposed harvest units. Handpiling is the least impactful treatment on habitat. Large down woody material will be retained which maintains habitat for prey species and potential resting and denning sites. Machine piling is preferred over underburning in areas where large down material is at minimum levels or below, primarily in the MCW PAG. It is also preferred in areas where the risk of burning the overstory stand is higher. More large snags and down woody material could be retained and risk of escape is dramatically reduced. Underburning and mowing would result in the greatest reduction in risk to residual stands, however there is also a greater risk of loss to existing snags and down woody material degrading habitat. This treatment may be more appropriate for stands occurring in the ponderosa pine and mixed conifer dry PAGs.

Bats: An estimated one hundred and eighty trees over 21 inches dbh are planned to be felled along the highway safety act roads and within Perry South Campground (*Table 3.6-26*). About 4,846 acres will also be harvested within this alternative. HSV salvage will remove dead or severely damaged trees. Minimum diameter of salvaged trees will be 16 inches for ponderosa pine and 12 inches for Douglas-fir. SPF salvage will utilize small diameter products such as posts, rails, house logs, chips, or firewood.

Most treatments are proposed for stands that experienced stand replacement fire. Live canopy cover remains in small isolated patches. Proposed treatments include salvage of dead or severely damaged trees. Limited habitat will be treated.

Removal of snags and down wood in proposed treatment units will decrease the amount of structure retained throughout the first 150 years of the stand. Down wood and snags that exist in old-growth stands are products of competition after large trees have been established (Maffei, pers. comm. 07-21-03). However snags and down wood will still be retained at ROD and LSRA levels. Figures 3.6-8 and 3.6-10 show how large snags will remain on the landscape and by 2097 most of the landscape will have relatively low numbers of large snags (i.e. greater than 20 inches).

Within the HSV mixed severity salvage, canopy cover remains in patches. Removal of snags or severely damaged trees and down wood will occur in potential habitat. In the short term treatment will decrease the amount of snags and down wood, which may decrease roosting habitat. However, without treatment to the mixed severity stands the remaining large live trees (greater than 21 inches dbh) may suffer mortality due to insects and disease. The loss of large trees in these stands will decrease available large green tree future habitat within the project area.

In the remaining suitable habitat with the absence of uncharacteristic occurrences, habitat trends will continue to increase with canopy layers, canopy cover, structure, down woody material, snags, and increased connectivity. Mixed conifer stands will continue to lose large ponderosa pine and Douglas-fir components being replaced by white fir and other less fire tolerant species. Suitable habitat will continue to exist with white fir providing the majority of the nesting, roosting, and foraging component. This habitat would be short-lived due to white fir longevity.

There is an increased risk of loss of the remaining suitable habitat by a stand replacing fire event or degradation by insects and disease. If such an event were to occur, it would

prolong the development of suitable habitat within the project area and may destroy critical habitat components like large snags and down woody material. However, some snags and down woody material would be created with the onset of these events.

Big Game

Deer: Hiding cover is present in denser stands, ponderosa pine thickets, and along riparian reserves where stand replacement fire did not occur. Mixed conifer stands provide both hiding and thermal cover in general. The project area lies within a Late-Successional Reserve. Standards and guidelines for the LSR will take precedent over big game standards and guidelines. However, every attempt will be made to try and incorporate S&G's into unit design to try and meet these wherever possible.

In areas that did not burn, stands will continue to increase in canopy cover, which may limit growth of forage species. However, hiding and thermal cover should increase in quantity and quality.

Thermal and hiding cover will be virtually non-existent within the moderate to severe burn intensity areas. Dead trees will still provide minimal amounts of thermal and hiding cover until the majority of dead trees have fallen. Within the first 20 years, the majority of dead trees are expected to fall. Figures 3.6-7 and 3.6-10 show how snags will remain on the landscape and by 2097.

Hiding cover, which may be more critical within the fire area, would also decrease as dead trees fall. Regeneration of trees would occur slowly from the fire perimeter toward the center, reducing sight distance as they attain 5-10 feet in height over 15-30 years. Regeneration of trees to provide thermal cover, which is defined as 30 feet tall providing 40% crown closure, is expected to take in excess of 60 years.

Summer forage values for deer are expected to increase both in the short and long term. Removal of forest canopies through wild or prescribed fire stimulates forest floor vegetation and provides nutrient rich forage to ungulates. Forage values are expected to remain improved until crowns of regenerating conifers start reaching 40 % percent crown closure in 60 years.

Within the winter range, large portions of bitterbrush were consumed, which will prolong the establishment of winter forage. The lack of cover may also displace deer that used wintering grounds within the Eyerly fire area to the east onto the Crooked River National Grasslands and private property and to the north to the Confederated Tribes of Warm Springs land.

During harvest operations, noise and equipment may displace deer within or adjacent to harvest units. Increased traffic due to operations will also put more deer at risk of collisions with vehicles.

The LRMP (USDA 1990a) states, hiding areas must be present over at least 30% of national forest land and will be dispersed throughout implementation units. However, units planned for harvest are already deficient of hiding cover. All units proposed for harvest suffered at least 25% mortality to the stand and most ground cover was burned, therefore unable to provide hiding cover now. Harvest will not change these conditions.

Harvest of hazard trees will remove snags along the highway safety act roads (64 and 1170) and within Perry South Campground. *Table 3.6-42* identifies proposed treatments within deer habitat types.

Table 3.6-42. Alternative 2 treatments by deer habitat

Deer Habitat Type	HSV-SR Acres	HSV-MS Acres	SPF-SR Acres	SPF-MS Acres	Total Acres
Winter Range	1,924	51	0	0	1,974
Summer Range	1,211	170	143	39	1,563
Transition Range	824	185	376	0	1,392
Management Area 7	1,815	125	0	0	1,940

The minimal amount of hiding cover that existing snags are currently providing will decrease in this alternative based on the retention of snags within the stands. However, movement through treatment units may be easier as snags are removed instead of falling and creating barriers. Removal of snags may also reduce the hiding cover of the deer's predators.

Elk: Hiding cover is present in denser stands, ponderosa pine thickets, and along riparian reserves where stand replacement fire did not occur. Mixed conifer stands provide both hiding and thermal cover in general. The project area lies within a Late-Successional Reserve. Standards and guidelines for the LSR will take precedent over big game standards and guidelines. However, every attempt will be made to try and incorporate S&G's into unit design to try and meet these wherever possible.

In areas that did not burn stands will continue to increase in canopy cover, which may limit growth of forage species. However, hiding and thermal cover should increase in quantity and quality.

Thermal and hiding cover will be virtually non-existent within the moderate to severe burn intensity areas. Dead trees will still provide minimal amounts of thermal and hiding cover until the majority of dead trees have fallen. Within the first decade post fire, the majority of dead trees are expected to fall. Hiding cover, which may be more critical within the fire area, would also decrease as dead trees fall, reaching a maximum effect by about year 10. Regeneration of trees would occur slowly from the fire perimeters toward their centers, reducing sight distance as they attain 5-10 feet in height in 15-30 years. Regeneration of trees to provide thermal cover, which is defined as at least 10 acres that are 40 feet tall providing 40% crown closure, is expected to take in excess of 70 years.

Forage values to elk are expected to increase both in the short and long term. Removal of forest canopies through wild or prescribed fire stimulates forest floor vegetation and provides nutrient rich forage to ungulates. Forage values are expected to remain improved until crowns of regenerating conifers start reaching 40% percent closure in 70 years.

There are no harvest units located in any Key Elk Habitat Area or in identified elk winter range. However, approximately 1¼ miles of the hazard tree project is located within elk winter range. Removal of hazard trees along the 64 road will not alter the function of elk winter range.

Effects of Alternative 3

Birds

Primary Cavity Excavators: This alternative will harvest snags in designated units to the 30 % and 50 % tolerance levels for the Lewis' woodpecker indicated by DecAID. Alternative 3 includes design elements to leave snags at a higher level than those described in the Metolius LSRA (USDA 1996b). Snag levels are located in *Table 2.7-3* in Chapter 2.

The seven post fire species analyzed require snags levels at or above 7.2 snags per acre greater than or equal to 9 inches dbh and there are 12,061 acres within the project area that meet that criteria. Alternative 3 will provide habitat at varying levels for these species. Estimates of average snags per acre are derived from the DecAID advisory tool by size class, the project area acres of habitat for Alternative 3 were calculated. *Table 3.6-43* shows the acres of habitat within the different tolerance levels for Alternative 3. The acres within the project area that were outside of the Eyerly Fire were not included in the table because they do not meet the definition of recent post-fire habitat.

Table 3.6-43. Alternative Comparison of habitat for cavity nesters (within USFS boundary)

Species	0 - 29 % tolerance (acres)			30 - 49 % tolerance (acres)			50 - 79 % tolerance (acres)			≥ 80 % tolerance (acres)		
	Alt 1	Alt 2	Alt 3	Alt 1	Alt 2	Alt 3	Alt 1	Alt 2	Alt 3	Alt 1	Alt 2	Alt 3
Lewis Woodpecker	4109	8865	4091	12051	8553	12835	2090	1038	1469	415	218	277
Black-backed Woodpecker	15507	16709	16397	1705	864	1112	1122	844	895	331	258	269
Hairy Woodpecker	5441	10120	8119	8197	5807	7108	3462	1584	2201	1565	1163	1244
White-headed Woodpecker	8455	12507	10814	5944	3716	4869	3034	1456	1947	1232	997	1043
Northern Flicker	12562	13397	12852	5843	5127	5645	260	151	176	0	0	0
Mountain Bluebird	3118	7921	3105	14783	10393	15101	763	360	467	0	0	0
Western Bluebird	4020	8783	4004	7618	6021	9782	4141	2082	2821	2886	1788	2066

In Alternative 3 there are an estimated 1,469 acres of Lewis Woodpecker habitat within the 50 to 79% tolerance level and 277 acres in the 80% plus. That means 1,469 acres of habitat meets the criteria of at least 24.8 snags per acre greater than or equal to 9 inches dbh and has at least 6.2 snags per acre greater than or equal to 21 inches dbh and 277 acres of habitat meets the criteria of at least 48.1 snags per acre greater than or equal to 9 inches dbh and has at least 16.2 snags per acre greater than or equal to 21 inches dbh (criteria identified in DecAID from empirical studies (Mellen et al. 2002).

Three studies conducted on recent post-fire habitat revealed that most species of cavity nesters selected larger than average trees for nesting (Hitchcock 1996, Hejl & McFadzen 1998, and Sabb & Dudley 1998). The only post-fire large tree habitat that will be altered in Alternative 3 in the 12,909 acres outside of designated units are hazard trees along roads. Within designated units snag retention levels outlined in *Table 3.6-2* show that within proposed units a large portion of snags retained are large snags (i.e. 15 inches plus dbh).

Removal of snags for Alternative 3 will have varying effects on cavity nesters that use recent post-fire habitat. Black-backed woodpeckers prefer unlogged post-fire habitat (Hitchcock 1996, Hejl & McFadzen 1998, and Sabb & Dudley 1998). Studies conducted

by Hitchcock (1996) found that three-toed woodpeckers, red-naped sapsuckers, and Williamson's sapsuckers were only found in unlogged sites that still contained some live trees. Hejl and McFadzen (1998) also found that brown creepers and three-toed woodpeckers prefer unlogged sites. Saab and Dudley (1998) found that hairy woodpeckers and mountain bluebird nest densities were highest in unlogged sites. The only post-fire large tree habitat that will be altered in Alternative 3 in the 14,893 acres outside of designated units are hazard trees along roads.

Several species of cavity nesters showed no preference to logged or unlogged sites. Hejl and McFadzen (1998) found hairy woodpeckers, northern flickers, mountain bluebirds, and red-breasted nuthatches showed no preference to logged or unlogged areas.

Two studies conducted in recent post-fire habitat revealed that Lewis' woodpeckers preferred logged sites (Hejl & McFadzen 1998 and Sabb & Dudley 1998). Lewis' woodpeckers need open spaces to forage, because unlike most species of woodpeckers, the Lewis' woodpecker flycatches. Hejl & McFadzen (1998) also found that Williamson's sapsucker preferred logged sites, while Sabb & Dudley (1998) found that western bluebirds preferred logged sites as well. About 2,893 acres will be treated, which may be beneficial to species of cavity nesters like the Lewis' woodpecker that prefer more open areas.

The majority of the fire is located in ponderosa pine and the Lewis' Woodpecker is identified as the focal species for Central Oregon. The Lewis' Woodpecker is also identified as one of the BCC birds. Therefore snags will be left in clumps based on the patch size and home range requirements of the Lewis' Woodpecker, which is 15 acres (Thomas et al. 1979). Saab and Dudley (1998) also showed that leaving clumped snags is preferred over even distribution for cavity nesters for salvage logging.

Within the HSV stand replacement salvage, live canopy cover remains in small isolated patches. Removal of snags and down wood in these areas will reduce the potential nesting habitat for cavity nesters. However, it is estimated that most of the snags will be on the ground within 15 years (USDA 1994c and Parks et al. 1999).

Alternative 3 will result in a decrease in structure, primarily material greater than 12" dbh. This will impact species like mountain bluebirds that prefer larger material for nesting and foraging the most. Loss of structure will change available habitat conditions favoring species that prefer snags in a more open landscape. Current species abundance may decrease or species may be displaced into adjacent areas or into marginal habitat. However, species that prefer more open stands will benefit from this treatment. Some large snags may be lost due to safety concerns and structure may be consumed during post harvest activities, primarily underburning. However, it is estimated that most of the snags will be on the ground within 15 years (USDA 1994c and Parks et al. 1999). Figures 3.6-8 and 3.6-10 show how large snags will remain on the landscape and by 2097 most of the landscape will have relatively low numbers of large snags (i.e. greater than 20 inches).

Fuel treatments will have varying impacts on snags and down woody material.

Underburning usually results in smaller material being consumed while retaining larger structure if burning occurs in the spring. However, advanced decay class material may be at risk in any season. Handpiling would result in larger down woody material and snags being retained, which maintains potential nesting structure for cavity nesters. Milne and Hejl (1989) have found that white-headed woodpeckers will use leaning or down logs as nesting substrate where habitat conditions are marginal or snag levels are reduced.

Machine piling or machine piling in trails is preferred where snag densities are low. Piles can be located away from snags and down logs to reduce impacts to potential habitat.

Underburning and mowing would result in the greatest reduction in risk to residual stands, however there is also a greater risk of loss to existing snags and down woody material degrading habitat.

Coopers and Sharp-Shinned Hawks: No Cooper's or sharp-shinned hawk habitat will be harvested with this alternative. Approximately 1,023 acres of habitat will remain for the short term. The proposed hazard tree project is not within suitable Cooper's or sharp-shinned habitat. 2,893 acres of treatment are stand replacement where there is no nesting or foraging habitat.

Removal of snags and down wood in proposed treatment units will decrease the amount of structure retained throughout approximately the first 150 years of the stand. This may decrease foraging habitat by decreasing prey populations dependent on dead wood structure. However, down wood and snags that exist in nesting habitat are products of competition after large trees have been established (Maffei, pers. comm. 07-21-03). Therefore, the removal of snags during salvage operations will not be removing constituent elements of nesting habitat, due to the fact that by the time the stand is re-established as nesting habitat the snag and down wood that exists on the landscape now will have completely decomposed. However snags and down wood will still be retained at ROD and LSRA levels. Figures 3.6-8 and 3.6-10 show how large snags will remain on the landscape and by 2097 most of the landscape will have relatively low numbers of large snags (i.e. greater than 20 inches).

In the remaining suitable habitat with the absence of catastrophic occurrences, habitat trends will continue to increase with canopy layers, canopy cover, structure, down woody material, snags, and increased connectivity. Mixed conifer stands will continue to lose large ponderosa pine and Douglas-fir components being replaced by white fir and other less fire tolerant species. Suitable habitat will continue to exist with white fir providing the majority of the nesting and foraging component. This habitat would be short-lived due to white fir longevity.

There is an increased risk of loss of the remaining suitable habitat by a stand replacing fire event or degradation by insects and disease. If such an event were to occur, it would prolong the development of suitable habitat within the project area and may destroy critical habitat components like large snags and down woody material. However, some snags and down woody material would be created with the onset of these events.

Further degradation from insects and disease may occur in areas containing green residual trees, especially those stands adjacent to stands that were severely burned. Damaged green trees and dead wood (habitat for Douglas-fir beetles) has increased and may increase mortality, by beetles, in the remaining live trees that provide canopy layers, canopy cover, structure, and increased connectivity for spotted owl habitat. Residual large green tree habitat is very important to retain since a large portion of the large green trees were lost during the fire. Within stands that suffered stand replacement and mixed severity many, of the smaller trees (i.e. less than 21" dbh) were lost. The loss of these smaller trees set back large green tree replacement. It will take several decades before large green trees occur within the stand replacement areas.

In the areas that did not burn, habitat trends should increase with canopy layers, canopy cover, structure, down woody material, snags, and increased connectivity. Mixed conifer stands may continue to lose large ponderosa pine and Douglas-fir components being

replaced by white fir and other less fire tolerant species. Suitable habitat would continue to exist with white fir providing the nesting and foraging component. This habitat would be short-lived due to white fir longevity and be more susceptible to wildfire.

In areas not identified for treatment, no treatment may result in increased fuel loadings when snags begin to litter the forest floor. The higher fuel loading may result in the suppression of regeneration, which may prolong the establishment of late successional habitat conditions. Increased fuel loadings may also put remaining habitat at risk from disturbance (i.e. fire).

Flammulated Owl: Along the highway safety act roads and within Perry South Campground, hazard trees will be felled for safety reasons. An estimated one hundred and eighty snags over 21 inches will be removed (*Table 3.6-26*). 2,893 acres will be harvested within this alternative. HSV salvage will remove dead or severely damaged trees. Minimum diameter of salvaged trees will be 12 inches. SPF salvage will utilize small diameter products such as posts, rails, house logs, chips, or firewood

Most treatments are proposed for stands that experienced stand replacement fire and do not occur in suitable habitat. Live canopy cover remains in small isolated patches. Proposed treatments include salvage of dead or severely damaged trees. Minimal potential habitat will be impacted because flammulated owl habitat is not described as post-fire habitat.

Removal of snags and down wood in proposed treatment units will decrease the amount of structure retained throughout approximately the first 150 years of the stand. This may decrease foraging habitat by decreasing prey populations dependent on dead wood structure. However, snags that exist in nesting habitat are products of competition after large trees have been established (Maffei, pers. comm. 07-21-03). Therefore, the removal of snags during salvage operations will not be removing nesting habitat, due to the fact that by the time the stand is re-established as nesting habitat the snag and down wood that exists on the landscape now will have completely decomposed. However snags and down wood will still be retained at ROD and LSRA levels. Figures 3.6-8 and 3.6-10 show how large snags will remain on the landscape and by 2097 most of the landscape will have relatively low numbers of large snags (i.e. greater than 20 inches).

Great Blue Heron: Along the 64 road and within Perry South Campground hazard trees will be removed for safety reasons. An estimated one hundred and twenty snags over 21 inches will be removed near the Metolius River and Lake Billy Chinook (*Table 3.6-36*). Within the project area there are two highway safety act roads (64 and 1170 rd) and two campgrounds. A large hazard tree removal project associated with the safety roads and campgrounds is planned. The result is the loss of large snag habitat for safety reasons. This limits the available nesting sites along the Metolius River and Lake Billy Chinook. Therefore, large snag habitat outside of designated areas, but within 200 yards of water, is very important to retain since a large portion of the large snag habitat will be lost in the recreation sites and along the highway safety act roads due to safety concerns.

The treatment units for Alternative 3 occur outside of potential blue heron habitat.

Great Gray Owl: The openings created by the salvage operations, adjacent to underburned stands may create suitable great gray habitat, assuming the underburned

stands meet nesting habitat described above. No suitable great gray owl habitat will be harvested with this alternative.

The proposed hazard tree project is not within suitable habitat. 2,893 acres will be harvested within this alternative. HSV salvage will remove dead or severely damaged trees. Minimum diameter of salvaged trees will be 12. SPF salvage will utilize small diameter products such as posts, rails, house logs, chips, or firewood.

Most treatments are proposed for stands that experienced stand replacement fire and are not considered habitat. Live canopy cover remains in small isolated patches and will not be treated. Proposed treatments include salvage of dead or severely damaged trees. No great gray habitat will be treated.

Removal of snags and down wood in proposed treatment units will decrease the amount of structure retained throughout the first 150 years of the stand. Down wood and snags that exist in old-growth stands are products of competition after large trees have been established (Maffei, pers. comm. 07-21-03). Therefore, the removal of snags during salvage operations will not be removing elements of great gray owl habitat, due to the fact that by the time the stand is re-established as nesting habitat the snag and down wood that exists on the landscape now will have completely decomposed. However snags and down wood will be retained at ROD and LSRA levels. Figures 3.6-8 and 3.6-10 show how large snags will remain on the landscape and by 2097 most of the landscape will have relatively low numbers of large snags (i.e. greater than 20 inches).

Northern Goshawk: Hazard trees located in *Table 3.6-26* will be removed. Also 2,893 acres will be harvested within this alternative. HSV salvage will remove dead or severely damaged trees. Minimum diameter of salvaged trees will be 16 inches for ponderosa pine and 12 inches for Douglas-fir. SPF salvage will utilize small diameter products such as posts, rails, house logs, chips, or firewood.

No goshawk habitat (nesting or foraging) will be harvested with this alternative. Approximately 681 acres of foraging and 248 acres of nesting goshawk habitat will remain for the short term. Approximately 1% of the project area (within USFS lands) is currently identified as nesting habitat, while 3% of the project area is foraging habitat (within USFS lands). Most of the existing goshawk habitat is found in the MCW, MCD, and PPD PAG's located to the west of the 1190 road within the project area.

The proposed hazard tree project is not within suitable goshawk habitat. 2,893 acres of treatment are stand replacement where there is no nesting or foraging habitat.

Removal of snags and down wood in proposed treatment units will decrease the amount of structure retained throughout approximately the first 150 years of the stand. This may decrease foraging habitat by decreasing prey populations dependent on dead wood structure. However, down wood and snags that exist in nesting habitat are products of competition after large trees have been established (Maffei, pers. comm. 07-21-03). Therefore, the removal of snags during salvage operations will not be removing constituent elements of nesting habitat, due to the fact that by the time the stand is re-established as nesting habitat the snag and down wood that exists on the landscape now will have completely decomposed. However snags and down wood will still be retained at ROD and LSRA levels. Figures 3.6-8 and 3.6-10 show how large snags will remain on the landscape and by 2097 most of the landscape will have relatively low numbers of large snags (i.e. greater than 20 inches).

In the remaining suitable habitat with the absence of catastrophic occurrences, habitat trends will continue to increase with canopy layers, canopy cover, structure, down woody material, snags, and increased connectivity. Mixed conifer stands will continue to lose large ponderosa pine and Douglas-fir components being replaced by white fir and other less fire tolerant species. Suitable habitat will continue to exist with white fir providing the majority of the nesting and foraging component. This habitat would be short-lived due to white fir longevity.

There is an increased risk of loss of the remaining suitable habitat by a stand replacing fire event or degradation by insects and disease. If such an event were to occur, it would prolong the development of suitable habitat within the project area and may destroy critical habitat components like large snags and down woody material. However, some snags and down woody material would be created with the onset of these events.

In areas not identified for treatment, no treatment may result in increased fuel loadings when snags begin to litter the forest floor. The higher fuel loading may result in the suppression of regeneration, which may prolong the establishment of late successional habitat conditions. Increased fuel loadings may also put remaining habitat at risk from disturbance (i.e. fire).

Osprey: Proposed salvage units for the Eyerly project are not located in suitable osprey habitat. However, along the 64 road and within Perry South Campground hazard trees will be removed for safety reasons. An estimated one hundred and twenty snags over 21 inches dbh will be removed within suitable osprey habitat. The result will be the loss of large snag habitat for safety reasons. This limits available nesting, roosting, and perch sites along the Metolius River and Lake Billy Chinook. Therefore, large snag habitat outside of designated areas is very important to retain since a large portion of the large snag habitat will be lost in the recreation sites and along the highway safety act roads due to safety concerns.

Red-tail Hawk: Removal of snags and down wood in proposed treatment units will increase the amount of habitat available for red-tailed hawks. Openings will either be enlarged or created during operations, which will increase foraging habitat. The large snags will provide nesting sites and will be interspersed with openings that may serve as foraging habitat. Under Alternative 3, 2,893 acres will be harvested, but no known nest trees will be harvested so there will be no direct effects. Indirect effects will be minor and include harvest of potential nest sites, but adequate levels of large snags for nest sites will be retained. HSV salvage will remove dead or severely damaged trees. Minimum diameter of salvaged trees will be 16 inches for ponderosa pine and 12 inches for Douglas-fir. SPF salvage will utilize small diameter products such as posts, rails, house logs, chips, or firewood.

Waterfowl: Along the 64 road and within Perry South Campground hazard trees will be removed for safety reasons. And estimated one hundred and twenty snags over 21 inches will be removed near the Metolius River and Lake Billy Chinook (*Table 3.6-36*).

The project area provides potential habitat for the following species: mallard, canvasback, common merganser, Canada goose, wood duck, northern pintail, blue-winged teal, cinnamon teal, northern shoveler, American wigeon, redhead, and hooded merganser.

There are no proposed salvage units within riparian reserves. However, the hazard tree project may remove trees from riparian reserves, which would decrease nesting habitat for species like wood ducks and hooded mergansers. However, the trees that will be removed will occur in habitat that may already be unsuitable due to the recreation that occurs. Therefore, impacts will be minor. There are no meadows adjacent to the Metolius River or Lake Billy Chinook so nesting habitat for many waterfowl species is lacking in the project area.

Mammals

American Marten: No suitable habitat will be harvested with this alternative. About 2,893 acres will be harvested within this alternative. *Table 3.6-24* identifies the treatments. HSV salvage will remove dead or severely damaged trees. Minimum diameter of salvaged trees will be 16 inches for ponderosa pine and 12 inches for Douglas-fir. SPF salvage will utilize small diameter products such as posts, rails, house logs, chips, or firewood.

Most treatments are proposed for stands that experienced stand replacement fire. Live canopy cover remains in small isolated patches. Proposed treatments include salvage of dead or severely damaged trees. No marten habitat will be treated. Removal of snags and down wood in proposed treatment units will decrease the amount of structure retained throughout the life of the new stand.

Removal of snags and down wood in proposed treatment units will decrease the amount of structure retained throughout first approximately the 150 years of the stand. Down wood and snags that exist in old-growth stands are products of competition after large trees have been established (Maffei, pers. comm. 07-21-03). Therefore, the removal of snags during salvage operations will not be removing elements of habitat, due to the fact that by the time the stand is re-established as habitat the snag and down wood that exists on the landscape now will have completely decomposed. However snags and down wood will be retained at ROD and LSRA levels. *Figures 3.6-15* and *3.6-16* show down wood will remain on the landscape and by 2092 most of the landscape will have relatively large percent down wood cover.

Existing suitable habitat is minor in the project area and fragmented. Most of the existing marten habitat is found in the MCW and MCD PAG's located to the west of the 1190 road within the project area. These patches of habitat are located within the MCD PAG and are unlikely to be sustained over the long term.

In the remaining suitable habitat with the absence of catastrophic occurrences, habitat trends will continue to increase with canopy layers, canopy cover, structure, down woody material, snags, and increased connectivity. Mixed conifer stands will continue to lose large ponderosa pine and Douglas-fir components being replaced by white fir and other less fire tolerant species. Suitable habitat will continue to exist with white fir providing the majority of the nesting, roosting, and foraging component. This habitat would be short-lived due to white fir longevity.

There is an increased risk of loss of the remaining suitable habitat by a stand replacing fire event or degradation by insects and disease. If such an event were to occur, it would prolong the development of suitable habitat within the project area and may destroy critical habitat components like large snags and down woody material. However, some snags and down woody material would be created with the onset of these events.

In areas not identified for treatment, no treatment may result in increased fuel loadings when snags begin to litter the forest floor. The higher fuel loading may result in the suppression of regeneration, which may prolong the establishment of late successional habitat conditions. Increased fuel loadings may also put remaining habitat at risk from disturbance (i.e. fire).

Fuels treatments associated with harvest treatments may have impacts to martens and their prey species. Treatments propose to handpile, machine pile, machine pile in trails, underburn or underburn and mow in proposed harvest units. Handpiling is the least impactful treatment on habitat. Large down woody material will be retained which maintains habitat for prey species and potential resting and denning sites. Machine piling is preferred over underburning in areas where large down material is at minimum levels or below, primarily in the MCW PAG. It is also preferred in areas where the risk of burning the overstory stand is higher. More large snags and down woody material could be retained and risk of escape is dramatically reduced. Underburning and mowing would result in the greatest reduction in risk to residual stands, however there is also a greater risk of loss to existing snags and down woody material degrading habitat. This treatment may be more appropriate for stands occurring in the ponderosa pine and mixed conifer dry PAGs.

Bats: An estimated one hundred and eighty hazard trees over 21 inches dbh are planned to be felled in 2004 along the highway safety act roads and within Perry South Campground. 2,893 acres will also be harvested within this alternative. HSV salvage will remove dead or severely damaged trees. Minimum diameter of salvaged trees will be 12 inches. SPF salvage will utilize small diameter products such as posts, rails, house logs, chips, or firewood.

Most treatments are proposed for stands that experienced stand replacement fire. Live canopy cover remains in small isolated patches. Proposed treatments include salvage of dead or severely damaged trees. Removal of snags and down wood in proposed treatment units will decrease the amount of structure retained throughout the life of the new stand.

Removal of snags and down wood in these areas will remove elements of bat habitat, however snags will remain at levels recommended in *Table 3.6-2* and down wood will remain ROD (C-40) levels. The decreased levels of snags and down wood may decrease available roosting and nesting habitat for bats dependent on snags and down wood structure.

In the remaining suitable habitat with the absence of catastrophic occurrences, habitat trends will continue to increase with canopy layers, canopy cover, structure, down woody material, snags, and increased connectivity. Mixed conifer stands will continue to lose large ponderosa pine and Douglas-fir components being replaced by white fir and other less fire tolerant species. Suitable habitat will continue to exist with white fir providing the majority of the nesting, roosting, and foraging component. This habitat would be short-lived due to white fir longevity.

There is an increased risk of loss of the remaining suitable habitat by a stand replacing fire event or degradation by insects and disease. If such an event were to occur, it would prolong the development of suitable habitat within the project area and may destroy critical habitat components like large snags and down woody material. However, some snags and down woody material would be created with the onset of these events.

Big Game

Deer: Hiding cover is present in denser stands, ponderosa pine thickets, and along riparian reserves where stand replacement fire did not occur. Mixed conifer stands provide both hiding and thermal cover in general. The project area lies within a Late-Successional Reserve. Standards and guidelines for the LSR will take precedent over big game standards and guidelines. However, every attempt will be made to try and incorporate S&G's into unit design to try and meet these wherever possible.

In areas that did not burn, stands will continue to increase in canopy cover, which may limit growth of forage species. However, hiding and thermal cover should increase in quantity and quality.

Thermal and hiding cover will be virtually non-existent within the moderate to severe burn intensity areas. Dead trees will still provide minimal amounts of thermal and hiding cover until the majority of dead trees have fallen. Within the first 20 years, a majority of dead trees are expected to fall. Hiding cover, which may be more critical within the fire area, would also decrease as dead trees fall. Regeneration of trees would occur slowly from the fire perimeter toward the center, reducing sight distance as they attain 5-10 feet in height over 15-30 years. Regeneration of trees to provide thermal cover, which is defined as 30 feet tall providing 40% crown closure, is expected to take in excess of 60 years.

Summer forage values for deer are expected to increase both in the short and long term. Removal of forest canopies through wild or prescribed fire stimulates forest floor vegetation and provides nutrient rich forage to ungulates. Forage values are expected to remain improved until crowns of regenerating conifers start reaching 40 % percent crown closure in 60 years.

Within the winter range, large portions of bitterbrush were consumed, which will prolong the establishment of winter forage. The lack of cover may also displace deer that used wintering grounds within the Eyerly fire area to the east onto the Crooked River National Grasslands and private property and to the north to the Confederated Tribes of Warm Springs land.

During harvest operations, noise and equipment may displace deer within or adjacent to harvest units. Increased traffic due to operations will also put more deer at risk of collisions with vehicles.

The LRMP (USDA 1990a) states, hiding areas must be present over at least 30% of national forest land and will be dispersed throughout implementation units. However, units planned for harvest are already deficient of hiding cover. All units proposed for harvest suffered at least 25% mortality to the stand and most ground cover was burned, therefore unable to provide hiding cover now. Harvest will not change these conditions.

Harvest of hazard trees will remove snags along the highway safety act roads (64 and 1170) and within Perry South Campground. *Table 3.6-44* identifies the proposed treatments within deer habitat types.

Table 3.6-44. Alternative 3 treatments by deer habitat

Deer Habitat Type	HSV-SR Acres	HSV-MS Acres	SPF-SR Acres	SPF-MS Acres	Total Acres
Winter Range	1,070	0	0	0	1,070
Summer Range	987	0	64	0	1,050

Transition Range	468	0	297	0	765
Management Area 7	1,202	0	0	0	1,202

The minimal amount of hiding cover that existing snags are currently providing will decrease in this alternative based on the retention of snags within the stands. However, movement through treatment units may be easier as snags are removed instead of falling and creating barriers. Removal of snags may also reduce the hiding cover of the deer's main predators.

Elk: Hiding cover is present in denser stands, ponderosa pine thickets, and along riparian reserves where stand replacement fire did not occur. Mixed conifer stands provide both hiding and thermal cover in general. The project area lies within a Late-Successional Reserve. Standards and guidelines for the LSR will take precedent over big game standards and guidelines. However, every attempt will be made to try and incorporate S&G's into unit design to try and meet these wherever possible.

In areas that did not burn stands will continue to increase in canopy cover, which may limit growth of forage species. However, hiding and thermal cover should increase in quantity and quality.

Thermal and hiding cover will be virtually non-existent within the moderate to severe burn intensity areas. Dead trees will still provide minimal amounts of thermal and hiding cover until the majority of dead trees have fallen. Within the first decade post fire, the majority of dead trees are expected to fall. Hiding cover, which may be more critical within the fire area, would also decrease as dead trees fall, reaching a maximum effect by about year 10. Regeneration of trees would occur slowly from the fire perimeters toward their centers, reducing sight distance as they attain 5-10 feet in height in 15-30 years. Regeneration of trees to provide thermal cover, which is defined as at least 10 acres that are 40 feet tall providing 40% crown closure, is expected to take in excess of 70 years.

Forage values to elk are expected to increase both in the short and long term. Removal of forest canopies through wild or prescribed fire stimulates forest floor vegetation and provides nutrient rich forage to ungulates. Forage values are expected to remain improved until crowns of regenerating conifers start reaching 40% percent closure in 70 years.

There are no harvest units located in any Key Elk Habitat Area or in identified elk winter range. However, approximately 1¼ miles of the hazard tree project is located within elk winter range. Removal of hazard trees along the 64 road will not alter the function of elk winter range.

Cumulative Effects

Birds

Primary Cavity Excavators: Cavity nesters that have post-fire data within DecAID were analyzed to show effects of the alternatives. To better understand how these cavity nesters are doing over a larger scale, the Breeding Bird Surveys (BBS) were used to look

at population trends within Oregon (Sauer 2003). *Table 3.6-45* shows trend data for these species.

Table 3.6-45. Trend data from BBS for cavity nesters listed in DecAID for post-fire habitats

Bird Species	Trend*
Lewis' Woodpecker	Slight Decline
Black-backed Woodpecker	Slight Increase
Hairy Woodpecker	Slight Decline
White-headed Woodpecker	Slight Increase
Northern Flicker	Slight Decrease
Mountain Bluebird	Sharp Increase
Western Bluebird	Slight Increase
Note: *Information from BBS 1966-2002 (Sauer 2003).	

Cumulatively, the Eyerly Fire Salvage project, along with other projects on the district, hazard tree removal, vegetation management projects, firewood cutting, and other various activities may lead to a change in use by some cavity excavator populations.

Prior to the fires, habitat for most of these species occurred scattered across the watershed in stands of multi-story mid, late and old forest. Existing snag levels varied across the landscape. The fire increased habitat for the northern flicker, mountain blue-bird and olive-sided flycatcher. These species are less dependent on a green component or canopy cover. Marshall et al. (2003) noted that mountain bluebird populations increased after a fire. This was based on a mosaic of green trees scattered through-out the fires, so habitat could be over-estimated and limited to edges with green trees or mixed intensity areas.

The Sisters Ranger District had been experiencing increasing levels of snags and down woody material since the early 1990's primarily from insect and disease outbreaks due to fire suppression. This was occurring in the mixed conifer habitats prior to the fires. Vegetation treatments were designed to reduce fuel loadings and fire risk so within units, lower dead wood levels were present than found in the surrounding landscapes. However, retention levels were based on the most current information at the time and snags were being retained at higher than historic management levels throughout the watershed.

The fires of 2002 and 2003 created a large influx of dead material over the landscape. This material will be existing on the landscape for some time. However, due to the relatively short standing time of snags, about 75% of the snags may fall within 20 years (Parks et al. 1999, Dahms 1949, Keen 1950, Haggard and Gaines 2001), much of the material will be present as down wood. There will be a very long lag time before snag recruitment will be at natural levels.

Other factors should be considered if treatment of burned areas is proposed. One is the arrangement of snags on the landscape. Saab and Dudley (1998) found that all species of cavity excavators selected for clumps of snags rather snags with a more uniform distribution. Also, cavity nesters selected for larger snags in general and many selected for more heavily decayed snags, meaning that most were snags prior to the fire (Saab and Dudley 1998, Haggard and Gaines 2001, Laudenslayer 2002).

Coopers and Sharp-Shinned Hawks: The Fires of 2002 and 2003 have resulted in a reduction of suitable nesting habitat, which includes components like canopy cover, loss

of prey species habitat, large snags, and down woody material. However, some snags and down woody material were created with these events. The fires could lead to reduced numbers of Cooper's or sharp-shinned hawk pairs occupying the project area due to less available suitable habitat.

Foraging habitat has been degraded and open areas are likely to see an increase in competition from other raptors such as red-tail hawks.

Past harvest activities include the Santiam Corridor, Santiam Restoration, McCache, and Jack Canyon project areas. Conditions existed in these areas with heavy mortality and increased risk of loss of habitat. The quality of habitat varied across the landscape due to mortality from insects and disease and with the treatment units. Trade-offs were made to reduce risk of further loss and to create fuel break areas where a large fire event may be stopped or contained.

Additional project areas have been analyzed or are being analyzed to reduce risk to the existing Cache/Trout and the Metolius LSR's. More open stand conditions will result from treatments. The South Trout project area is still under analysis. Cooper's and sharp-shinned hawk habitat will be treated however the landscape may be more resilient to large-scale events due to past and future treatments in these areas.

Flammulated Owl: The Eyerly fire resulted in the loss of large ponderosa pine and sugar pine trees, which results in a loss of foraging substrate and fewer future nest trees. Most of the softer snags that flammulated owls use for nesting were consumed during the fire and replaced with hardened snags that will not be soft enough for flammulated owl use for several years. The loss of large snags may result in a decrease in nest structures, reduced population levels, and increased competition for remaining snags within the fire area. The loss of large green trees and large snags from the fire will result in a large area of unsuitable flammulated owl habitat.

Effects on the flammulated owl resulting from the Fires of 2002 and 2003 include the loss of some canopy in mixed severity burns and loss of most of the canopy in the moderate to high severity burned areas. The fire also reduced the number of suitable large snags with cavities that are used by flammulated owls used for nesting. This results in a decrease in available suitable nesting and roosting habitat and a reduction in the number of occupied territories. Snags created contain few cavities and are fire hardened.

Open ponderosa pine stands dominated by medium to large structure (>21" dbh) have declined significantly over the past several decades. The Metolius Watershed Analysis (1996) shows that 64% of the Metolius watershed was dominated by medium to large ponderosa pine and 24% dominated by small (9-21" dbh) structure. The medium to large structure occurred throughout the watershed up to approximately the wilderness boundary or high elevation forest where small structured stands dominated. In 1991, only 13% of the watershed was dominated by medium to large structure and 62% dominated by small structure. There was also a shift in species composition from ponderosa pine in 1953 to ponderosa pine, white fir mixed, and ponderosa pine mixed stands in 1991 (*Table 3.6-46*).

Table 3.6-46. Shift in Species Composition from 1953 to 1991

Structure Class	1953	1991
Small (9-21" dbh)	24%	62%
Medium to Large (>21" dbh)	64%	13%

Therefore, large structure ponderosa pine has declined across the watershed, which reduces nesting habitat for this species due to a decline in the availability of large snags. Due to the reduced availability of large ponderosa pine snags and trees, birds need to travel farther to forage. This reduces nest attentiveness and increases the vulnerability to predation further decreasing nesting success. Increased brush levels may also limit flammulated owl foraging success across a wide range limiting use to few areas across the district.

Past harvest activities, firewood collection, burning, and recent wildfires have also led to reduced levels of large trees and snags. There may be increased competition between other secondary cavity excavators for limited nesting sites, further reducing nesting success. The Cache Mountain and Eyerly fires are recent examples of areas containing suitable habitat that were at high risk of loss from wildfires due to increased brush levels and stand densities. These areas have been set back for several decades until they can provide suitable habitat.

Overall, implementation of the action alternatives will have little effect to habitat conditions for this species, due to the majority of the treatments occurring in stands that contain greater than 75 % mortality to the trees.

Great Blue Heron: The Eyerly fire burned along the lower stretches of the Metolius River and along Lake Billy Chinook resulting in the loss of many green trees and some of the snags in the area. Existing potential nest trees were either consumed or heavily charred as a result of the fire. The fire did create some new snag habitat for great blue herons. Due to high fire severity, many replacement trees were also lost prolonging the establishment of future habitat for several decades.

Recreation use levels would remain constant but studies are showing increasing trends, which may result in increased disturbance during the critical nesting period. Increased recreation pressure around and adjacent to water bodies may further decrease habitat suitability.

Great Gray Owl: To better analyze cumulative effects, large projects occurring across the district within the past 5-10 years will be analyzed. Approximately ¼ of the Sisters Ranger District has been analyzed (63,000 acres) in the project areas mentioned below.

The fires of 2002 and 2003 effects on suitable great gray owl habitat include the loss of suitable nesting and roosting habitat, which consist of canopy cover, structure, snags, down woody material, and the prolonged establishment of future suitable nesting and roosting habitat. These fire events primarily impacted dense forest habitat some of which was considered potential habitat for great gray owls. High intensity burning resulted in the loss of some snag and down woody material habitat and future nesting habitat. Degraded stands may also suffer from additional mortality from the loss of large trees from added stress and from increased insect activity. Douglas-fir bark beetles may move into these stressed trees and result in mortality. Large Douglas-fir trees are primarily targeted. They then can move into healthy stands and infect healthy trees. This impact could further reduce suitable great gray nesting and roosting habitat.

Within the southwest and northwest portions of the burn many acres were underburned with patches of stand replacement. The new openings adjacent to underburned stands may have created suitable great gray habitat, assuming the underburned stands meet nesting habitat described above. Also some stands that were clear-cut harvested in the

past had become brush fields, primarily consisting of snowbrush and manzanita, burned and were set back to the stand initiation phase. Plant associations of meadow and xeric shrublands within the fires perimeter suffered from moderate to high intensity burn so they have been also set back into the stand initiation phase. The absence of brush could provide potential great gray foraging habitat.

Implementation of the Metolius Basin, Santiam Corridor, Santiam Restoration, Jack Canyon, Big Bear, Broken Rim, Highway 20, and McCache project areas has resulted in the reduction of canopy cover across these project areas. This, coupled with the large scale mortality from the insect epidemic of the early 1990's, resulted in thousands of acres with open stand conditions which is considered unsuitable nesting habitat for great gray owls. However, past harvest activities, particularly shelterwood and clearcut treatments, occurring adjacent to mature stands created suitable habitat for this species outside what is considered typical suitable habitat (meadow habitat adjacent to mature/old growth stands) which may have led to occupation of these areas by great grays. Associated post-harvest activities, primarily gopher baiting, is generally prescribed for these types of treatments. This may lead to increased mortality of birds using these areas as foraging habitat.

Fire suppression has resulted in degradation of some meadows across the district due to conifer encroachment. This further reduces potential suitable habitat for this species. However, meadow enhancement has been implemented in two meadows within the past 5 years (Glaze meadow and Trout Creek Swamp) and is planned for more areas in the future, which may increase habitat.

Northern Goshawk: There are 18 known goshawk nest sites across the Sisters Ranger District. Annual monitoring does not occur yearly for each site so information regarding nesting success cannot be fully determined. In 2002, 8 of 18 sites were monitored. Only 3 of 8 sites nested successfully while no response was found at the remaining 5 sites monitored.

Table 3.6-47 depicts the stratification of nest sites by PAG for the Sisters Ranger District.

Table 3.6-47. Goshawk nest sites by PAG for the Sisters Ranger District

PAG	% of Nests in PAG	# of Nests in PAG
MCD	44%	8
MCW	33%	6
PPD	17%	3
RIP	6%	1

The majority of the known nest sites on the Sisters Ranger District are located within the mixed conifer PAGs. These PAGs experienced moderate to heavy mortality with the insect outbreak of the early 1990's with impacts occurring a few years later. This event has probably had the greatest influence on goshawk habitat across the district due to the reduction of canopy. These open stands are considered unsuitable nesting habitat for goshawks.

The Eyerly Fire resulted in a reduction of suitable nesting habitat, which includes components like canopy cover, large snags, and down woody material. The fire has led to less available suitable habitat.

According to the burn severity map, the South Fork Street Creek nest stand and surrounding area suffered low burn severity. The low burn intensity consisted of an underburn and it is undetermined whether the nest will be occupied. Landscape level

surveys have not been conducted in this area so it is unknown how many territories may have been impacted. Other effects resulting from the wildfire include the loss of dense canopy in mixed severity burns and loss of canopy in the moderate to high severity burned areas. This results in a decrease in available suitable nesting and foraging habitat and a reduction in the number of occupied territories. Foraging habitat has been degraded and open areas are likely to see an increase in competition from other raptors such as red-tail hawks.

The fires of 2002 and 2003 resulted in a decrease in both mature and late-successional stands and canopy cover over a large proportion of the watershed. This has led to a decrease in potentially available habitat for this species. However, where underburning occurred, habitat may have been enhanced by opening up the understory and allowing for greater use of these stands.

Much of the existing habitat has a significant white fir component, is overstocked, and in some areas, has a high occurrence of disease problems. Mixed conifer stands would continue to lose large ponderosa pine and Douglas-fir components being replaced by white fir. Canopy closure may be sufficient for goshawks, however large structure would be sparse over the landscape and may reduce potential nesting habitat.

Past harvest activities include the Metolius Basin, Santiam Corridor, Santiam Restoration, McCache, and Jack Canyon project areas. Conditions existed in these areas with heavy mortality and increased risk of loss of habitat. The quality of habitat varied across the landscape due to mortality from insects and disease. Trade-offs were made to reduce risk of further loss and to create fuel break areas where a large fire event may be stopped or contained.

Additional project areas have been analyzed or are being analyzed to reduce risk to the existing Cache/Trout LSR's. More open stand conditions will result from treatments. The South Trout project area is still under analysis. Goshawk habitat may be treated however it will be limited in scope. The landscape may be more resilient to large-scale events due to past and future treatments in these areas.

Osprey: The Eyerly Fire burned very hot along the lower stretches of the Metolius River and along Lake Billy Chinook resulting in the loss of large trees, green trees, and some snags in the area. Some existing roost, perch, and nest trees were either consumed or heavily charred as a result of the fire. Due to high fire severity, many replacement trees were also lost prolonging the establishment of future habitat for several decades. Also, within the project area there are small tracts of private land with houses along the river and reservoir. Osprey use may be limited in these locations, especially during the summer months, due to the heavy amount of human use. Another concern associated with these areas is the loss of large snag habitat for safety reasons. This limits the available nesting and perch sites along the river. Therefore, large snag habitat outside of designated areas is very important to retain since a large portion of the large snag habitat will be lost in the recreation sites due to safety concerns.

Past vegetation management projects including Santiam Restoration and Metolius Basin contained specific vegetation management treatments designed to enhance bald eagle habitat, therefore they will also enhance osprey habitat. The treatments included reducing the risk of the loss of large trees and facilitating the development of future habitat.

Within the upper stretches of the Metolius River several factors influence osprey habitat including campgrounds, summer home tracts, private lands, major roads, and past harvest

activities. Hazard trees are routinely removed from recreation facilities and along major travel routes. Continued loss of large snag habitat in and adjacent to campgrounds and summer home tracts along the upper stretches of the Metolius River and major travel routes due to safety reasons limits the available nesting and perching sites along the river. Therefore, large snag habitat outside designated recreation areas is very important to retain since most, if not all, large snag habitat will be lost in the recreation sites. Private lands occur within ¼ mile of the Metolius River and Lake Billy Chinook. These sections are not managed for osprey habitat. Therefore, it is assumed that any habitat provided by these parcels is incidental and may not be long term. Past harvest activities resulted in the removal of large trees and snags. This coupled with the loss of large snag habitat has reduced the available nesting, roosting and perching habitat for osprey along the Metolius River.

Red-tail Hawk: To better analyze cumulative effects, large projects occurring across the district within the past 5-10 years have been analyzed.

Within the Eyerly fire perimeter, short-term foraging opportunities should increase as a result of the loss of brush within xeric shrublands, meadows, and previously harvested clear-cut stands. These open grass and forb areas should supply foraging opportunities. Eventually the brush will return to many of these areas so the benefit will be short-term. Stands that suffered stand replacement burns will provide habitat for red-tails also. As standing snags begin to fall, larger openings will be created. The snags that are left could provide nesting trees adjacent to the new openings. As with the xeric shrublands, meadow, and previously harvested clear-cut stands, as snowbrush and manzanita re-establish in openings foraging habitat will decrease over time.

Outside of the Eyerly fire suitable habitat would be maintained for the short-term until past harvest units begin to grow, which will reduce foraging opportunities. Large snags and trees will remain on the landscape. However, stand densities will continue to increase which results in an decrease in habitat suitability.

Implementation of the Metolius Basin, Jack Canyon, Santiam Restoration, Santiam Corridor, Big Bear, and Hazard Tree projects along with the future implementation of the McCache and South Trout project areas may result in an increase in red-tail hawk foraging habitat. Stands that were clear-cut harvested in the past created suitable habitat.

Also occurring within the past 5 years have been the Cache Creek, Cache Mountain, Link, and B&B Complex fires on the district. These fire events primarily impacted dense forest habitat not normally occupied by red-tail hawks. However, high intensity burning resulted in the loss of some snag habitat and future-nesting habitat. They also resulted in increased foraging habitat due to the loss of dense forest conditions.

Overall, the implementation of vegetation management projects and the occurrence of large-scale fires improved red-tail hawk habitat until the stands recover (20-50 years).

Waterfowl: Campgrounds and several summer home tracts occur along the Metolius River. Loss of snag habitat in and adjacent to these areas is a concern due to the limited amount of nesting structures available along potentially suitable habitat. However, high use recreation areas may not preferred nest sites due to the increased disturbance levels. Snag habitat along the river in between campgrounds and private land is important to retain due to the loss of this habitat component elsewhere.

Mammals

American Marten: The Eyerly Fire resulted in a reduction in mixed conifer climatic climax suitable habitat within the fire's perimeter. As a result the fire will prolong the development of suitable habitat within the project area and reduced suitable habitat components like canopy cover and down woody material. However, some snags and down woody material were created with these events. The fire could lead to reduced numbers of marten occupying the project area due to less available suitable habitat. Other fire effects include loss of prey species habitat, loss or degradation of elements of habitat including, canopy cover, down woody material, and the prolonged establishment of future suitable habitat. In the areas that were burned, most down wood was consumed.

Further degradation from insects and disease may occur in areas containing green residual trees, especially those stands adjacent to stands that were severely burned in the Eyerly fire. Damaged green trees and dead wood (habitat for Douglas-fir beetles) has increased and may increase mortality, by beetles, in the remaining live trees (adjacent to burned stands) that provide canopy layers, canopy cover, structure, and increased connectivity habitat. Residual large green tree habitats are very important to retain since a large portion of the large green trees were lost during the fire. Within stands that suffered stand replacement and mixed burn severity, many of the smaller trees (i.e. less than 21" dbh) were lost. The loss of these smaller trees set back large green tree replacement and may result in several decades before large green trees occur within the stand replacement areas.

The fires of 2002 and 2003 may result in a downward trend due to the loss of suitable habitat and the prolonged establishment of long-term sustainable habitat.

Past harvest activities include the Metolius Basin, Santiam Corridor, Santiam Restoration, McCache, and Jack Canyon project areas. Conditions existed in these areas with heavy mortality and increased risk of loss of habitat. The quality of habitat varied across the landscape due to mortality from insects and disease. Trade-offs were made to reduce risk of further loss and to create fuel break areas where a large fire event may be stopped or contained.

Additional project areas have been analyzed or are being analyzed to reduce risk to the existing Cache/Trout and Metolius LSR's. More open stand conditions will result from treatments. The South Trout project area is still under analysis. Marten habitat may be treated however it will be limited in scope. The landscape may be more resilient to large-scale events due to past and future treatments in these areas.

Bats: The Eyerly Fire resulted in a reduction of suitable habitat, which includes components like canopy cover, down woody material, soft large snags, and important special habitat components like hollow trees. As a result of the fire, development of suitable habitat will be prolonged. The loss of canopy cover will decrease the thermal cover important to bats during severe temperatures (both extreme heat and cold). However, some snags and down woody material were created with these events. Species abundance and richness within the project area may have decreased or species may be displaced into adjacent areas or into marginal habitat from the results of the fire.

Further degradation from insects and disease may occur in areas containing green residual trees, especially those stands adjacent to stands that were severely burned. Damaged green trees and dead wood (habitat for Douglas-fir beetles) has increased and may increase mortality, by beetles, in the remaining live trees that provide canopy layers, canopy cover, structure, and increased connectivity for spotted owl habitat. Residual large green tree habitats are very important to retain since a large portion of the large green trees were lost during the fire. Within stands that suffered stand replacement and mixed burn severity, many of the smaller trees (i.e. less than 21" dbh) were lost. The loss of these smaller trees set back large green tree replacement and may result in several decades before large green trees occur within the stand replacement areas.

Past harvest activities include the Metolius Basin, Santiam Corridor, Santiam Restoration, McCache, and Jack Canyon project areas. Conditions existed in these areas with heavy mortality and increased risk of loss of habitat. The quality of habitat varied across the landscape due to mortality from insects and disease. Trade-offs were made to reduce risk of further loss and to create fuel break areas where a large fire event may be stopped or contained.

Additional project areas have been analyzed or are being analyzed to reduce risk to the existing Cache/Trout and Metolius LSR's. More open stand conditions will result from treatments. The South Trout project area is still under analysis. The landscape may be more resilient to large-scale events due to past and future treatments in these areas.

The 4,200 acre Cache Mountain fire has also led to an increase in snag numbers across the larger landscape outside the project area. However about 75% of the snags may fall within 20 years (Parks et al. 1999, Dahms 1949, Keen 1950, Haggard and Gaines 2001) These snags may only remain on the landscape for 20 years (USDA 1994c and Parks et al. 1999). There will be a long lag period in between due to the lack of replacement trees where fire severity was high to moderate. However, species that use snags and down wood within green forests may not benefit by the increase in habitat. The Cache Mountain and Eyerly fires supplied an influx of snags and down wood in the summer of 2002. An additional influx of snags and down wood occurred in the summer of 2003 on the Deschutes National Forest with the Link (3,597 acres), 18 (3,962 acres), and Davis (21,100 acres), and B&B Complex (90,860 acres) Fires. The fires will lead to a lag time before suitable habitat condition will exist in these areas and may preclude use by most bat species.

Trends are indicating increased recreation levels within our national forests. Much of this use is concentrated around water bodies/waterways. Increased human use can lead to increased disturbance of day and night roosts, maternity sites, and winter hibernaculum's.

Big Game

Deer and Elk: Wildfire effects to big game include the loss of cover: both hiding and thermal cover. This results in big game being more susceptible to hunting pressure, predators, and mortality. They may need to expend more energy reserves during critical times causing increased stress levels. However, reduction in cover may also stimulate herbaceous growth which would increase forage values during the spring and summer months primarily.

Water is a limiting factor within the fire area, especially within the eastern half. All five guzzlers within the fire area were burned and as a result, are non-functioning. These provided water during critical dry periods.

Approximately 100 miles of bulldozer line on the Sisters Ranger District was constructed during suppression activities. Many roads that were brushed in were also reopened. The dozer line and reopened roads may contribute to more available access throughout the fire area. Other changes in open road densities occurred as a result of fire activities. Several closed roads were opened, primitive roads improved to provide greater access, and dozer line effectively widened some road prisms.

Within the project area recreation pressure continues to increase. Mushroom picking activity was heavy in the spring of 2003 within the Eyerly project area and is expected to be heavy in the spring of 2004. OHV use is also increasing within the area. The increase in human activity will result in increased stress levels in the animals. A roads analysis provided recommendations for closing an additional 35.28 miles of road and decommissioning 43.52 miles of road within the project area. These closures and decommissioning will decrease fragmentation throughout habitat and are presented here as a reasonably foreseeable action. *Table 3.6-48* identifies potential changes in road densities.

Table 3.6-48. Recommended Changes in Open Road Densities within Deer Habitat

Allocation	Current Road Density (m/m ²)	Recommended Road Density (m/m ²)
MA-7 Deer Habitat	1.81	1.41
Biological (Summer)	2.99	2.05
Biological (Transition)	2.24	1.32
Biological (Winter)	1.29	1.32

Several large vegetation management projects have occurred in the past several years. These include Metolius Basin, Big Bear, Broken Rim, Highway 20, Jack Canyon, McCache, Santiam Corridor, and Santiam Restoration. With the exception of the Metolius Basin and Highway 20, all occur within summer range and were developed to address the mass mortality caused by insects in the early 1990's. Within these project areas, there has been an overall decrease in cover. However, stands were declining or dead. A decrease in cover was going to occur whether the area was treated or left alone. Down woody material levels also increased across the landscape. This provides added benefits in the form of hiding cover, especially in fawning areas; but abundant down woody material levels also impede movement and increase the risk of loss of existing cover to a large fire event. An increase in forage also resulted in these project areas. This

may have helped to increase the health and vigor of resident herds using the area leading to increased survival rates.

Deer: The Highway 20 project area was located within transition range. The Metolius Basin project area is the only vegetation management project to occur within biological winter range. A total of 69,322 acres of biological winter range occurs on the Sisters Ranger District. Overall, an estimated 12% of the winter range on the Sisters Ranger District is proposed to be treated with the Metolius Basin project. This area is not as important as other portions of the winter range in that snow conditions may preclude use for much of the winter.

Biological winter range lost during the Eyerly fire, in addition to the Metolius Basin project, will result in an overall reduction in forage and cover on approximately 15,400 acres or 22% district wide. However, summer forage values are expected to increase dramatically within the fire area with the re-sprouting of forbs and shrubs.

During the summer of 2003, additional large wildfires occurred on the Sisters Ranger District, the largest being the B&B fire. However, forage species are expected to increase dramatically, as like Eyerly, and improve big game populations within the watershed. Additional impacts from the fires include impacts related to the loss of cover. There is an increased chance of mortality due to hunting, predation, etc. due to the increased visibility. This will become greater as snags begin to fall across the landscape. Big game will also need to expend more energy during extreme weather conditions trying to stay warm or cool. And snow levels will increase resulting in additional energy needs to move. Winter forage is also lost as a result of the fires. Lichens and shrubs utilized during the winter months were consumed during the fires. However, much of the area that experienced stand replacement fire is not typically occupied during the winter months so this impact may be minor across the watershed except for the Eyerly area. Another potential impact may result in the lowered quantity and quality of forage species if shrubs like ceanothus and manzanita become established over large tracts of the fire. These species do not equate to valuable forage and replace other potential species like bitterbrush which is more heavily utilized.

Elk: Approximately 14% of winter elk range within the fire perimeter suffered from stand replacement burning. Only 1% (219 acres) of the total Metolius Elk winter range block has been set back to the stand initiation phase, thus reducing both hiding and thermal cover. During the summer of 2003, additional large wildfires occurred on the Sisters Ranger District, the largest being the B&B fire. This impacted the KEHA. Two areas used heavily by big game were located in the highest fire intensity areas, the First Creek and Abbot Butte areas. However, forage species are expected to increase dramatically, as like Eyerly, and improve big game populations within the watershed. Additional impacts from the fires include impacts related to the loss of cover. There is an increased chance of mortality due to hunting, predation, etc. due to the increased visibility. This will become greater as snags begin to fall across the landscape. Big game will also need to expend more energy during extreme weather conditions trying to stay warm or cool. And snow levels will increase resulting in additional energy needs to move. Winter forage is also lost as a result of the fires. Lichens and shrubs utilized during the winter months were consumed during the fires. However, much of the area that experienced stand replacement fire is not typically occupied during the winter months so this impact may be minor across the watershed except for the Eyerly area. Another potential impact may

result in the lowered quantity and quality of forage species if shrubs like ceanothus and manzanita become established over large tracts of the fire. These species do not equate to valuable forage and replace other potential species like bitterbrush which is more heavily utilized.

Neotropical Migratory Birds (NTMBS)

Effects of Alternative 1

The Eyerly fire resulted in loss of habitat for many species requiring dense canopies, large trees, and soft large snags. However, about 75% of the snags may fall within 20 years (Parks et al. 1999, Dahms 1949, Keen 1950, Haggard and Gaines 2001). It will take decades for green trees to replace the larger snags. The prolonged establishment of habitat may displace some species of birds from the area for a significant period of time. Brush levels will increase in the next 10 years favoring NTMBS that prefer the stand initiation phase.

In areas outside the Eyerly fire, habitat for species that are more dependent on closed canopies and dense understories (i.e. Townsend's warbler and red-breasted nuthatch) will continue to increase over time. White fir will continue to out compete ponderosa pine and Douglas fir resulting in increased stand densities and loss of late successional conditions over time. This will eventually result in fewer large snags and down woody material on the landscape and fewer nesting sites. Loss of ponderosa pine and Douglas fir results in fewer foraging opportunities for species like the white-headed woodpecker and brown creeper who need large diameter trees. Increased stand densities and brush densities increases the risk of loss which could further reduce the availability of habitat in the area for most late successional species. However, increased densities may provide habitat for species like the hermit thrush and several other closed canopied species.

Surveys were not conducted for neotropical migrant bird species. However, district personnel have made incidental sightings during field outings. Species detected can be found in Appendix B (district files).

The no action alternative may result in increased fuel loadings when snags begin to litter the forest floor. The higher fuel loading may result in the suppression of regeneration, which may prolong the establishment of late successional habitat conditions. Increased fuel loadings may also put remaining habitat at risk from disturbance (i.e. fire).

Trees that pose a hazard to public safety would continue to be monitored and felled when identified. An estimated one hundred and eighty hazard trees over 21 inches dbh are planned to be felled along the highway safety act roads and within Perry South Campground.

Effects of Alternative 2

An estimated one hundred and eighty hazard trees will be removed from highway safety act roads and Perry South Campground (*Table 3.6-26*). About 4,846 acres will also be harvested within this alternative. HSV salvage will remove dead or severely damaged trees. Minimum diameter of salvaged trees will be 12 inches. SPF salvage will utilize small diameter products such as posts, rails, house logs, chips, or firewood.

Removal of snags and down wood in proposed treatment units will increase the amount of habitat available for species of birds that prefer openings with limited ground cover. Openings will either be enlarged or created during operations, which will increase foraging habitat. Removal of snags may decrease potential perch sites for species. However, the open stands may allow better foraging habitat for species like the olive-sided flycatcher.

Within the HSV mixed severity salvage, canopy cover remains in patches. Removal of snags or severely damaged trees and down wood will occur in potential habitat. In the short term treatment will decrease the amount of snags and down wood, which may decrease habitat for cavity nesters. However, without treatment to the mixed severity stands the remaining large live trees (greater than 21 inches dbh) may suffer mortality due to insects and disease. The loss of large trees in these stands will decrease the available future habitat within the project area for species such as the brown creeper and pygmy nuthatch.

In areas not identified for treatment, no treatment may result in increased fuel loadings when snags begin to litter the forest floor. The higher fuel loading may result in the suppression of regeneration, which may prolong the establishment of late successional habitat conditions. Increased fuel loadings may also put remaining habitat at risk from disturbance (i.e. fire).

Fuels treatments associated with harvest treatments may have impacts to NTMBS. Treatments propose to handpile, machine pile, lop and scatter, and underburn in proposed harvest units. Handpiling is the least impactful treatment on habitat. Large down woody material will be retained which maintains habitat for prey species and potential resting and denning sites. Machine piling is preferred over underburning in areas where large down material is at minimum levels or below, primarily in the MCW PAG. It is also preferred in areas where the risk of burning the overstory stand is higher. More large snags and down woody material could be retained and risk of escape is dramatically reduced. Underburning and mowing would result in the greatest reduction in risk to residual stands, however there is also a greater risk of loss to existing snags and down woody material degrading habitat. This treatment may be more appropriate for stands occurring in the ponderosa pine and mixed conifer dry PAGs.

Effects of Alternative 3

An estimated one hundred and eighty hazard trees will be removed from highway safety act roads and Perry South Campground (*Table 3.6-26*). 2,893 acres will also be harvested within this alternative. HSV salvage will remove dead or severely damaged trees.

Minimum diameter of salvaged trees will be 12. SPF salvage will utilize small diameter products such as posts, rails, house logs, chips, or firewood.

Removal of snags and down wood in proposed treatment units will increase the amount of habitat available for species of birds that prefer openings with limited ground cover. Openings will either be enlarged or created during operations, which will increase foraging habitat. Removal of snags may decrease potential perch sites for species. However, the open stands may allow better foraging habitat for species like the olive-sided flycatcher.

In areas not identified for treatment, no treatment may result in increased fuel loadings when snags begin to litter the forest floor. The higher fuel loading may result in suppression of regeneration, which may prolong the establishment of late successional habitat conditions. Increased fuel loadings may also put remaining habitat at risk from disturbance (i.e. fire).

Fuels treatments associated with harvest treatments may have impacts to NTMBS. Treatments propose to handpile, machine pile, lop and scatter, and underburn in proposed harvest units. Handpiling is the least impactful treatment on habitat. Large down woody material will be retained which maintains habitat for prey species and potential resting and denning sites. Machine piling is preferred over underburning in areas where large down material is at minimum levels or below, primarily in the MCW PAG. It is also preferred in areas where the risk of burning the overstory stand is higher. More large snags and down woody material could be retained and risk of escape is dramatically reduced. Underburning and mowing would result in the greatest reduction in risk to residual stands, however there is also a greater risk of loss to existing snags and down woody material degrading habitat. This treatment may be more appropriate for stands occurring in the ponderosa pine and mixed conifer dry PAGs.

Cumulative Effects

Several factors influence neotropical bird habitat including past harvest activities, post harvest activities, firewood collection, fire suppression, recreation facilities, aspen restoration projects, and roads.

Past harvest activities have led to the loss of large tree habitat, which has resulted in a decline in foraging and nesting habitat for several species. However, more recent vegetation management projects are more focused on restoration of large, open ponderosa pine stands by focusing on thinning reducing stand densities and mowing and burning, reducing brush levels. These types of activities will enhance habitat conditions for those species dependent on open ponderosa pine stands.

Post harvest activities, primarily burning, have led to a reduction in snag habitat, as well as firewood collection. This, in conjunction with safety concerns surrounding recreation facilities and main roads has led to a reduction in snag habitat across the district.

Fire suppression has resulted in an increase in brush layers and stand densities. This created habitat for some species but led to a decrease in habitat for those species more commonly associated with ponderosa pine habitat. Increases in this type of habitat may have increased habitat for predators like accipiters and small mammals. This has not been proven, however research on white-headed woodpeckers is suggesting high nest predation

by golden-mantled ground squirrels. These small mammal populations may be increasing due to increased cover from predators and increases in habitat.

Several fires have occurred within the past 5 years including the Cache Creek, Cache Mountain, Eyerly, RNA, Link, 18 Davis, and B&B Complex fires. These events have created habitat for post-fire species like Lewis' woodpeckers. However, fire intensity and size has been greater than desired resulting in the loss of suitable habitat for species like pygmy nuthatches, brown creepers, and hermit thrushes.

Landbirds identified in *Tables 3.6-23 through 3.6-25* that were not discussed in a previous section were analyzed looking at trend data from breeding bird surveys. *Table 3.6-49* outlines trends in species.

Table 3.6-49 Trend data for bird species with potential habitat within the Eyerly project area

Bird Species	Habitat Preference	Trend*
Pygmy Nuthatch	Ponderosa Pine Forests – Large Trees	Steady Increase
Chipping Sparrow	Ponderosa Pine Forests – Regenerating Pines	Sharp Decline
Brown Creeper	Mixed Conifer – Large Trees	Steady Increase
Hermit Thrush	Mixed Conifer – Dense Understory	Steady Decline
Olive-sided Flycatcher	Open Habitats	Sharp Decline
Rufous Hummingbird	Forest Edges near Meadows	Steady Decline
Vesper Sparrow	Open Habitats/Meadows	Holding Steady
Williamson's sapsucker	Mixed Conifer – Large snags	Steady Decline
Brewer's Sparrow	Bitterbrush Openings	Steady Decline
Note:		
*Information from BBS 1966-2002 (Sauer 2003).		

Survey and Manage Species

Effects of Alternative 1

Outside the Eyerly fires perimeter in perennial wet areas potential Crater Lake Tightcoil habitat will continue to persist in the narrow bands of riparian vegetation. Within the fire's perimeter the only perennial wet areas are near Alder Springs and along the Metolius River. Within these wet areas any Crater Lake Tightcoil habitat that existed was affected in different ways, depending on the burn intensity, but was most likely degraded due to the consumption of riparian vegetation. These locations will continue to improve, as riparian vegetation is re-established.

Effects of Alternative 2

There are no scheduled salvage activities within perennial wet areas. However, along the 64 road and within Perry South Campground hazard trees will be removed for safety reasons. An estimated one hundred eighty snags over 21 inches will be removed near the Metolius River and Lake Billy Chinook. The hazard tree project however may fell trees

within wet areas. Any known *Pristiloma arcticum crateris* sites will be not be degraded during the hazard tree project.

Effects of Alternative 3

Similar to Alternative 2, there are no scheduled salvage activities within perennial wet areas. However, along the 64 road and within Perry South Campground hazard trees will be removed for safety reasons. An estimated one hundred eighty snags over 21 inches will be removed near the Metolius River and Lake Billy Chinook. The hazard tree project however may fell trees within wet areas. Any known *Pristiloma arcticum crateris* sites will be not be degraded during the hazard tree project.

Cumulative Effects

Within the fire most riparian areas suffered at least an underburn, which consumed most of the vegetation and down wood. Most suitable mollusk habitat was lost within the fire's perimeter. Intense fire that burns through the litter and duff layers is devastating to most gastropods (Burke et. al 1999).

Several factors influence mollusk habitat within the Metolius watershed including past harvest activities within riparian reserves, roads, recreation use along streams and the Metolius River, and implementation of fisheries enhancement projects. Past harvest activities within riparian reserves have led to the loss of substrate like down woody material and at times has resulted in compaction. This has created barriers to dispersal of mollusks and led to unsuitable habitat until soils recover.

Roads within riparian reserves limit suitable habitat conditions and dispersal due to compaction. The effects of subsoiling/ripping to mollusks are unknown.

Increased recreation use along streams and the Metolius River like dispersed camping, user created trails, and ATV use has led to degradation of habitat with the removal of down woody material and riparian vegetation and increased compaction.

Implementation of fisheries enhancement projects will also enhance and maintain healthy riparian reserves. Addition of down woody material and protection of the streambank and riparian vegetation will be beneficial to mollusks and their habitat.

❖ 3.7 Air Quality

❖ 3.7.1 Air Quality Introduction

The principle impacts of burning forest residues, whether by prescribed fire or wildfire, relate to effects on human health and temporary visibility reductions from smoke and dust. Emissions from fire (smoke) results in the release of particulates into the atmosphere, possibly affecting the health of forest workers, visitors and residents of northwestern Deschutes County.

3.7.1.1 Management Direction

The Clean Air Act

The 1990 Clean Air Act (CAA) is an amended federal law first passed in 1970. Under this law, the Environmental Protection Agency (EPA) protects and enhances the quality of the nation's air resources by setting limits on how much of a pollutant can be in the air. A State Implementation Plan (SIP) considers local geography and industry to further define how provisions of the CAA will be implemented. The Oregon Clean Air Act Implementation Plan was developed by the Department of Environmental Quality in 1989 under ORS 468A.035. Further delineated, pollution prevention measures are implemented under 40 CFR § 81.219 Central Oregon Air Quality Control Region (as defined in section 302(f) of the Clean Air Act, 42 U.S.C. 1857h(f)).

The Clean Air Act, and associated measures listed above, states that Federal Land Managers will attempt to “protect and enhance the quality of the Nation's air resources so as to promote the public health and welfare...”

❖ 3.7.2 Air Quality Existing Condition

Pollutants from Smoke

The critical pollutants thought to effect human health include particulate matter (PM) emitted from smoke that is less than 10 microns in diameter (PM10). Particulates less than 10 microns are able to traverse the nose and mouth (known as the “extra thoracic airway”) and enter the upper airways starting with the trachea. Due to their very small size and weight (the average human hair is 70 microns in diameter), PM10's can remain airborne for weeks. Over ninety percent of smoke particles are less than 10 microns. Wood smoke has been documented to be mutagenic, though no direct studies have proven it is carcinogenic to humans. Mutagenic compounds cause changes to the structure of a cell in ways that can be transmitted during cellular division. This is of primary concern because mutations can be precursors for cancer (Boutcher, 1992). Exposure to PM10's aggravates chronic respiratory diseases such as asthma, bronchitis and emphysema.

Burning debris will release carbon dioxide and water (making up about 90% of the total mass emitted from the combustion process), criteria pollutants (those pollutants regulated by the EPA under the clean air act), Including carbon monoxide and sulphur/ nitrogen oxide, and hazardous air pollutants (also known as (“air toxins”). Air toxins include several hundred known substances including the class of compounds known as aldehydes

(formaldehyde's, acetaldehyde and acrolin) and polynuclear aromatic hydrocarbons (PAH's), several of which are known to be carcinogenic.

Meteorologic Patterns

The Eyerly Project Area, located within the Metolius Basin, is bounded in the west by the east flank of Green Ridge and decreases in elevation along the dissected canyon drainages to the lower slopes of the Metolius arm of Lake Billy Chinook to the east. Weather patterns are primarily influenced by Pacific Ocean fronts which result in downslope winds moving over Green Ridge from the southwest and through the canyons across Lake Billy Chinook. Airborne particulate matter is generally dispersed to the north and east as southwesterly weather cells cross the eastern slopes of Green Ridge or track along the crest of the Cascades, following the Metolius Basin up and around the Metolius horn. Temperature changes throughout the day affect how PM and other pollutants are dispersed. Daytime heating causes pollutants to rise along with the heated air. Surface cooling at night can create downslope winds that carry pollutants from higher terrain to low lying areas. Pollutants may pool in the lower region or exit to the east via the watershed drainages.

Cooler temperatures in late fall and winter can combine with precipitation above 3,500 feet, resulting in the accumulation of snowpack. Temperature inversions may occur when emissions are trapped under a layer of cold surface area. This is most common in the winter when snow covering the ground in mountain valleys prevents the earth's surface from heating. Similarly, stagnant air masses can result from atmospheric conditions of high pressure. Low pressure frontal systems pass north along the crest of the Cascades to move air and break down inversions.

❖ 3.7.3 Air Quality Environmental Consequences

3.7.3.1 Impacts Common to All Alternatives

Wildland Fire Activity

The potential for future wildland fire within the Eyerly Fire Area exists regardless of the alternative selected, but would be even greater in the absence of fuels reduction activities (Metzger 2003). Heavier fuel loading in the event of future wildland fire could result in greater smoke and debris emissions, which would adversely affect health and visibility.

Smoke Exposure

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

3.7.3.2 Impacts Common to All Action Alternatives

Prescribed Fire

Air quality would be affected primarily by smoke produced during prescribed fire and pile burning proposed in Alternatives 2 and 3.

The locations of proposed prescribed fire and pile burning activities are shown on the *fuels treatment maps* at the end of *Chapter 2*. *Table 3.7-1*, below, displays the type of burning proposed and an estimate of smoke emissions using an average of 10 tons per acre of fuel consumed during the burning operations. Lop and scatter fuels treatments are also proposed. Underburning is proposed to be a follow up treatment to lop and scatter units, fuels consumed would be approximately 5 tons per acre.

Table 3.7-1. Smoke Emission by Fuels Treatment Method

Fuels Treatment	PM <10 – lbs/Acre	PM<2.5 – lbs/Acre	Ave. Consumption Tons/Acre
Pile and Burn	498	395	10
Prescribed Fire – Jackpot/Underburn	446	354	10
Prescribed Fire – LS, Underburn	190	145	5

Effects of the alternatives on smoke emissions are primarily related to the amount and type of fuels treatment proposed. *Table 3.7-2* displays the estimated smoke emissions for the alternatives.

Table 3.7-2. Estimated Smoke Emission by Alternative

Alternative	Acres Treated	Total Tons PM<10	Total Tons PM<2.5
Alternative 1 – No Action	0	0	0
Alternative 2 – Proposed Action	2328	580	460
Pile and Burn	650	145	115
Underburn/Jackpot Burn	1899	180	138
LS, Underburn	4877	905	713
Total			
Alternative 3 –			
Pile and Burn	1703	424	336
Underburn/Jackpot Burn	405	90	72
LS, Underburn	785	75	57
Total	2893	589	465

Emissions

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

Prescribed fire and pile burning would be conducted under favorable smoke dispersal conditions, avoiding impacts to Class I airsheds and urban areas. Inversion conditions, which would increase the potential for smoke pooling in valleys and drainages, would be avoided during burning operations.

Visual Effects

Class I airsheds would be affected minimally since these airsheds are higher in elevation than the majority of the project area. The nearest Class I airshed is Mt. Jefferson Wilderness located approximately 7 miles west of the Eyerly project area. The prevailing wind patterns reflecting a westerly or southwesterly flow would result in minimal potential for impacts.

Dust

Dust would be created from proposed operations in Alternatives 2 and 3, such as log haul on roads and operation of machinery within treatment units. Dust abatement and signing would be conducted on haul routes to minimize effects to public safety. Dust created during operations would be short term.

3.7.3.3 Cumulative Impacts

Deschutes National Forest policy dictates that prescribed burning be accomplished during periods of optimal smoke dispersion; however, there may still be some cumulative smoke impacts from concurrent Forest Service, Confederated Tribes of Warm Springs, and private prescribed burning operations.

❖ 3.8 Botanical Resources

❖ 3.8.1 Introduction

Major plant community types include, in order of decreasing abundance, Dry Ponderosa Pine, Wet Mixed Conifer, Dry Mixed Conifer, Wet Ponderosa Pine and a very small amount of Juniper Woodland. Along with these basic forest types, plant habitat is also provided by the courses of intermittent and permanent streams (riparian zones), seeps and springs, seasonally moist and dry meadows, forest fringes, scablands and large rock outcrops.

Numerous small, non-prescribed, quickly suppressed fires have occurred in the area within the past several decades, but larger fires have been uncommon. A 5400 acre fire in 1941 burned portions of the eastern edge of the project area as did a 1300 acre fire in 1961. A 3000 acre fire occurred in the northwestern corner of the project area in 1926. Harvesting activities occurred over much of the roaded portion of the project area between the late 1970s and the early 1990s. These activities were most intense in the Mixed Conifer Plant Association Groups.

❖ 3.8.2 Existing Condition

Prior to the 2003 field season, few formal surveys for TES or S&M plant species had been conducted within the proposed project area. Nevertheless, several rare plant species were known to occur within, or immediately adjacent to the project area. Four occurrences of the Survey and Manage species *Cypripedium montanum* (mountain lady-slipper) (CYMO) had been documented within the project area. Known sites of the Sensitive Species *Penstemon peckii* (Peck's penstemon; PEPE) and *Agoseris elata* (tall agoseris; AGEL) were known to occur adjacent to the project area boundary and suitable habitat for each seemed likely to exist within the project area. The adjacent PEPE population is identified as a Protected Population in the Peck's Penstemon Species Conservation Strategy. A number of plant species occur unexpectedly within the project area. *Acer macrophyllum* (big-leaf maple), typically occurs only west of the Cascade crest in Oregon. *Allium campanulatum* (Sierra onion) generally occurs to the east and south of central Oregon while *Allium douglasii* var. *nevii* (Douglas' onion) is a more northern taxon.

Effects of the Eyerly Fire on Botanical Resources

Existing vegetation has been altered, often markedly, as a result of the 2002 fire. Of the approximately 23,000 acres burned in the Eyerly Fire, areas of High, Moderate, and Low burn severity each accounted for roughly 7,000 acres or about equal thirds of the total burned acres. Of the approximately 4800 acres upon which salvage activities have been proposed, about 4400 acres (92%) are regarded as having experienced a Stand Replacement level of fire severity. In areas with either a High or Stand Replacement level of fire severity, few, or typically, no trees have survived. Likewise, a high percentage of

shrubs, at least those detectable due to persistence of charred remains above ground, are, a year later, showing no evidence of basal sprouting, and appear to be dead. Existing herbaceous vegetation appears to have been incinerated over most of the total burned area, but its presence has continued to increase conspicuously during the course of the 2003 growing season. As of August of 2003, herbaceous plants, especially annuals representing one to two dozen genera, were providing area cover of 30-70%, even in areas that experienced high levels of fire severity.

The vegetation that existed prior to the 2002 fire performed many important functions in the local ecosystem of which it was a part. Its macrostructure moderated local air temperatures, at all times of the year, promoted higher local humidity and the retention of moisture in the soil and downed wood. All rooted vegetative material, and the litter and humus and larger woody debris produced by it, reduced the erosive energy of water, both that falling from the sky and that subsequently moving along the soil surface. The existing vegetation also provided habitat for wildlife as it provided sources of food, and shelter from physical elements and predators.

Botanical Surveys During 2003 Field Season

The bulk of the botanical surveys planned for the proposed Eyerly Fire project area were completed during the period between June 9, 2003 and July 17, 2003. These surveys focused on units proposed for salvage activities in Alternative 2 of the Eyerly Fire Salvage DEIS. Alternative 2 proposes salvage, both standard commercial harvesting and harvesting of special forest products, within about 122 units with a total area of about 4,776 acres. Surveys were conducted in all units where fire effects were classified as Mixed Severity. Among the units where fire effects were more severe – those classified as having experienced Stand Replacement severity – surveys were conducted in units determined to represent the diversity of forest types, elevations, aspects and slopes, within this group severely burned units. Surveys were periodically conducted in riparian zones immediately adjacent to proposed treatment areas as harvest activities in these units have the potential to impact habitat conditions along adjacent creeks. To date, surveys have been conducted in 54 (44%) of the units included in Alternative 2. Area surveyed is approximately 2390 acres, or 50% of the area proposed in Alternative 2 for some type of salvage activity.

Mountain lady's slipper orchid (*Cypripedium montanum*). Four new sites have been located. A total of eight CYMO sites are now documented within the proposed project area. Stems per site ranges from one to 113. At six of these eight sites, most or all plants occur on road cut-banks. The 2002 fire appears to have burned over each of these sites, but lightly. Botanists familiar with this species in other portions of its range are not accustomed to seeing plants located on the relatively open, bare mineral soil of cut-banks (Vance, Helliwell; pers. com.). This suggests that plants at these sites may, prior to the fire, have been outliers of larger, populations on nearby forested slopes. In fact, there is an undocumented record of a large CYMO population existing upslope from one of the larger cut-bank populations. Thorough efforts to locate larger CYMO populations on (previously) forested slopes adjacent to the cut-bank populations in all cases failed. In most instances, fire intensity on adjacent slopes was sufficient to burn through the duff

layer, leaving exposed mineral soil. A possible explanation for the high percentage of Eyerly CYMO sites located on cut-banks is that populations occupying the relatively fuel-laden forested slopes, did not survive the more intense fire-generated heat in these areas. Burned-over habitat that appears suitable for, but is unoccupied by this species, was commonly encountered.

Peck's penstemon (*Penstemon peckii*). No new sites, and very little suitable habitat for this species, were encountered. The extent of the Four Corners population was assessed on June 12, 2003, during the peak of the PEPE flowering period. No plants or clearly suitable habitat were found within the adjacent burned area, although plants exist along the 1180-090 road immediately adjacent to a proposed project unit.

Tall agoseris (*Agoseris elata*). No sites of AGEL were found during surveys. Habitat for this species is not especially well understood, so it is not possible to confidently assess the extent of potential habitat existing within the project area. Other *Agoseris* species were commonly encountered during surveys, especially *A. retrorsa* and *A. grandiflora*.

No other TES or S&M taxa were detected during these surveys.

Noxious Weeds

Prior to the 2003 field season, eleven noxious weed sites were known to exist within the project area. Knapweeds (*Centaurea* spp.) are the dominant noxious weed at eight of these sites. Other noxious weeds at these sites include Scotch broom (*Cytisus scoparius*) and St. Johnswort (*Hypericum perforatum*). Large noxious weed sites exist outside of the project area (the Fly Creek drainage to the east, Forest Road 11 to the south), along roads providing access to the project area. Although the Oregon Department of Agriculture and Jefferson County have conducted several years of herbicide treatments on knapweed on private land within the Fly Creek drainage, there is currently little opportunity for herbicide application on federal land within or immediately adjacent to the Eyerly Salvage Project Area. Within and near the project area, the current (1998) Deschutes National Forest Noxious Weed Environment Assessment allows herbicide treatment only on 3.5 acres within the Fly Creek drainage. A supplement to this EA was in preparation in 2002, but has been delayed pending the release of an updated Regional noxious weed EIS (Environmental Impact Statement). Chemical treatment of knapweed on private land in the Fly Creek is continuing in 2003. Contracted goat-grazing of knapweed along Fly Creek occurred immediately following the Eyerly Fire in 2002. At least during the 2003 growing season, control of noxious weeds within the project area will be limited principally to manual techniques.

Current documentation indicates that fire suppression efforts during the Eyerly fire resulted in the production of approximately 27 miles of bulldozer-created fire lines. Some of these lines simply widened existing vegetation-free zones associated with forest roads, but most of the lines are located away from roads. Lines vary from one to five bulldozer blades in width. Analysis in GIS indicates that bulldozer lines intersected six of the noxious weed sites within the project area. Hence, it is possible that bulldozer activity during fire suppression contributed to the spread of noxious weed seeds within the project area.

Noxious Weed Surveys During the 2003 Field Season

Weed surveys were conducted simultaneously with TES and S&M plant surveys in the 54 units in which rare plants surveys were conducted. Surveys for roadside occurrences of noxious weeds and other invasive plant species, combined with monitoring and manual treatment, will continue into the fall of 2003. New detections this season are listed below.

Knapweeds (*Centaurea* sp.). Nine new sites have been located within the project area. Population sizes at these sites range from fewer than five, to hundreds of plants.

Medusahead (*Taeniatherum caput-medusae*). Twelve (22%) of the 54 surveyed units included this grass. Typically, only one to several plants existed at any specific site. In all cases, plants and their fruiting heads were bagged and removed from the project area.

St. Johnswort (*Hypericum perforatum*). Three new sites have been located. One of these is a well-established site on the heavily traveled FR 1100, immediately south of the Four Corners.

Bull thistle (*Cirsium vulgare*). Ten (19%) of the 54 surveyed units included this plant. Another six units included immature thistles that were possibly CIVU.

Cheat grass (*Bromus tectorum*). This invasive species was noted in 23 (43%) of the 54 surveyed units. Its presence ranges from slight to extensive within these units.

Dozer line surveys. Approximately 70% of the dozer lines and safety zones within the project area were surveyed for weeds. Of these lines and zones, 10% had *Taeniatherum caput-medusae* (medusahead), 14% had *Centaurea maculosa* (spotted knapweed), 14% had *Bromus tectorum* (cheatgrass) and 41% had *Cirsium vulgare* (bull thistle).

The BAER (Burned Area Emergency Rehabilitation) Team Botanical Report for the area burned in the Eyerly Fire details a three-year plan for preventing the spread of noxious weeds across the burned area. A copy of this Report is included in the Eyerly Salvage Project File. Most of the recommendations that comprise this plan have been, and are being implemented by the Sisters Ranger District botany staff. Some of these recommendations include: 1) detection and mapping of existing noxious weed sites in and adjacent to the burned area; 2) employ goats to reduce knapweed seed set along Fly Creek, and monitor effectiveness; 3) hand pull smaller roadside noxious weed sites; 4) identify existing and potential vectors for noxious weeds; 5) implement road closures; 6) seek out and treat new sites of noxious weeds that are associated with bulldozer lines and other areas of disturbance specifically associated with fire suppression activities.

Additionally, as per recommendations included in this BAER Report, approximately 2500 acres, where Stand Replacement burning occurred on steep slopes, were seeded by helicopter with annual rye and soft winter wheat. Monitoring of the rate and evenness of application was conducted immediately following the seeding. Monitoring of the success of establishment and persistence of these grasses will begin during the 2003 field season.

Motor vehicles are probably the major vector for the spread of noxious weeds within the project area. Such vehicles may include those associated with public recreational use or harvesting of special forest products (e.g., mushrooms, firewood), or general forest management operations including inventory, monitoring, road maintenance and fire suppression. Such vehicles have the potential to transport weed seeds included in soil and

mud stuck in tire treads or upon undercarriages. Also, portions of whole, seed-bearing weed plants can become wedged in bumpers and within undercarriages when vehicles drive through patches of weeds. By these means, weed seed can be imported to the project area or moved about within the project area.

Noxious weeds are an undesirable presence in forest ecosystems because they tend to displace native plants, including, potentially, rare and protected species, degrade habitat for animal species, promote soil erosion, and lessen the value of recreational experiences. Spotted and diffuse knapweed are responsible for the most serious and extensive weed infestations near and within the project area. Noxious weeds such as the knapweeds are aggressive colonizers of disturbed native plant communities in relatively open, sunny settings. As perennially disturbed sites, roadsides are generally a highly suitable habitat for noxious weeds. Of course, much of the project area can now be described as sunny and disturbed. All of the documented noxious weed sites within the project area are adjacent to roads. Knapweeds, unfortunately, are also aggressive competitors with native herbaceous plants, even within little-disturbed native plant communities, where light is abundant. Hence, knapweeds have the potential to move from roadside infestations, directly into adjacent native plant communities.

Desired Future Condition

Late successional and rare plant species would be well distributed within existing suitable habitats and be potentially able to disperse to unoccupied sites where suitable habitat exists or is newly developing. Connectivity of habitat and availability of vectors for spores, pollen, seeds or vegetative propagules would allow genetic exchange with populations outside of the project area and/or establishment of new populations beyond the borders of the project area. Local populations would be sufficiently robust and resilient to permit loss of some individuals or habitat, and natural disturbances would not threaten persistence of the species at other than a local scale within the project area.

The extent of non-native, invasive plant species would be on the decline. Direction within the existing Forest Invasive Plant Species EA would allow effective treatment of existing sites and prompt treatment of newly discovered sites. Forest staff, contractors and recreationists would be aware of the primary importance of prevention as a means of limiting the spread of invasive plant species.

❖ 3.8.3 Botanical Resource Environmental Consequences

Effects Common to All Alternatives

There will be no effects to Threatened, Endangered, Proposed or Candidate Plant species. Implementation of the BAER Team recommendations, including physical soil stabilization measures, invasive plant species prevention and control, revegetation, and monitoring, will continue regardless of which Alternative is selected. None of these activities should have significant direct effects on TES/S&M species or their potential habitat. There is potential for the introduction and spread of noxious weeds while conducting BAER-directed activities but this risk will be minimized by adherence to

mitigations provided here (see *Project Design Elements: Noxious Weed Control, Section 2.8*) and in the Eyerly Salvage Project Botanical Biological Evaluation.

Weed management measures recommended in the BAER Team Botanical Report will be continued regardless of the Alternative that is selected. BAER-directed activities within the project area, including those associated with revegetation and direct actions to reduce erosion, pose a risk of introduction and spread of noxious weeds. These risks can be minimized by adherence to mitigation measures included here (Mitigation Section) and in the Eyerly Salvage Botanical Biological Evaluation. BAER-directed efforts toward revegetation and soil stabilization have the potential to indirectly affect noxious weeds by reducing the extent of disturbed, sparsely vegetated land surface while promoting vegetative competition against weeds.

Effects of Alternative 1 - No Action

No direct negative effects to TES/S&M potential habitat or occupied sites, known or yet to be documented, are anticipated. A direct and indirect, minor positive effect would be the zero risk of mechanical damage or of the inadvertent creation of a warmer/drier local microclimate due to adjacent salvage harvesting activities. There is potential for negative effects associated with intensity of future fires. Retention of all fire-killed/severely injured trees is likely, relative to the fuel loading resulting from the action Alternatives, to result in future fires of higher intensity. Increased fire intensities are likely to be detrimental to at least some plant species, rare and otherwise, and to their potential habitat. There is evidence (see Botanical Existing Conditions section) that high severity fire may be detrimental to the mountain lady's slipper orchid. Inversely, extensive retention of fire-killed trees will likely result in increased availability of habitat for plant species dependent on or benefiting from decaying wood and the various moist microsites that it provides.

Effects Common to All Action Alternatives

The salvage activities proposed in each of the action Alternatives should have no direct effects on known, or yet to be documented, sites of TES/S&M plants if the mitigations provided here (Mitigation Section) and in the Eyerly Salvage Botanical Biological Evaluation are followed.

The salvage activities proposed in each action Alternative carry with them a risk of the introduction and spread of noxious weeds. This risk is lower in Alternative 3 due to the lower number of acres proposed for salvage-related entries and soil disturbance.

The differing levels of snag retention proposed in the action Alternatives creates the potential for differing levels of indirect effects relating to fire intensity and habitat availability. Relative to Alternative 3, the lower level of snag retention proposed

Effects of Alternative 2

Alternative 2 may result in future fires of somewhat lower intensity. Lower intensity fires will probably generally favor site-specific persistence of certain native plants species, both rare and otherwise. It appears that the mountain lady's slipper orchid can appropriately be included in this group.

Effects of Alternative 3

The higher level of snag retention proposed in Alternative 3 is likely to result in a greater future availability of habitat for plant species requiring or benefiting from the various moist microsites provided by down, decaying wood.

Cumulative Effects

Relative to Wet forest types, Dry forest types such as Dry Ponderosa Pine and Dry Mixed Conifer tend to be more sparsely vegetated and, have higher levels of both direct and diffuse sunlight. Such conditions appear to promote the presence of certain noxious weeds such as the knapweeds. Soil disturbance, such as is associated with the construction and maintenance of the 165+ miles of roads within the project area also favor the presence of invasive plant species. Roads also serve as corridors for the movement of weed-dispersing vectors such as motorized vehicles. As a result of the 2002 fire, thousands of acres of previously shaded duff have been converted to sunny mineral soil. Fire suppression efforts, including about 50 total miles of dozer lines and assorted drop sites and safety zones, further contributed to sum of soil disturbances associated with the fire.

❖ 3.9 Cultural Resources

❖ 3.9.1 Introduction

Archaeological resources are locations that contain evidence of previous human presence or activity, including areas or structures used for living, working, ceremonies, trade, transportation, conflict and recreation. The majority of known cultural resource sites in the Deschutes National Forest reflect historic use patterns prior to the 19th Century (e.g. stone tool detritus). More recent historic uses are related exploration, early settlement, ranching, and timbering.

❖ 3.9.2 Existing Condition

Current survey in November and December of 2002 covered some of the high probability areas. Additional survey to cover remaining high probability and a sample of low probability areas will be completed prior to a decision on the project. High probability in this project area includes approximately 4,000 acres. The remainder of the project (1,010 acres) is considered low probability for the presence of significant historic and prehistoric resources.

Through these past and present surveys, 21 heritage sites have been located and recorded. Sites are defined by having 10 or more artifacts or the presence of features such as a cave, rock art, fire pit remains, structure, ect. Isolates are defined as not having any features and locating less than 10 artifacts. Of the sites; 6 are prehistoric, 14 are historic, and one has both a prehistoric and historic component. Four of these sites are considered significant

and eligible for inclusion on the National Register of Historic Places, two are considered not significant (all pending SHPO review), and 16 remain unevaluated for significance. The site evaluations completed were done by applying the criteria for eligibility in 36CFR60.4. For prehistoric sites, information potential was determined by assessing research value or potential as addressed in research topics presented in the Deschutes County Prehistoric Context Statement (Houser, 1996) and Management Strategy for Treatment of Lithic Scatter Sites (Keyser et al, 1988).

One population of tribal use plants is known in the project area. The Warm Springs, Paiute, and Wasco Tribes from The Confederated Tribes of the Warm Springs Reservation of Oregon are the known tribes with historic associations to this area. The project area is within lands ceded to the Federal Government by The Confederated Tribes of the Warm Springs Reservation of Oregon under treaty in 1855 and ratified by Congress in 1859.

Desired Future Condition

The desired condition is not clearly stated in the Forest Plan but can be derived from the implied goals of the Standards and Guides and the Monitoring Plan. It would be desired to know the location and extent of all cultural resources, have evaluated each one for eligibility to the Register, and have developed management plans for eligible properties that would provide protection or mitigate effects that will occur to the resource.

❖ 3.9.3 Cultural Resources Environmental Consequences

Effects Common to All Alternatives

The Metolius River has been identified as a location of tribal value. Tribal passive use values will not be affected except where these activities may disturb archaeological sites and resources. Any treatment, commercial salvage, and activities involving the establishment of temporary roads and skid trails will be mitigated or avoided to protect eligible and unevaluated historic properties.

Effects of Alternative 1 - No Action

Selection of the No Action alternative would result in no salvage operations being performed within the Eyerly Project Area, and therefore the threat of damage to archeological sites and resources would be reduced. Care would still be taken to avoid adverse effects to archeological resources resulting from future projects including road management activities and maintenance of recreation sites.

Effects Common to All Action Alternatives

The action alternatives have up to 20 historic properties (either prehistoric or historic) or unevaluated properties within the proposed treatment units that have the potential to be effected by the project. In units proposed for commercial salvage, the heavy equipment, skidding of logs, intense activity at landings, and possible pile burning can all affect an historic property by breaking artifacts, changing their association and locations, and further damage of breakage or loss of hydration rinds from intense heat from pile burning. Units proposed for Special Forest Products Salvage may include commercial harvest and have similar impacts.

By type of treatment, the following mitigation measures will avert potential effects to historic properties. In units to be underburned, avoid burning over sites that are historic, no line construction through or mop up in any historic properties. No piles should be built for burning within any historic properties. Commercial salvage should exclude all historic properties from treatment units, landings, temporary roads, and skid trails. Machine piling should also avoid entering site area to remove fuels or create piles.

Where sites need to be avoided by any treatment and archaeologist will mark the area to be avoided prior to any needed implementation layout or design. Avoidance areas will be marked in any contractor files or maps as area to be avoided and not as archaeological sites. All areas to be avoided or otherwise within treatment areas should be monitored by an archaeologist one time during implementation and then again after implementation has been concluded to confirm that avoidance measures were implemented and effective.

Underburning can affect some historic sites by damaging glass and tin artifacts in historic debris dumps or scatters and potential for damaging any remains of historic structures, corrals, and fence lines. Burning can also impact prehistoric sites by breakage or redistribution of artifacts by line construction by hand tools and dozers or mopping up.

Mitigation measures to avert potential adverse effects to historic properties would be carried out, as described in the previous section.

Effects of Alternative 2

Alternative 2 has 20 sites in areas proposed for treatment that may be affected. All sites are in units that are proposed for salvage that may include underburning and/or machine piling and burning after the thinning. Mitigation measures to avert potential adverse effects to historic properties would be carried out, as described in the *Impacts Common to All Action Alternatives* section.

Effects of Alternative 3

Alternative 3 has 15 sites in treatment areas. All sites are in units that are proposed for salvage that may include underburning and/or machine piling and burning after the thinning.

Cumulative Effects

For the Eyerly Fire Salvage Project, any and all effects are expected to be avoided or mitigated (see *Effects Common to All Action Alternatives*), resulting in no adverse cumulative effects from project activities. Past effects to heritage resources in the project area that could be identified are discussed below.

Most evaluated heritage sites have been affected by the Eyerly Fire, firefighting efforts, post-fire erosion, or increased visibility due to loss of covering vegetation and duff. Other sites in the analysis area have been identified and damaged by roads established in historic and recent times, or past vegetation management activities. Several sites have undetermined source disturbances or natural disturbances. All of the known sites have existing disturbance from one or more of these sources.

Four of the significant or unevaluated sites have been affected by a road being present in the site area that has damaged or disturbed historic or prehistoric materials in the site. Six sites have been affected by past vegetation treatment through commercial logging, precommercial thinning, revegetation, or other past vegetation treatments. At least ten

sites have been affected in the past by natural causes such as rodent or insect burrowing or natural deterioration of historic components.

❖ 3.10 Economic and Social Analysis

❖ 3.10.1 Introduction

The importance of recovering economic value is the primary purpose of the Eyerly Fire Salvage Project. The potential positive impact to the economy of Central Oregon from the utilization of timber burned and damaged in the fire has been reflected in public response to project scooping.

Economic impact analysis of the activities proposed in the Eyerly Fire Salvage project focuses on the makeup of the communities of Central Oregon, a comparison of recent local work and unemployment data to the state of Oregon as a whole, and a discussion of economic trends by industry.

Social factors important to Central Oregon, and specifically to land and forest management as a source of local income include: the region's rural setting and its history of farming and ranching; the manner in which the local population utilizes resources for recreation; the collection of wood for fuel, fish and game for sport; and the effect of an increasing population on the region's job market and economy.

❖ 3.10.2 Existing Condition

Demographics

Three Central Oregon counties; Jefferson, Crook, and Deschutes Counties, are considered in this analysis. The Eyerly Fire Salvage area is located within Jefferson County. The total population for the three county area during the 2000 Census totaled 153,558. Populations and change for the region and by each individual county are displayed in the table below.

Table 3.10-1. Central Oregon Population Growth

	Population		Change		Net
	1990	2000	Actual	Percent	Migration
Central Oregon (all)	102,745	153,558	50,813	49.5	43,983
Jefferson County	13,676	19,009	5,333	39	3,728
Deschutes County	74,958	115,367	40,409	53.9	35,696
Crook County	14,111	19,182	5,071	35.9	4,559
Sources: US Bureau of the Census, Vital Records, Oregon Health Division					

The major population centers within the area are: Prineville (7,356), Bend (52,029), Redmond (13,481), and Madras (5,078).

Future population projections mimic that of the past decade. Deschutes, Crook, and Jefferson Counties are expected to continue with aggressive growth.

As with the Nation and Oregon as a whole, the population in the Central Oregon area is becoming both older and more diverse. But there are major differences within the area. For instance, the major cities, Bend, Redmond, Prineville, Madras, had lower medium ages than Oregon, in fact Prineville's, Madras's, and Redmond's medium age has actually decreased since 1990. Whereas more rural counties like Wheeler (Second highest in Oregon in percentage of over-65 population), and unincorporated areas such as La Pine, are much older than the National or Oregon average and tend to be more retiree-heavy. Although racial diversity is increasing, with the Hispanic population increasing the fastest, Central Oregon, except for Jefferson County, is less racially diverse than Oregon as a whole. According to the 2000 census, Crook is 93% white with the Hispanic population increasing 179% since the 1990 census, Deschutes is 95% white with the Hispanic population increasing 182%, Jefferson is 69% white with the Hispanic population increasing 133%. Oregon as a whole is 87% white with a Hispanic population increase of 144%.

The education attainment level, except for Deschutes County, within Central Oregon, is also lower than Oregon's as a whole. The percentage of population having graduated from high school is 47% in Crook, 56% in Deschutes, 44% in Jefferson. For Oregon as a whole it is 53%.

Employment

According to the 2000 Census, estimated civilian labor force is: Crook, 7,525, up 12% since the 1990 census; Deschutes, 57,614, up 40 % since the 1990 census, Jefferson, 8,570, up 31% since the 1990 census. Where as the labor force in Oregon as a whole increased 18%. In Crook County the three largest sectors were trade (1,640), lumber and wood products (1510), and government (1,180). In Deschutes County the three largest sectors were Finance/Insurance/Real Estate (14,170), trade (13,080), and government (6,900). In Jefferson County the three largest sectors were government (2,460), trade (1250), and lumber and wood products (1,150).

Unemployment rates in the individual counties were: Crook, 9.1 percent; Deschutes, 6.4 percent; Jefferson, 6.5%. The unemployment rate in Oregon as a whole was 5.7%.

The economies of Deschutes and Jefferson are the most robust in the Zone. In Deschutes County although there has been an increase in the number of jobs created, the huge increase in the labor force (up 40%) has negated much of this success, at least in terms of the unemployment rate. But, due to their diversity, both economies, are expected to remain very strong. On the other hand, in Crook, with its overall low economic diversity, dominated by one manufacturing sector industry (lumber and wood products) and one wholesale trade sector company (Les Schwab), have had their economies lag behind Oregon's as a whole. Future projections call for continued growth and diversification of their economies.

Income

Average annual wages in Central Oregon are displayed in the table below.

Table 3.10-2. Average Annual Wages in Central Oregon 1990 – 1999 *

Industry	1990	1999	Change	Percent Change
All Industries	\$25,152	\$25,516	\$ 363	1.4
Private Coverage	24,089	24,617	527	2.2
Agriculture, Forest, and Fish	19,630	17,983	(1,647)	-8.4
Construction and Mining	29,156	28,532	(625)	-2.1
Manufacturing	30,633	30,807	174	0.6
Lumber and Wood Products	31,251	31,811	560	1.8
Other Manufacturing	29,028	29,547	520	1.8
Trans., Comm., and Utilities	33,963	35,231	1,267	3.7
Wholesale and Retail Trade	18,510	19,415	905	4.9
Fin., Ins., and Real Estate	26,286	28,468	2,181	8.3
Services	21,493	23,264	1,771	8.2
Government	30,760	30,485	(274)	-0.9
Note: * Adjusted to 1999 \$				
Sources: Oregon Covered Employment & Payrolls by County and Industry				
Oregon Employment Department; US Bureau of Labor Statistics				

Per capita personal income in 1999, as reported by the U.S. Department of Commerce, Bureau of Economic Analysis by county were as follows: Crook, \$21,168; Deschutes, \$26,077; and Jefferson, \$18,808. Although the per capita income in the area is traditionally lower than Oregon's as a whole, there has been a widening of the gap mainly due to the loss of relatively high paying jobs in the lumber and wood products industries. Deschutes County's per capita income, which is the highest in the area, and close to Oregon's as a whole, is attributable to a number of factors. The first being that although Deschutes County also lost significant jobs in the wood products industry they have been replaced by other high-paying manufacturing jobs. In addition, the increase of high-paying "high" tech jobs, and an influx of wealthy new comers have bolstered all income measures (per capita, total personal income, and medium family income) as compared to the other counties.

Although the past decade has seen a significant reduction in employment within the lumber and wood products industry, the lumber and wood products industry is still an important contributor to the local economies. In Crook County, 1,510 people were employed in the lumber and wood products industry. This accounts for 25 percent of all wage and salary employment in the county, and represents the third highest paying job in the county. In Deschutes County, 4,770 people were employed in the lumber and wood products industry. This accounts for 10 percent of all wage and salary employment, and represents the seventh highest paying job in the county. In Jefferson County, 1,150 people were employed in the lumber and wood products industry. This accounts for 19 percent of all wage and salary employment, and represents the third highest paying job in the county.

Agriculture is an important use in Central Oregon. Leading crops include cattle, and forage and hays. In Jefferson County there is also a substantial amount of seed and vegetable products. Total agricultural sales for each county in 2000 were as follows: Crook, \$34,604,000; Deschutes, \$21,855,000; and Jefferson, \$46,431,000. Although farm income is a very small portion of total personal income in the area, the agriculture sector's role in the local economies is substantial in all but Deschutes County.

Employment and income statistical references do not specifically track recreation and tourism as a sector. Instead recreation and tourism contributes to several sectors, transportation, services (accommodations, eating and drinking, recreation), retail trade, and even government. The Oregon Tourism Commission publishes an annual report with estimates to total travel related spending in each County. Estimates for 1999 were 20.4 million in total travel spending in Crook, 414 million in Deschutes, and 52.9 million in Jefferson. Estimated employments from these expenditures are as follows. In Crook, 380 people were employed in industries supporting recreation and tourism, representing 6.3 percent of all wage and salary employment in the county.

In Deschutes County, 5160 people were employed in industries supporting recreation and tourism. This represents 10.5 percent of all wage and salary employment in the county. In Jefferson, 1040 people were employed in industries supporting recreation and tourism. This represents 16.8 percent of all wage and salary employment in the county.

Social Context

Surrounding physical and biological environments influences human social life. This is most evident in rural areas where the variety and quality of available natural resources often determines the chief means of economic livelihood and what leisure activities people are likely to pursue and, therefore, influence local preferences for the use of public lands. From a historical prospectus it is evident that all of the local community's cultures were natural resource based and to a certain degree, especially in the more rural less populated areas, still are. Livestock, agriculture and timber were the backbone of the economic structure and as a result strongly shaped the social fabric that still defines the communities today. Since much of the surrounding land is administered by federal agencies, chiefly the Ochoco and Deschutes National Forests and the Prineville District of the BLM, changes in federal land use policies can impact the socioeconomic and socio-cultural way of life.

One needs to keep in mind that the various communities, and the individuals within them, contain a broad spectrum of perceptions and values related to the road system and use of resources on the surrounding national forests. These same communities and individuals also have interests that span multiple geographic and political scales simultaneously.

The following descriptions portray communities only in the most simplistic terms, and do not capture the full community richness.

Many of the communities (rural industrial, as defined in the Deschutes NF Forest Plan) within Central Oregon, such as Crescent and Gilchrist, are closely tied to the Forests in work, subsistence, and play, and are directly affected by what happens on the Forests. The relationship between the Forests and these communities is based in part on access to logs so that individuals can make a living from their harvesting, manufacturing, and transportation businesses; and catering to recreationalists and tourists drawn to the area. People from these communities also use fuelwood, fish, and game for part of their subsistence and/or recreational activities. Recreation (often roaded and/or motorized) is also an important component of the life styles for many of the people living in these communities.

Communities, such as those found along the Metolius and upper Deschutes (Camp Sherman/Sisters), are better defined by their recreation opportunities and recreation residences (rural recreation and residential, as defined in the Deschutes NF Forest Plan). Environmental and scenic amenities and nearby recreational opportunities play a major

role in their existence. Local service-oriented businesses are a major economic driver in these communities. These communities don't typically depend on extraction-based activities, instead scenic amenities, and recreation opportunities have more influence, both economically and socially on these communities.

Bend (Central Oregon Urban Center, as defined in the Deschutes NF Forest Plan), is the dominant community in the Zone. It has a large industrial sector with wood products playing a major role, and a large service sector based on recreation and tourism. In addition its' financial, real estate sectors, and economy as whole has increased substantially as people have moved into the area because of the amenities the surrounding area provides, much of which is associated with the national forests. It is also the major shopping and service center for most of the communities within the area. Because of its population size and density, and economic and social diversity, the health of the wood products and service sectors of the economy, along with environmental and amenity values, play an important role in defining what is important to the Bend community.

Communities such as Prineville, Redmond, and Madras, from a historically perspective, better fit the "rural industrial" community described above. But with their exploding populations and diversifying economies, they are developing a more diverse set of interests more along the lines of Bend's. With the recent weakening of the economy, it is clear that these communities are still very much tied to the woods product industries both economically and culturally.

Other communities within the Zone (e.g. Paulina, Silver Lake) can generally be defined as ranching or farming communities. These communities are closely tied to the Forests in work, subsistence, and play, and are directly affected by what happens on the Forests. These communities are linked more economically because of the need for summer forage for livestock, not timber, and to provide services for recreation and tourists. . These communities generally have no manufacturing based industries and have small, undiversified economies. Like "rural industrial communities", the people who reside in these communities also use fuelwood, fish, and game for part of their subsistence and/or recreational activities.

The one over-riding demographic trend in the area is that of rapid population increase through in-migration. With the general gentrification that is occurring through the area and the influx of retirees, many of who are well to do, and professionals from many specialty areas, is resulting in rapid economic and social change.

Management Direction

Economic

Forest Service Direction Regarding Reforestation Following Wildfire: Direction regarding reforestation following wildfire depends on whether salvage occurs, and on the objectives of the salvage (whether it is for recovery of economic value or for fuels reduction), land capability, and management objectives.

- Capable and Available lands - forestlands legally physically and economically capable of being managed for timber production without irreversible resource damage to soils or watershed conditions, capable of being restocked within 5 years, and not withdrawn from timber production by Congress, the Secretary, or the Chief.

- Suitable lands - that portion of the Capable and Available lands your LMP allocated to producing regularly scheduled timber harvests, e.g., those lands that contribute to ASQ/PSQ.
- Five-year regeneration requirement - National Forest Management Act (NFMA) regulations 36CFR219.27(c)(3), require that harvested lands be reforested within 5 years. The Forest Service has established a policy that this requirement is applied to salvage as well as to “green” timber sales.

Congress has long emphasized restocking of unstocked National Forest forestland. Combining this emphasis with other indicators from Congress and the public about ten years ago, the FS established a policy that the five-year regeneration requirement should be applied to salvage. The following clarifications have been reviewed by the WO; please adhere to the following Region 6 direction for salvage. “Deforested” here means current stocking is below that needed to meet management objectives.

Where no salvage is done, deforested capable lands should be reforested as quickly as practicable. Plans to reforest non-capable lands should be made after careful consideration of land management objectives and the likelihood of success.

Social

Civil Rights legislation and Executive Order 12898 (Environmental Justice) direct an analysis of the proposed alternatives as they relate to specific subsets of the American population. The subsets of the general population include ethnic minorities, people with disabilities, and low-income groups.

Environmental Justice is defined as the pursuit of equal justice and protection under the law for all environmental statutes and regulations, without discrimination based on race, ethnicity, or socioeconomic status. The minority and low income populations groups living in counties surrounding the fire area work in diverse occupations. Some minorities, low income residents, and Native Americans may rely on recreational tourism, collection of forest products, or related forest activities for their livelihood. This is especially true for those individuals that reside in the rural communities adjacent to National Forest Lands, such as Warm Springs, Madras, Camp Sherman, and Culver, Oregon.

❖ 3.10.3 Economic and Social Analysis Environmental Consequences

Effects Common to All Alternatives

The effects to the local economies are based on the estimated number of jobs created or maintained and estimated employee income.

The effects to the local economy are based on the net sale value, and the number of jobs created or maintained. The actual net sale value would depend on the market value of the timber when sold and the actual logging costs. These figures are based on the March 17, 1999 Appraisal Update Report, published by Region 6 of the Forest Service.

The net sale value was calculated using the value of the timber to be removed and subtracting the costs of logging. Logging costs include stump to truck (what it costs to get the trees from the unit to the landing), haul (getting the trees from the landing to the mill), road maintenance, road construction, and slash disposal.

The number of jobs created was calculated by using figures from the FY 1996 TSPIRS Report, Account 3. This report displays the number of jobs created or maintained and the amount of timber harvested across the entire Ochoco National Forest. Based on these factors, an average of 23 jobs was created for each MMBF of timber harvested.

Effects of Alternative 1 - No Action

Economic

There would be no net sale value, and no jobs would be created or maintained. There would be no benefits to the local economy. This alternative may have negative impacts to the local economy because timber-related jobs would not be maintained.

Social

This alternative would continue the local economic situation as described under the heading "Social Context." Opportunities for employment of minority and low income workers may arise through restoration activities, such as riparian planting and hand piling of small diameter material within the fire perimeter, but there would be no disproportional adverse social effect.

Effects Common to All Action Alternatives

Economic

Recovery of Economic Value: The salvage harvest units under alternatives 2 and 3 have measurable economic recovery potential in terms of volume of sawlog material. Volumes of this material were estimated from a combination of field reconnaissance and stand exams. The amount of volume that would be left for wildlife trees and coarse woody debris was removed from the estimate of total volume to arrive at harvest volume. The Special Forest Products units have some potential for economic recovery, but it is very limited. Posts, poles, firewood, and house logs could potentially be harvested from these units if there is interest from buyers of these products at the time they would become available. In both of these types of units, economic recovery is very time-dependent- the smaller the diameter of the trees to be salvaged, the less time the trees will retain value. Based on current market conditions (May, 2004), the Douglas-fir is expected to have a value delivered to the mill of \$400/mbf, and the ponderosa pine is expected to have a value delivered to the mill of \$300/mbf (see *Net Value of Timber*, following Table 3.10-6).

Alternative 3 would yield about 47 percent of the salvage volume of Alternative 2, and would harvest about 65 percent of the Special Forest Products acres of Alternative 2 (Table 3.10-3).

Table 3.10-3. Comparison of Raw Material Recovery of the Alternatives

Alternative	Volume (million BF)	Special Forest Products Acres
1	0	0
2	23.3	552
3	10.9	361

Under Alternative 3, a higher percentage of the salvage volume would be removed by helicopter- 15 percent versus 8 percent under Alternative 2 (Table 3.10-4). These helicopter systems would generally be about 25 percent more expensive than the skyline systems.

**Table 3.10-4. Comparison of Logging Systems of the Alternatives
(Does not include Special Forest Products Acres)**

Alternative	% Ground Based	% Cable/Skyline	% Helicopter
1	NA	NA	NA
2	74	18	8
3	74	11	15

Funding: The action alternatives are compared in terms of their net value, i.e. the value of the logs delivered at the mill minus the costs of getting the logs to the mill. Reforestation is not considered in this analysis because the salvage of the timber killed by the Eyerly Fire is not what created the need for reforestation- the fire created the need for reforestation. Planting of trees and associated activities would occur regardless of whether or not any salvage occurs, and would be done according to the direction discussed above (see *FS Direction Regarding Reforestation Following Wildfire*, under Social and Economic Management Direction). Net revenues generated by the sale of this timber would provide a potential source of funding for reforestation (KV receipts), but would not be the only source of funding.

The Special Forest Products salvage units (small diameter trees) are not included in this analysis. These units would be salvaged if a market is found for posts, poles, chips, and/or firewood. In general, they are not expected to yield much revenue (if any), but removal of any salable material would help in reducing fuel loads.

Logging Costs: The logging costs shown in *Tables 3.10-5 and 3.10-6* were developed in consultation with local Forest Service timber appraisers, and the regional logging specialist (Toupin, Dunaway, Longbom, personal comm.).

Cost assumptions common to both alternatives are as follows:

- Timber would be hauled approximately 200 miles at the rate of \$1.50 per loaded mile.
- Average yarding distance for ground-based whole-tree yarding would be 600 feet.
- Average yarding distance for ground-based cut-to-length yarding would be 800 feet.
- Average yarding distance for cable yarding would be 350 feet.
- Average yarding distance for skyline yarding would be 600 feet.
- Average yarding distance for helicopter yarding would be 1500 feet.

Cost assumptions specific to Alternative 3 are as follows:

- Stump-to-truck costs (\$/ccf) were increased by 10 percent to reflect the lower per acre volume removed as a result of increased retention of wildlife snags.
- Temporary road construction costs (\$/ccf) for the skyline with temp. road construction units were increased by 33 percent to reflect the lower per acre volume removed as a result of increased retention of wildlife snags.

Table 3.10-5. Expected Logging Costs of Alternative 2

System	Acres	Total Volume (ccf)	Stump-Truck (ccf)	Brush Disp. (ccf)	Road Maint. (ccf)	Temp. Road (ccf)	Misc. (ccf)	Haul (ccf)	Total Cost (ccf)	Total Cost (mbf)	Total Cost
Ground-WT	1573.5	14,140	\$55	\$4.50	\$5	\$0	\$6.00	\$35.00	\$105.50	\$202.88	\$1,491,770.00
Ground-CTL	1573.5	14,389	\$70	\$4.50	\$5	\$0	\$6.00	\$35.00	\$120.50	\$231.72	\$1,733,874.50
Cable	203	1,662	\$95	\$4.50	\$5	\$0	\$6.00	\$35.00	\$145.50	\$279.80	\$241,821.00
Skyline	501	7,414	\$100	\$4.50	\$5	\$0	\$6.00	\$35.00	\$150.50	\$289.41	\$1,115,807.00
Skyline-TRC	144	2,334	\$100	\$4.50	\$5	\$15	\$6.00	\$35.00	\$165.50	\$318.26	\$386,277.00
Helicopter	330	4,912	\$125	\$4.50	\$5	\$0	\$6.00	\$35.00	\$175.50	\$337.49	\$862,056.00
Total	4325	44,851									\$5,831,605.50

Table 3.10-6. Expected Logging Costs of Alternative 3

System	Acres	Total Volume (ccf)	Stump-Truck (ccf)	Brush Disp. (ccf)	Road Maint. (ccf)	Temp. Road (ccf)	Misc. (ccf)	Haul (ccf)	Total Cost (ccf)	Total Cost (mbf)	Total Cost
Ground-WT	884	6,738	\$60.50	\$4.50	\$5.00	\$0	\$6.00	\$35.00	\$111.00	\$213.45	\$747,862.50
Ground-CTL	884	6,738	\$77.00	\$4.50	\$5.00	\$0	\$6.00	\$35.00	\$127.50	\$245.18	\$859,031.25
Cable	80	600	\$104.50	\$4.50	\$5.00	\$0	\$6.00	\$35.00	\$155.00	\$298.07	\$93,000.00
Skyline	227	2,821	\$110.00	\$4.50	\$5.00	\$0	\$6.00	\$35.00	\$160.50	\$308.64	\$452,770.50
Skyline-TRC	35	562	\$110.00	\$4.50	\$5.00	\$20	\$6.00	\$35.00	\$180.50	\$347.10	\$101,441.00
Helicopter	421	3,558	\$137.50	\$4.50	\$5.00	\$0	\$6.00	\$35.00	\$188.00	\$361.52	\$668,904.00
Total	2531	21,016									\$2,923,009.25

Net Value of Timber: The timber species harvested under the action alternatives would be primarily ponderosa pine and Douglas-fir, about an even mix. White fir and incense-cedar are present, but together account for less than 10 percent of the volume. Diameters of trees harvested would generally range from 12-20 inches for Douglas-fir, and 12-20 inches for ponderosa pine, although trees larger than this that are in excess of snag requirements would also be available for removal. Pond values (value of logs delivered at the mill) for these species were established by contacting local mills and asking what they are paying for this material. This was cross-check by reducing the Oregon Dept. of Forestry (ODF) pond values (*Table 3.10-7*) by 40-50 percent for ponderosa pine, 20 percent for Douglas-fir, and 25 percent for white fir and incense-cedar. These reductions account for staining, checking, and other quality degradations due to natural decay processes after fire (*Table 3.10-8*). **Based on this information and the estimated mix of species and diameters, an average pond value, or selling value, of the logs was established at \$350/mbf.**

Table 3.10-7. Pond Values for Fire-Killed Timber

Pond Values (\$/mmbf) ODF, 4th Quarter 2002, Klamath Unit			
Species	8-14 in.	14-22 in.	22 in.+
P-Pine	355	525	640
Doug. Fir	475	505	505
White Fir	325	340	340
Incence-Cedar	550	550	550
Notes: Measured as diameter inside bark (dib)			

Table 3.10-8. Pond Values for Fire-Killed Timber: Adjusted for Degrade (Stain, etc.)

Pond Values (\$/mmbf) ODF, 4th Quarter 2002, Klamath Unit			
Species	8-14 in.	14-22 in.	22 in.+
P-Pine	275	300	325
Doug. Fir	375	400	400
White Fir	250	255	255
Incence-Cedar	420	420	420
Notes: Measured as diameter inside bark (dib)			

Stumpage values are given in *Table 3.10-9* and *Table 3.1010*. . Total net value of the salvage would be approximately \$2.3 million for Alternative 2 and approximately \$900 thousand for Alternative 3.

Table 3.10-9. Expected Stumpage Value (Net Value) of Alternative 2

Alternative 2 Expected Stumpage Value								
System	Acres	Total Volume (ccf)	Total Volume (mbf)	Volume/Acre (mbf)	Pond Value (\$/mbf)	Total Loggin\$/mbfg Cost ()	Stumpage Value (\$/mbf)	Total Stumpage Value
Ground-WT	1573.5	14,140	7353	\$350.00	\$202.88	\$147.12	\$1,081,769.67	1573.5
Ground-CTL	1573.5	14,389	7482	\$350.00	\$231.72	\$118.28	\$884,992.85	1573.5
Cable	203	1,662	864	\$350.00	\$279.80	\$70.20	\$60,672.67	203
Skyline	501	7,414	3855	\$350.00	\$289.41	\$60.59	\$233,585.63	501
Skyline-TRC	144	2,334	1214	\$350.00	\$318.26	\$31.74	\$38,526.45	144
Helicopter	330	4,912	2554	\$350.00	\$337.49	\$12.51	\$31,962.48	330
Total	4325	44,851	23,323				\$2,331,509.76	4325

Table 3.10-10. Expected Stumpage Value (Net Value) of Alternative 3

Alternative 3 Expected Stumpage Value								
System	Acres	Total Volume (ccf)	Total Volume (mbf)	Volume/Acre (mbf)	Pond Value (\$/mbf)	Total Logging\$/mbfg	Stumpage Value (\$/mbf)	Total Stumpage Value
Ground-WT	884	6,738	3504	\$350.00	\$213.45	\$136.55	\$478,392.41	Ground-WT
Ground-CTL	884	6,738	3504	\$350.00	\$245.18	\$104.82	\$367,228.11	Ground-CTL
Cable	80	600	312	\$350.00	\$298.07	\$51.94	\$16,203.72	Cable
Skyline	227	2,821	1467	\$350.00	\$308.64	\$41.36	\$60,669.61	Skyline
Skyline-TRC	35	562	292	\$350.00	\$347.10	\$2.90	\$847.06	Skyline-TRC
Helicopter	421	3,558	1850	\$350.00	\$361.52	-\$11.52	-\$21,321.24	Helicopter
Total	2531	21,016	10,928				\$902,019.67	Total

The net return to the federal government is the total net value of the timber (stumpage value) minus the costs of preparing and administering the sales. Sale preparation costs are estimated to be \$45 per thousand board feet (mbf) and administration costs are estimated to be \$14 per thousand board feet (mbf). Table 30a displays the expected net return to the federal government for alternatives 2 and 3.

Table 3.10-11. Net Return to Federal Government

Alternative	Total Volume (mbf)	Total Stumpage	Total Sale Preparation Cost	Total Sale Admin. Cost	Net Return to Federal Government
2	23,323	\$2,331,510	\$1,049,513	\$326,515	\$955,481
3	10,928	\$902,020	\$491,774	\$152,996	\$257,249

Cost of Fuels Treatments: Fuels treatments include activities to deal with the fuels generated from logging, as well as the natural dead fuel loadings on the site. The logging costs in *Table 3.10-5* and *Table 3.10-6* include slash disposal costs expected as a result of the logging operations. *Tables 3.10-12* and *3.10-13* show the additional costs of treating the natural dead fuels as described under section 2.9.8.

Per acre costs are also shown in *Tables 3.10-12* and *3.10-13*. The costs for handpiling and lop and scatter are estimates based on the relatively low amounts of fuel expected to be generated in the 1 to 6 in. diameter range. Underburning costs reflect what is expected to be more of a “jackpot burning” scenario, i.e. the burning of fuel concentrations. Machine piling costs reflect the treatment of non-merchantable small dead trees.

Table 3.10-12. Alternative 2 Fuels Treatment Costs

Fuels Treatment	Acres	Cost/Acre	Treatment Cost	Slash Collections from Sale	Additional Cost to Government
Handpile	310	\$125.00	\$38,785	-	-
Lop and Scatter	1877	\$25.00	\$47,469	-	-
Machine Pile	2051	\$125.00	\$257,454	-	-
Underburn	608	\$50.00	\$30,399	-	-
Total	4846		\$374,107	\$201,830	\$172,277

Table 3.10-13. Alternative 3 Fuels Treatment Costs

Fuels Treatment	Acres	Cost/Acre	Total Cost	Slash Collections from Sale	Additional Cost to Government
Handpile	179	\$125.00	\$22,379	-	-
Lop and Scatter	785	\$25.00	\$19,627	-	-
Machine Pile	1524	\$125.00	\$190,496	-	-
Underburn	405	\$50.00	\$20,233	-	-
Total	2893		\$252,735	\$94,572	\$158,163

Costs of Reforestation Treatments: The estimated reforestation costs for acres subject to the NFMA 5-year reforestation requirements are displayed in *Table 3.10-14*.

Table 3.10-14. Reforestation Costs

Alternative	Acres NFMA 5-year Req.	Planting (\$/ac)	Deer/Elk Repellent (\$/ac)	Exams/Monitor. (\$/ac)	Total Refor. Cost/Acre	Total Reforestation Cost
2	3918	\$406	\$100	\$70	\$576	\$2,256,768
3	2532	\$406	\$100	\$70	\$576	\$1,458,432

Social

Within the social context presented above, the action alternatives developed for this project have the potential to bring in workers from the outside to perform logging, reforestation, mushroom harvesting, and related activities.

While the outside workforce is more likely to be racially diverse than the local resident population, the residents have worked effectively with and supported anticipated fluctuations in the workforce expected with the implementation of an action-based alternative. The primary services needed by the workers would be food and shelter. Local businesses that can supply food (grocery stores and restaurants) and other services would capture most of the money being spent by the workers in the area. Some businesses may need to increase their employment, either by temporarily adding employees, or giving present employees more hours. This would likely result in increased local household incomes during implementation of project activities. Since these businesses have supported similar workforces in the past, capital expansion would probably not be required.

Since reforestation activities are expected to span a period of several years, it is reasonable to expect a good proportion of the work will go to minority-based small businesses, as they have in the past. The vast majority of these businesses and their employees are based along the I-5 corridor, so again most of the disposable income from these activities would not flow into local communities.

All action alternatives propose change in access to the project area by a net reduction in open roads of 3.8 miles. There would be minor limitations to existing access for special forest products on the eastern reaches of Prairie Farm Creek. Resources gathered for subsistence or of cultural importance, such as edible plants or animals, or materials for shelter, are not likely affected by any federal action proposed within the fire area. Decommissioning the 1170800 road segments will also limit the opportunities for vehicle access to dispersed camping along this section of Prairie Farm Creek. Reducing the amount of dispersed, non-fee camping available in the project area may have a larger

impact on lower income families; however, there are numerous other available locations in and near the Eyerly Fire area for non-fee camping.

Recent research by the Center for Watershed and Community Health outline both the direct and indirect effects of wildfire on the health and welfare of impoverished individuals, families, and communities. Beside the direct impacts of the fire on potential jobs and income, there are also negative impacts to the value of property and other assets created by the public perception of risk created by local wildfires. The long term effect of a decrease in a sustainable local timber supply for local mills combined with a short term decrease in recreational opportunities can also affect major local employers and taxpayers. This means that the tax base decreases and the costs of sustaining local services cost more. Thus poor householders in local communities are especially vulnerable to the fallout of a wildfire like this on their local economy. They have limited financial ability to cope with the disruptive effects this may have on local economic activity and dependent social services. The effects discussed in this section, are very difficult to measure, but would tend to have a disproportional impact on local low income households. In contrast, minority groups from outside the immediate area would, whether harvesting forest products or helping in reforestation and restoration efforts, probably see fewer changes in income when compared to other groups.

Effects of Alternative 2

There would be some contributions to the local economy. The net sale value is estimated to be \$2.07 Million. An estimated 130.4 timber and timber-related jobs would be created or maintained. Timber could be logged in one to two seasons, and should be carried out as early as possible if this alternative is selected due to the decrease in economic value from decay and insect infestation the longer the dead and damaged trees remain in place. The estimated duration of jobs related to treatment of timber products would be several (6-7) years. About \$2.28 million would result in employee income. Indirect benefits from employment would contribute to the local economy.

Effects of Alternative 3

There would be some contributions to the local economy. The net sale value is an estimated \$720,000. An estimated 60.5 timber and timber-related jobs would be created or maintained. Logging operations could take as little as a month to accomplish, and should be carried out as early as possible if this alternative is selected due to the dead and damaged trees decrease in economic value. Estimated duration of jobs in support of timber products treatment would occur over several (5-6) years as timber is harvested and treated. About \$1.06 million would result in employee income. Indirect benefits from employment would contribute to the local economy.

Cumulative Effects

Over the last 10 years, an annual average of approximately 68.9 MMBF of timber has been sold from the Deschutes National Forest. In the near future, the amount of timber offered for sale is expected to be near the annual average for the last 5 years. The Deschutes National Forest is expected to continue offering timber for sale and is expected to continue making contributions to the local economy as a result of timber harvest activities.

❖ 3.11 Fire and Fuels Accumulation

❖ 3.11.1 Introduction

This report provides information and analysis for fire and fuels resource condition of the Eyerly Fire Salvage Project

Management Direction

Direction for managing fire and fuels may be found in:

- Forest Plan Final EIS, Chapter 3
- The Deschutes National Forest Land and Resource Management Plan, Chapter 4 and Appendix I.
- Northwest Forest Plan
- Metolius Late-Successional Reserve Assessment
- Metolius Watershed Analysis
- Regional Forester's Plan Amendment (Eastside Screens)
- Inland Native Fish Strategy (INFISH)

The National Fire Plan provides national direction for hazardous fuel reduction, restoration, rehabilitation, monitoring, applied research and technology transfer. In August 2000 President Clinton asked the Secretaries of Interior and Agriculture to recommend how best to respond to the recent fire events, reduce the impacts of wildland fires on rural communities, and ensure sufficient firefighting resources in the future. The President also asked what actions federal agencies, in cooperation with states and local communities, could take to reduce immediate hazards to communities in the wildland/urban interface, and to ensure that fire management planning and firefighting personnel and resources are prepared for extreme wildland fires in the future (USDA, 2000, p. 1).

The Forest Service responded in October 2000, with the report "Managing Impacts of Wildfires on Communities and Environment" (USDA, 2000), known as the "National Fire Plan". In the report, the Chief of the Forest Service outlined operating principles including: firefighting readiness, prevention through education, rehabilitation, hazardous fuel reduction, restoration, collaborative stewardship, monitoring, jobs, and applied research and technology transfer.

The Eyerly Fire Salvage Project responds to the rehabilitation, hazardous fuel reduction, and restoration elements of the National Fire Plan.

- Rehabilitation – Focus rehabilitation efforts on restoring watershed function, including protection of soil and water resources, biological communities, and prevention of invasive weeds.
- Hazardous Fuels Reduction – Assign highest priority for hazardous fuels reduction to: communities at risk, readily accessible municipal watersheds, threatened and endangered species habitat, and other important local features where conditions favor uncharacteristically intense fires.
- Restoration – Restore healthy, diverse, and resilient ecological systems to minimize uncharacteristically intense fires on a priority watershed basis. Methods will include removal of excess vegetation and dead fuels through thinning, prescribed fire, and other treatments.

Comparison of Objectives To Management Direction

Management direction for down material and fuels is provided in the Deschutes National Forest Land and Resource Management Plan as amended by Northwest Forest plan and Regional Forester's Eastside Plans Amendment. Existing direction related to fire and fuels is described in Appendix C. Direction related to down wood within the Metolius LSR is displayed in *Table 3.11-1* (Metolius LSRA, p.57).

Table 3.11-1. LSR Down Wood Material by PAG

Plant Association Group (PAG)	LSR Down Wood in Tons per Acre
MCW (Climatic)	25 - 35
MCD (Fire Climax)	8 - 12
PPW (Fire Climax)	6 - 10
PPD (Fire Climax)	5 - 8

❖ 3.11.2 Fire and Fuels Accumulation Affected Environment

Ecological Role of Fire as a Disturbance Process

In April 2002, a national course-scale assessment was completed that quantifies land condition in the conterminous United States. The analysis describes the degree of fire regime departure from historic fire cycles due to fire exclusion and other influences (Schmidt et al 2002).

This course scale analysis identifies changes to key ecosystem components such as species composition, structural stage, tree or shrub stand age, and canopy closure. It characterizes the landscape by five “Fire Regime Groups” and three “Fire Condition Classes” (USDA/USDI 2002).

A fire regime is a generalized description of fire’s role within an ecosystem – characterized by fire frequency, predictability, seasonality, intensity, duration and scale (USDA/USDI, 2002).

Fire condition class is a landscape level attribute which characterizes the degree of departure of vegetation composition and structure, and fire frequency and severity that currently exist inside fire regime.

The national fire regime scheme has been modified for use within the Pacific Northwest Area.

For the Eyerly Fire Area Fire Regimes are identified by Plant Association Group (PAG) as shown in Table 3.11-2.

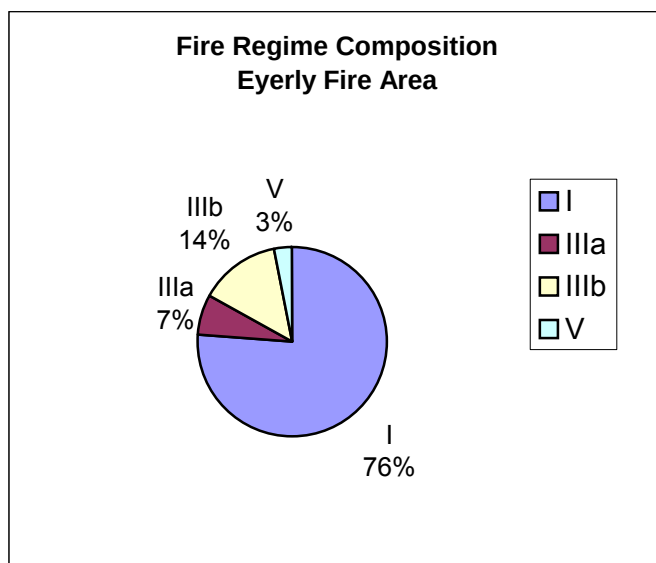
Table 3.11-2 Fire Regimes

Fire Regime Group	Fire Frequency	Fire Severity	Plant Association Group
I	0 – 35 years	Low	Ponderosa Pine
II	0 – 35 years	Stand Replacement	Western Juniper
IIIa	<50 years	Low/Mixed	Mixed Conifer Dry
IIIb	50 – 100 years	Mixed	Mixed Conifer Wet

Condition class descriptions: Condition classes are a function of the degree of departure from historical fire regimes resulting in alterations of key ecosystem components such as species composition, structural stage, stand age, and canopy closure (*Table 3.11-3*). One or more of the following activities may have caused this departure: fire exclusion, timber harvesting, grazing, introduction and establishment of exotic plant species, insects or disease (introduced or native), or other past management activities.

Table 3.11-3. Condition Class

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

Figure 3.11-1. Fire Regime Group Composition for Eyerly Fire Area

The majority of the Eyerly Fire Area is within Fire Regime I (Ponderosa Pine PAG), the majority (71%) of the fire area is within the Dry ponderosa pine PAG. About 5% of the area is in the Wet Ponderosa Pine PAG however these areas generally occur as isolated patches within the Dry type and are included within Fire Regime I. The next most prevalent Fire Regime Group is IIIb (Mixed Conifer Wet PAG) followed by Fire Regime IIIa (Mixed Conifer Dry PAG). The balance of the Eyerly area (about 3%) is composed of juniper, meadow, riparian, rock, water, and xeric shrublands (*Figure 3.11-1*).

The Eyerly Fire would not change Fire Regime composition; however, changes would occur to condition class based on fire severity. Condition Class can be determined by comparing the degree of departure from historic natural conditions for each Fire Regime within the Eyerly Fire Area. Components in the assessment include: vegetation condition, fire severity and fire frequency.

Vegetation Condition

Pre-Fire Conditions

Fire Regime I: Fire Regime I consists of the Dry and Wet Ponderosa Pine PAG's and makes up the majority of the Eyerly Fire Area, about 14, 077 acres (76%). Historic ranges of variability (HRV) have been developed for the various seral/structural stages. The pre-fire conditions were characterized by a deficiency of area dominated by large –size ponderosa pine. The HRV for this structural stage is 30 – 70%, the pre-fire condition was 3%. The majority (81%) of the Fire Regime I area was dominated by pole (5 – 9" dbh) and small (9 – 20" dbh) sized stands of ponderosa pine. Departure from historic reference conditions is estimated to be in excess of 67%.

Fire Regime IIIa: Fire Regime IIIa consists of the Dry Mixed Conifer PAG and makes up about 7% of the Eyerly Fire Area. Because the fire frequency was relatively short for this regime historic ranges for seral/structural stages are skewed toward the occurrence early seral species, such as ponderosa pine. The pre-fire condition for this regime shows a marked effect of fire exclusion with a general deficiency of area dominated by early seral species compared to historic ranges. Historically the expected area dominated by early seral species would be from 35 – 79%. Pre-fire composition for early seral conditions was 12%. Departure from historic reference conditions is estimated to be between 33 and 67%.

Fire Regime IIIb: Fire Regime IIIb consists of the Wet Mixed Conifer PAG and makes up about 14% of the Eyerly Fire Area. Pre-fire conditions for Fire Regime IIIb were close to the HRV's for most seral/structural stages, deficiencies were apparent in areas dominated by large size trees (>20" dbh) for all seral stages. Departure from historic reference conditions is estimated to be less than 33%.

Post-Fire Conditions

Fire Regime I: Effects of the Eyerly Fire resulted in loss of much of the tree dominated area. Currently approximately 88% of area within this fire regime is dominated by early successional grass, forb, shrub stage, the HRV for this stage is 3 – 21%. Departure from reference conditions is estimated to be in excess of 67%.

Fire Regime IIIa: Currently about 44% of the area within this fire regime is dominated by the grass, forb, shrub stage, the HRV for this stage is 2 – 15%. Nearly all of the area which was dominated by late successional stages was lost in the fire, approximately 39%. Departure from historic reference conditions is estimated to be in excess of 67%.

Fire Regime IIIb: Effects of the Eyerly Fire resulted in loss of much of the tree dominated area. Currently approximately 60% of area within this fire regime is dominated by early successional grass, forb, shrub stage, the HRV for this stage is 3 – 20%. Departure from historic reference conditions is estimated to be between 33 and 67%.

Fire Frequency and Severity

Pre-Fire Condition

Fire Regime I: The Deschutes National Forest maintains a historic large fire record dating back to about 1905. An analysis of this record indicates that up the occurrence of the Eyerly Fire about 2,043 acres had burned within the Eyerly Fire area. Approximately 1,243 acres burned within the area classed as Fire Regime I. The historic reference fire frequency ranges from about 5 to 35 years. This short-interval fire cycle would indicate that most of the Fire Regime I area would have experienced 3 or more fire events during the last 100 years. Prior to the Eyerly Fire frequency of fire disturbance had departed substantially from reference conditions.

Fire Regimes IIIa and IIIb: Approximately 800 acres burned within the area classed as Fire Regimes IIIa and IIIb. The historic reference fire frequency ranges from 35 to 100 years. It is likely that within the Eyerly Fire area most of the area in these Fire Regimes had missed 1 fire cycle.

The historic record contains no data on the severity of past large fires. Historically fires occurring with Fire Regime I were low intensity and had little effect on the dominant vegetation layer. Large-stand replacing fire could occur within Fire Regime I under extreme weather conditions, but were very rare events associated with exceptional droughts.

Within Fire Regimes IIIa and IIIb historically were of mixed intensity and had variable effects to the dominant vegetation. Large, stand replacing fire could occur but were usually rare. Fire disturbance resulted in a mix of stand ages and size classes. Historic fire severity within Fire Regime IIIa would tend to low intensity supporting and maintaining a higher percentage of early seral ponderosa pine.

Post-Fire Condition

The scale, intensity and severity of the Eyerly Fire was uncharacteristic compared to reference conditions within Fire Regime I. Burn severity for the Eyerly Fire within Fire Regime I was uncharacteristic with 84% of the area affected as stand replacement. The fire severity expected within Fire Regime I under historical conditions would be low severity.

Burn severity for Fire Regimes IIIa and IIIb was likely within the historic range of variability, with 34% of the area affected as stand replacement.

Table 3.11-4 summarizes the elements of vegetation condition, fire frequency and severity in the determination of condition class for the Eyerly Fire Area.

Table 3.11-4. Eyerly Pre- and Post-Fire Fire Regime Elements

Fire Regime	Vegetation Condition*	Fire Frequency	Fire Severity	Condition Class
I				
Pre-Fire	70	70	80	3
Post-Fire	70	70	80	3
IIa				
Pre-Fire	40	40	25	2
Post-Fire	70	40	30	3
IIb				
Pre-Fire	25	40	25	1
Post-Fire	40	25	30	2
Note:				
* Departure from Reference Conditions				

Fuel Loading and Arrangement

Fuel levels and risk of damage from wildfires is a component of the purpose and need for the Eyerly Fire Salvage Project. Components are described below.

- Bringing fuel load levels and fuel arrangement to conditions that reduce the likelihood of stand-replacement fire in regenerated stands, particularly during the early stages of stand development, will promote the long-term survival and growth of new conifers.

Fuel load and arrangement will be described for the Eyerly Fire Area. Fuel conditions resulting from the alternatives will have associated effects on fire behavior including potential fire intensity. The effects a fire may have on resources depends on fire intensity and the conditions of the environment, including vegetation, in which it burns.

- Fuel loading within the Metolius Late Successional Reserve (LSR) is likely to reach levels that would potentially damage soil productivity, residual live trees and snags in the event of a reburn.

The Northwest Forest Plan provides direction to enhance and protect late and old structure within Late Successional Reserves. Over time the existing dead trees will fall and become down wood accumulating as surface fuels with the potential to increase fire intensity. It is recognized that down wood is an essential component of ecosystems within the Eyerly Fire area, particularly within LSR, providing wildlife habitat, soil protection and other important functions. Alternative down wood levels that provide essential function and levels which represent a potential for adverse impacts to soil productivity and other ecosystem components is analyzed.

Affected Area

Fuel Load and Arrangement

One objective in burned areas is to reduce fuels so that they more closely approximate historic dead and down woody fuel loads. At lower and middle elevations, this is an important ecological concept because fuel loads can significantly contribute to the effects of a fire disturbance but often exist in levels above pre-European settlement (Brown, R. 2000 p.14; Everett, et al 2000 p. 220). It is generally accepted that fire suppression and

past large-tree harvesting operations have contributed to excess tree densities and fuel loads in ecosystems that developed with relatively short fire intervals (Brown, 2000 p.7).

In many places in the western United States organic matter is produced at a higher rate than it can be cycled by decay. The accumulation of this woody material may increase the likelihood of severe stand replacing wildfires (DeBano et al. 1998 p. 140). “Fuel buildups continue and become more continuous in distribution. As a consequence, subsequent occurrence of high-severity fire results in generally greater changes in plant compositions and structure than would occur if the communities had been subjected to more frequent low-intensity fires”(DeBano et al. 1998 p. 201). Uncharacteristically high fuel levels create the potential for fires that are uncharacteristically intense (Franklin and Agee, 2003). If lower and mid-elevation ecosystems are to experience a disturbance regime similar to that which they are adapted, the fuels must first be reduced to keep fire effects within an historic range. One goal of this project is to manage future fuel loads and fuel arrangement to be within a manageable range for both fire suppression and ecosystem processes.

Within the project area the Burned Area Emergency Rehabilitation (BAER) team mapped four levels of burn severity in relation to loss of vegetation. The four strata were listed as High, Moderate, Low and Unburned. BAER severity classes measured for the emergency rehabilitation assessment are relatively accurate descriptors of fire intensity were used to stratify post-fire dead down fuel loading. Within each of these strata the post-fire down woody fuel loading was assessed using a combination of the following three methods: Brown, James K. 1974 Handbook for inventorying downed woody material, USDA Forest Service General Technical Report INT-16. Ogden, Utah; Photo Series For Quantifying Natural Forest Residues in common Vegetation of the Pacific Northwest, USDA Forest Service General Technical Report PNW-105 May 1980; and Fire Management Analysis Plus software. (See *Appendix C: Eyerly Fuels Treatment Guidance* for representative photos and tables of fuel loading).

The post fire 1 hour and 10 hour timelag fuel loading which is represented by the less than three inch diameter fuels within the high and medium severity strata are typically less than .5 tons per acre with occasional concentrations of 3.0 tons per acre. Fuel loadings in areas that burned at low intensity had a slightly higher fuel loading as a result of the needle cast and small branches that began to fall from the scorched trees.

A significant amount of the 100 hour and 1000 hour time lag fuels which are represented by fuels greater than 3” in diameter in the high and medium intensity strata were also consumed during the initial burning periods. Immediately after the fire the larger down woody fuel loading was in the neighborhood of 5 tons per acre. This near complete consumption of down logs was attributed to the low fuels moistures at the time the fire passed through the area. After the fire and into the fall fire weakened trees started to fall which resulted to a steady increase of dead down woody fuel loading. The fall rate of trees between 3 inches and 16 was modeled on a stand by stand basis with Fire Management Plus (FMA+) software to predict potential fuel loading. The results indicated that there is available snags that once they fall will exceed fuel loading standards identified in the Deschutes National Forest Land Management Plan.

The unburned portions within the fire are outside the proposed treatment areas and associated with campgrounds, improvements or adjacent to Lake Billy Chinook.

Table 3.11-5. Existing Fuel Loading by Fire Severity on Vegetation, Eyerly Planning Area

Severity/Strata	Acres	< 3" dia Fuel Loading (tons per acre)	>3" dia. Fuel Loading (tons per acre)	Total (tons per acre)
High (Stand Replacement)	14,728	0.05 – 1.5	0.5 – 5.0	0.55 – 5.5
Moderate (Mixed)	3,430	0.05 – 2.0	1.0 – 10.0	1.5 – 11.0
Low (Non-Lethal)	1,816	0.25 – 3.0	2.0 – 20.0	2.5 – 23.0
Unburned	201	10 - 20	20 - 50	30 - 70
Total	20175			

Results of the fuels inventory are not unexpected. Areas experiencing high burn intensity in all PAG's have a lower fuel loading than those areas where the Eyerly Fire burned at moderate or low intensity. Resulting primarily from high intensity fire consuming more of the down surface fuels than moderate and low intensity.

❖ 3.11.3 Fire and Fuels Accumulation Environmental Consequences

General Description of Vegetative Succession and Fuels Conditions

Discussion of Factors Used To Describe Effects Common to All Alternatives

The following factors relate to fuel loading, fire intensity, and fire occurrence:

Fire Behavior

Fire Behavior is the manner in which fire reacts to topography, weather, and fuels (DeBano et al 1998 p. 11; NWCG,1998 p. G-7). These three elements comprise the fire environment, the surrounding conditions, influences, and modifying forces that determine fire behavior (NWCG, 1994 p. 8).

Modifying any one of these elements has a direct result on fire behavior, which is basically described by flame length and rate of spread. Favorable conditions for crown fires include heavy accumulations of dead and downed litter, conifer reproduction and other ladder fuels, and continuous conifer tree forest (Rothermel 1991 p.2).

The greater the fuel loading, the more intensely a fire is likely to burn (DeBano et al 1998 p.57) Conversely a reduction in fuel loading can limit the fires intensity. Fuel characteristics affecting fire behavior are vegetative density, species composition, amount of surface fuel, arrangement of fuels and moisture content (Rothermel 1983 p.9). Fuels contribute to the rate of spread of a fire, the intensity/flame length of the fire, how long a fire is held over in an area, and the size of the burned area (Rothermel 1983 p.59).

Treatments that reduce surface fuel loads have been shown to decrease fire behavior and severity (Graham et al 1999 p.18, 20) (Pollet and Omi, 1999, p. 3). Van Wagendonk (1996) found in fire simulations that a reduction in fuel loads decreased subsequent fire behavior, increased fire line control possibilities and decreased fire suppression costs. Fire line construction rates increase with decreased fuel loads, decreased fuel loads means a lower resistance to control.

Intensive forest management that involves the creation of activity fuels (slash) can indeed increase fire

behavior parameters such as rate of spread and flame length. However, treatment of slash (e.g. burning,

chipping, removal, isolation) will reduce fire behavior and fire intensity (Omi and Martinson, 2002). Graham et al (1999 p.22) reports that thinning from below and intermediate tree harvest can effectively alter fire behavior by reducing crown bulk density and ladder fuels, but will not reduce crown fire potential unless tree densities are substantially reduced. Graham et al (1999 p.20) also states that all intermediate treatments should be accompanied by surface fuel modification, and the most success is achieved when using prescribed fire for such treatments.

There are three types of fuels that affect fire behavior; fine fuels such as grass or forbs, small woody fuels less than three inches in diameter and large woody fuels greater than three inches in diameter. Fine fuels are the major contributors to fire spread, carrying the ignition and flaming front of a fire (Rothermel 1983 p.1). Without these fine fuels, many fires will not get large, although there are exceptions. However, eliminating fine fuels (litter, duff, grasses) is neither possible nor desirable. Small woody fuels influence a fire's rate of spread and fire intensity, and small woody fuels lose their moisture faster, start easier and burn more readily (Agee 1993).

Under a frequent fire regime it will be possible to maintain fine fuels at lower levels and various patch sizes than under a less frequent fire regime, but fine fuels will always exist. Aside from eliminating the fine fuels that contribute to fire spread, only the total amount and arrangement can be modified to benefit fire control efforts. From a firefighter's perspective, it is better to construct fire line through 2" of this small material to reach mineral soil (therefore stopping fire spread) than to dig through 10" of fine fuels because the fire line construction will progress faster and the fire could potentially be contained at a smaller size.

Large fuels (greater than 3" diameter) do not contribute greatly to fire spread, and are not considered in the BEHAVE fire spread prediction model, though they do remain burning after the fire front has passed (Andrews 1986 p.9) and contribute to fire severity. Large fuels also contribute to mortality of residual over story trees and soil surface sterilization (Hall 2001 p.8). Due to large dead and down woody fuel contributions to fire behavior and control, reducing the amount of large, dead and down woody debris will increase the potential for using prescribed fire, in turn; help keep the fine fuel load at a relatively low level.

There are several expressions of fire intensity. Radiant intensity is the rate of thermal radiation emission. Convective intensity is that part of the total heat output from a fire that lifts gases and entrains air above the flame zone. Total fire intensity, the rate of heat output of the fire as a whole, is the function of the rate of area burned, fuel loading, and estimated heat yield. Reaction intensity, the total heat release per unit area of fuel bed divided by the burning time, is the time-averaged rate of heat release of the active fire front. Fireline intensity, also called Byram's intensity, is the product of the available heat of combustion per unit area of ground surface and the rate of spread of the fire. The equation is (from DeBano et al 1998 p. 57):

$$I = .007HWR, \text{ where}$$

$$I = \text{intensity (kW/m)}$$

$$H = \text{Heat yield (cal/g)}$$

$$W = \text{fuel loading (Mg/ha)}$$

$$R = \text{rate of spread (m/min)}$$

Fire line intensity was also described by Rothermel in 1991 as:

$$I = Rwh, \text{ where}$$

$$I = \text{intensity (Btu/ft/s)}$$

$$R = \text{rate of spread (ft/s)}$$

$$W = \text{available fuel (lb/sq ft)}$$

$$H = \text{heat of combustion (Btu/lb)}$$

Based on these established relationships it follows that if available fuel is reduced, there is a reduction in fire line intensity. Fireline intensity has been related empirically to flame length, which is easily measured in the field (DeBano et al 1998 pp. 56 – 57).

Fire Hazard

Fire hazard generally refers to the difficulty of controlling potential wildfire. It is commonly determined by fire behavior characteristics such as rate of spread, intensity, torching, crowning, spotting and fire persistence and by resistance to control. Fire severity, referring to the effects of fire on the ecosystem, may also be considered to be an element of fire hazard (Brown et al, 2003, p. 4).

Downward heat transfer into the soil is an important determinant of fire severity (Ryan and Noste 1985). Fire intensity, largely a measure of upward heat transfer, is not a reliable indicator of fire severity because it correlates poorly with downward heat transfer (Brown et al, 2003).

Resistance to Control

Resistance to control is generally viewed as an estimate of the suppression force required for controlling a unit of fire perimeter. The USDA Forest Service Pacific Southwest Region (1976) developed a resistance to control rating scheme based on difficulty of handline construction and an inventory of downed woody fuel loadings by size classes. High and extreme resistance to control ratings were reached for the following loadings in tons per acre:

<u>0-3 inch diameter</u>	<u>3 – 10 inch diameter</u>	
	High	Extreme
5	25	40
10	15	25
15	5	15

The above ratings were based on the assumption that few downed pieces greater than 10-inch diameter were present. In computing the ratings, the number of large pieces (greater than 10 inches) by length class is more important than their loading in determining resistance to control. If the number of pieces greater than a 10-inch diameter exceeded 10 to 20 per acre, depending on length, less 3 – 10 inch diameter material would be required to reach the high and extreme resistance to control ratings (Brown et al, 2003).

Fire Occurrence

Based on recent fire records the Eyerly Fire area has a moderate fire occurrence rate averaging 2.8 fire starts per year, with 36 fires recorded during the period from 1988 through 2001. Fire cause was 80 percent lightning and 20 percent human caused. This pattern will likely remain constant into the future.

Restoring Fire as A Disturbance Process

A consideration in burned areas is to reduce fuels so that they more closely approximate historic dead and down woody fuel loads, in effect. At lower and middle elevations, this is an important ecological concept because fuel loads can significantly contribute to the effects of a fire disturbance but often exist in levels above pre-European settlement (Brown, R. 2000 p.14; Everett, et al 2000 p. 220). It is generally accepted that fire suppression and past large-tree harvesting operations have contributed to excess tree densities and fuel loads in ecosystems that developed with relatively short fire intervals (Brown, R. 2000 p.7).

In many places in the western United States organic matter is produced at a higher rate than it can be cycled by decay. The accumulation of this woody material may increase the likelihood of severe stand replacing wildfires (DeBano et al. 1998 p. 140). “Fuel buildups continue and become more continuous in distribution. As a consequence, subsequent occurrence of high-severity fire results in generally greater changes in plant compositions and structure than would occur if the communities had been subjected to more frequent low-intensity fires”(DeBano et al. 1998 p. 201). If lower and mid-elevation ecosystems are to experience a disturbance regime similar to that which they are adapted, the fuels must first be reduced to keep fire effects within an historic range. One goal of this project is to manage future fuel loads and fuel continuity to within a manageable range for both

fire control and ecosystem processes. Treatments which reduce surface fuels, increase canopy base height, decrease crown density, and increase the proportion of fire-resistant trees (example ponderosa pine) contribute to the fire-resiliency of forest stands (Graham et al, 2004).

Within the Eyerly Fire area Fire Regimes I and IIIa would be areas on which to focus for restoring fire's role as a disturbance process. The occurrence of the Eyerly Fire presents an opportunity to examine the affected area and identify areas and treatments that would help create conditions favorable for the re-introduction of fire, primarily prescribed fire, as a disturbance process into the area.

Fire Regime I: Fire regime I includes Dry and Wet Ponderosa Pine plant association groups (PAG's). In ponderosa pine forests, it has taken several decades of fire suppression to create the conditions existing which existed prior to the Eyerly Fire, and one treatment is not going to immediately return this forest to a condition to which it would function under the historical low-severity fire regime (Brown, R. 2000 p.13). The goal, then, is not to completely return these forests to a historic fuel load with one treatment, but to prescribe treatments that would start to move them toward a historic level, which would allow a more natural fire regime to function.

Ponderosa pine forests have undergone substantial structural changes since earlier this century due to fire suppression, logging and other activities. Heavy fuel loads and ladder fuels make these stands more susceptible to large, uncharacteristic crown fires. This may result in an increased risk of fire intensity and severity that could exceed the lethal limits of thick barked species (USDA, 2000 p.13; USDA, 2001 p.2). "Certain forest types (low elevation ponderosa pine, for example) may be susceptible to burning in ways that have not been seen in centuries." (Beschta et al 1995 p.5) The type of fire behavior that can be exhibited by this changed stand condition can make conditions less safe for firefighting operations.

To move forests towards a more natural fuel condition, fire will be managed, through the use of prescribed fires. Actions proposed in the alternatives are aimed at reducing fuel loading now so that as conifer stands develop the option of using prescribed fire will be available to either maintain or enhance desired conditions. A reduced fuel load would increase the variance of weather and fuel conditions under which prescribed fire could be applied.

Hall (2003) suggests that the historical condition contained very little woody fuel averaging about 3 to 6 tons/acre. The optimum range of Coarse Woody Debris (CWD) for warm dry forest types is described as 5 to 20 tons per acre (Brown, 2003). After the Eyerly Fire, projected fuel loads show the surface fuel loads on PP sites averaging about 37 tons/acre after 25 years, and range from 19 to 63 tons per acre.

Fire Regime III: Fire Regime III includes the mixed conifer wet and mixed conifer dry PAG's. Agee (1992) believes that historically the mixed conifer forests show the most frequent fire activity of all Eastside forests, although cooler, wetter sites (mixed conifer wet) would tend to have longer fire return intervals. Frequent fire intervals in drier plant associations are likely due to higher productivity, when compared to Ponderosa pine associations. After a fire, the fine dead fuels needed to carry another fire are rapidly replaced in the mixed conifer associations.

The optimum range of Coarse Woody Debris (CWD) for cooler mesic types is described as 10 to 30 tons per acre (Brown, 2003). After the Eyerly Fire, projected fuel loads show the surface fuel loads on mixed conifer sites average 59 tons/acre, after 25 years, and range from 29 – 81 tons/acre.

To introduce prescribed fire as a disturbance on the Eyerly Fire area, it is necessary to first remove some of the fuels to allow for these fires to be safe and ecologically beneficial. From a firefighting perspective, less fuel is better, however, it is not ecologically appropriate to reduce fuel levels below that which provides for other ecosystem functions and such reductions are not proposed in this project.

Effects of Alternative 1 - No Action

Vegetative succession following forest fire including reburn depends on a number of interacting factors including fire severity, prefire vegetation, species adaptations to fire, environmental conditions and chance.

The following description of likely vegetative succession and fuels condition development over time is patterned after Brown et al, 2003, p. 9. Additional site specifics are described for the Eyerly Fire area based on existing literature and observation of the Eyerly Fire area.

0 to 10 Years After Eyerly Fire (2003 – 2013)

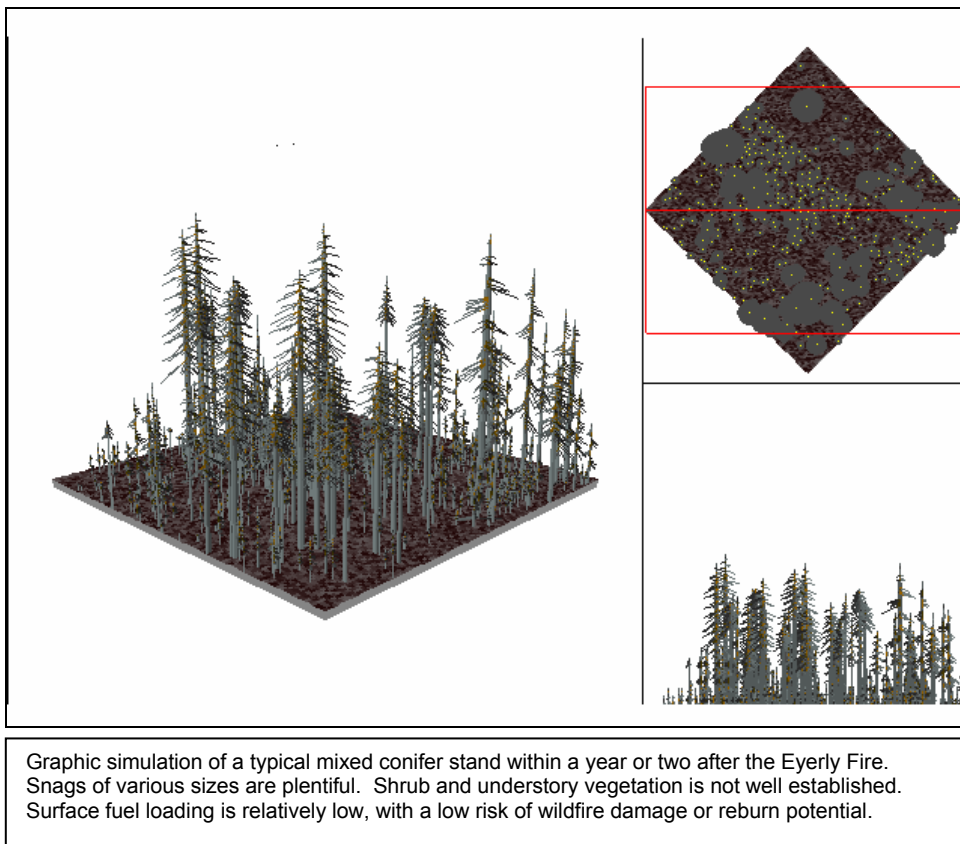
During this period small diameter standing dead trees, those less than 3 inches dbh, will fall to the ground, while larger dead trees remain. Natural conifer regeneration would be sparse if any.

Native forbs and grasses would begin to re-occupy the site. Notable among shrub species would be snowbrush (*Ceanothus velutinus*), which will likely become re-established quickly, resprouting from existing burned plants and from dormant heat scarified seed in the soil. Another shrub likely to be present is greenleaf manzanita (*Arctostaphylos patula*). Bitterbrush (*Purshia tridentate*) may be present but uncommon above 5,000 feet elevation.

Surface fuels for most of this period would not support fire spread sufficiently to pose a threat of any damage. Depending on distribution shrubs and grasses may have become sufficiently established over patches of an acre or less to present a horizontally continuous fuel bed of fine fuels to support the spread of small fires of an acre or so in size. Potential for reburn (Beschta et al, 1995) is low during this period of time.

Fuel model 2 or 5 (*Figure 3.11-2*) would characterize the fuel condition. Fire intensity would be low to moderate with flame lengths of 2 – 4 feet resulting under most weather conditions. Wildfire would be a surface fire with no potential for crowning, and spotting would be minimal. Potential for suppression forces to control this type of wildfire would be high.

Figure 3.11-2. Post-fire Conifer Stand Simulation



10 to 30 Years After Eyerly Fire (2013 – 2043)

Most stands will have experienced rapid increases in surface fuel loading as a high percentage of the standing dead trees fall. Surface fuels loading would increase in most stands to a total of 40 to 70 tons per acre. The graph below displays the likely surface fuel loading development over time. Graph shows averages based on PAG and burn severity.

Figure 3.11-3. Surface Fuel Loading

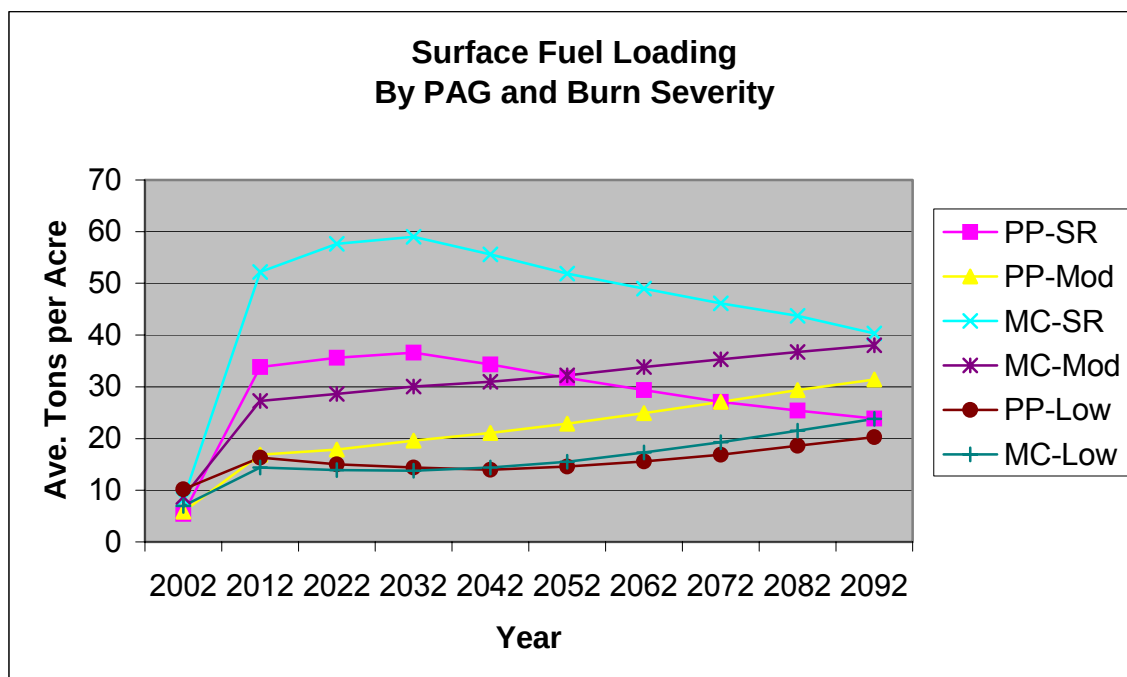


Figure 3.10-3 Modeling Predictions

To project future trends of Coarse Woody Debris (CWD) the Fire and Fuels Extension (FFE) (Beukema and others 2000) to the Forest Vegetation Simulator (FVS) (Stage 1973) was used to simulate the effects of alternative management strategies on future quantities of CWD and small woody fuels. The FVS simulates tree growth, tree mortality and regeneration, and the impacts of a wide range of silvicultural treatments. The FFE simulates additions to fuel pools from stand dynamics and management activities, and the removal of fuels through decay, mechanical treatments, and prescribed or wildfires. Various types of fuels are represented, including canopy fuels and surface fuels by diameter classes. Fire behavior and fire effects such as fuel consumption, tree mortality and smoke production are modeled. Model outputs include fuel characteristics, stand structure, snag density, and potential fire behavior that provide a basis for comparing proposed stand and fuel treatments

The graph (Figure 3.11-3) demonstrates that PP and MC stands with stand replacement burn severity would experience an increase in total surface fuels and reach the maximum amount of surface fuels during the period between years 2030 and 2035. Moderately burned stands (both PP and MC) average a lower amount of surface fuel loading with projections indicating a steady increase over time. Stands with a low burn severity, which basically experienced an underburn, remain at low amounts of surface fuels for some time.

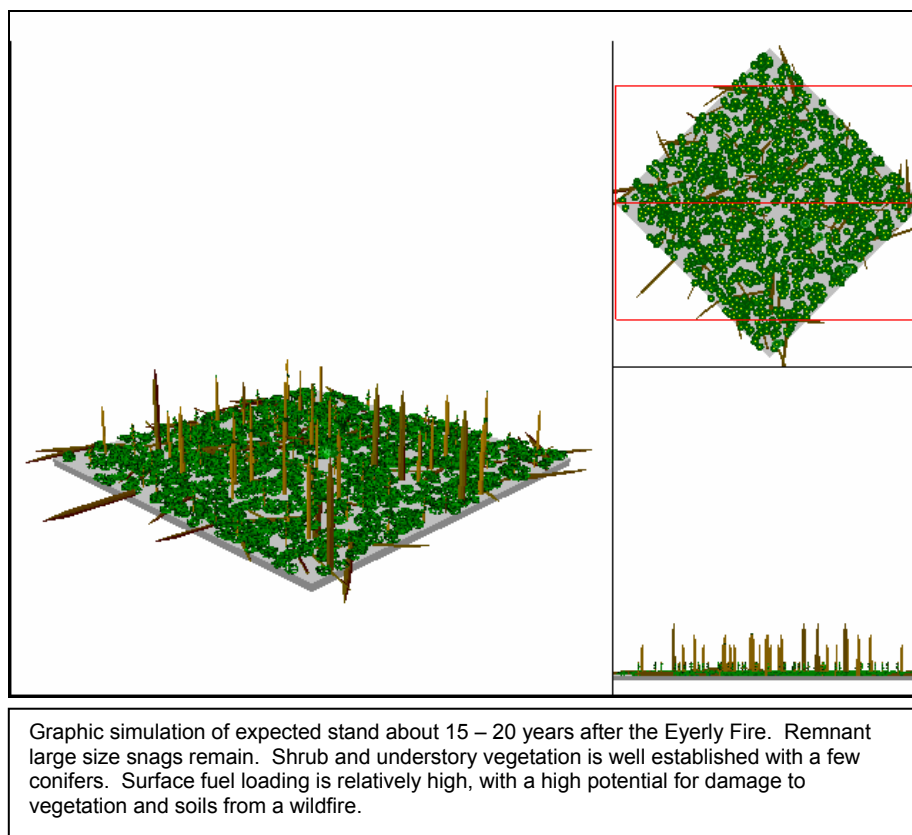
Native grasses and shrubs would be well established, with shrub species dominating the understory. Shrub composition would likely be dominated by snowbrush with manzanita well represented especially on south facing slopes and areas of shallower soils (Volland, 1976).

Some conifer regeneration is expected to be evident during this time period. Density of conifer regeneration would be expected to be low probably less than 50 trees per acre and patchy in distribution. Early seral species lodgepole pine and ponderosa pine would be expected.

Downed CWD would exhibit some decay and support a longer burning period. A duff layer would not be well established and would be unable to either contribute to or protect from soil heating (Brown et al, 2003). High severity fire could be substantial where a large proportion of the soil surface was directly overlain by large woody material (Brown et al, 2003).

Fuel model 6 (shrub: *Figure 3.11-4*) would characterize the fuel condition due to the anticipated dominance of shrubs. A portion of the area would also be characterized as fuel model 12 due to the relatively high level of larger woody fuels. Potential fire behavior increases during this period due to the increased fuel bed depth, fuel loading and arrangement. Potential flame lengths would be in excess of 10 feet under severe conditions and 4 to 6 feet under moderate conditions. Wildfires would tend to be surface fires, however potential for tree torching and crowning would be high depending on the density of continuity of naturally regenerated trees. Potential for spotting would be high due snags, and high potential for lofting firebrands into the air. These fuel conditions would present control problems to suppression forces responding to such a fire primarily due to high fire intensity (>4 ft flame lengths), spread rate (high in fuel model 6) and resistance to control due to high levels of down fuel.

Figure 3.11-4. Shrub and Understory Veg Simulation



30 to 60 Years After Eyerly Fire

Surface fuels, in MC stand replacement burn areas, during this period would be at moderate to high levels generally exceeding 40 tons per acre. Fuel loadings in PP stand replacement areas would average 25 to 35 tons per acre. Trend would be downward as indicated in the graph above. Most of the reduction in the amount of CWD would be due to decay, as material less than 3 inches diameter decays relatively quickly while larger material remains. Fuel loading within both PP and MC, and moderate and low severity burn areas would increase slowly as natural tree mortality, branch and needle die-off continue in these stands to add dead material to the surface. Surface fuel loading within moderately burned areas would tend to average higher amounts as some trees damaged or weakened in the fire eventually die and then fall adding to surface fuels.

As conifer trees develop and produce shade shrub species such as snowbrush and manzanita would begin to decrease (Volland, 1973). Pre-fire data from forest inventory

plots give an indication of the understory plant composition and percent cover under a well-developed forest canopy. The general trend would be toward decreased percent cover as the conifer canopy increases, shrubs would be present but not as dominant as they had been during earlier periods following the fire.

Downed CWD would exhibit considerable decay and support a longer burning period. A duff layer would be establishing to a variable extent depending on overstory conifer development. Burnout of large woody pieces and duff would be assisted by the interaction of these two components (Brown and others 1991).

Total surface fuel loading, within stand replacement severity areas, begins to decrease after 40 to 50 years, primarily due to decomposition. Smaller diameter CWD decays faster than larger pieces and make up a smaller percent of the total amount. The dynamics of movement of biomass through the system is shown below based on projections using FVS and FFE. PP and MC with stand replacement burn severity are shown in the table below.

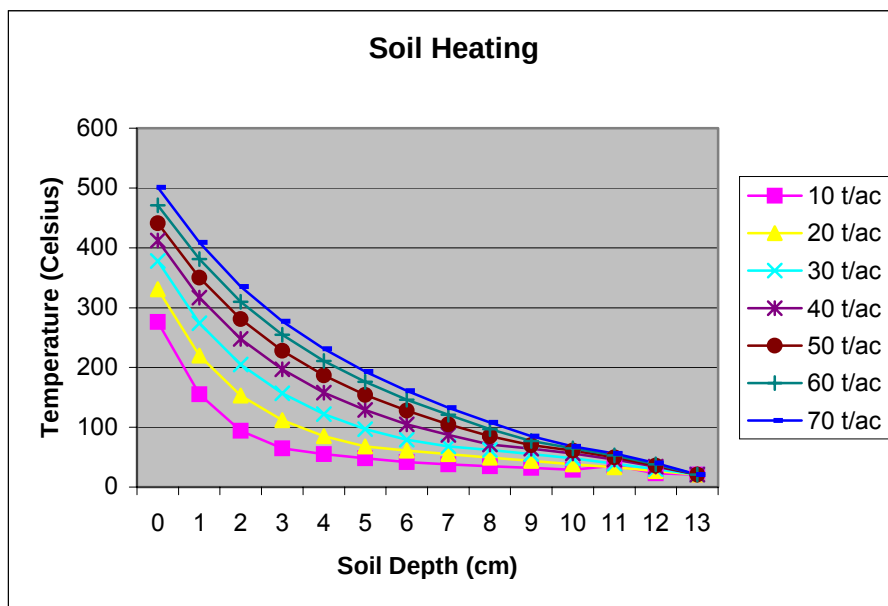
Table 3.11-6. Dynamic Movement of biomass

Year	% of Total Biomass as Surface Fuels <6 inches Diameter (avg %)	% of Total Biomass as Surface Fuels >6 inches Diameter	% of Total Biomass as Surface Fuels	Estimated Total biomass onsite (Range tons per acre))	Comments
2002 (Pre-fire)					Pre-fire conditions are variable reflecting past activity history and stand development, dense and multi-strata forest conditions are prevalent. Total biomass is relatively high with a small percentage as surface fuels.
PP MC	11 10	5 10	16 20	37 – 158 68 - 208	
2002 (Post-Fire)					Total biomass has been reduced by the Eyerly Fire. Average total reduction is about 17 to 30%. Surface fuels percentage increases as dead material falls. Fuels less than 6 inches diameter are proportionately higher due to faster fall rates.
PP MC	2 1	5 5	7 6	42 – 125 86 - 160	
2010					Large increases in percentage of biomass as surface fuels as smaller trees fall. Some decay reduces the overall total biomass.
PP MC	20 19	27 28	49 47	41 – 110 47 - 138	
2035					Total biomass is continues to decrease due to decay. Large (>6 inches diameter) surface fuels dominate, much of the smaller size material has decayed.
PP MC	15 13	50 54	65 67	22 – 86 33 - 106	
2060					This point in time represents the minimum amount of biomass present on stand replacement sites. Reductions due to the fire and decay are high and additions from new growth haven't compensated for the losses. A high percentage of biomass remains surface fuels.
PP MC	11 9	48 53	59 62	21 – 83 36 - 96	
2090					Large increases in total biomass on site due to new growth off-setting losses due to decay. High proportion of surface fuels add complexity to fuel and vegetation profile, increasing hazard of damage to vegetation and soils.
PP MC	9 7	36 38	45 45	35 – 133 56 – 189	
Note: PP-Ponderosa Pine; MC-Mixed Conifer					

Fuel model 6 (shrub: *Figure 3.11-6*) would characterize the fuel condition due to the anticipated dominance of shrubs. A portion of the area would also be characterized as fuel model 12 due to the relatively high level of larger woody fuels. Potential fire behavior increases during this period due to the increased fuel bed depth, fuel loading and arrangement. Potential flame lengths would be in excess of 10 feet under severe conditions and 4 to 6 feet under moderate conditions. Wildfires would tend to be surface fires, however potential for tree torching and crowning would be high depending on the density and continuity of naturally regenerated trees. Potential for spotting would be high due to snags, and high potential for lofting firebrands into the air. These fuel conditions would present control problems to suppression forces responding to such a fire primarily due to high fire intensity (>4 ft flame lengths), spread rate (high in fuel model 6) and resistance to control due to high levels of down fuel.

The potential for soil heating and associated damage to soils is largely influenced by the amount of surface fuels and size and arrangement of such fuels. Soil heating directly kills soil microorganisms or alters the reproductive capacity of some species (DeBano 1991). The effects are short-term when soil heating is low and does not penetrate beyond the uppermost soil layer, such as typically occurs in low severity fires (Harvey et al. 1994). The effects from high severity fires last longer and reach deeper into the soil. *Figure 3.11-5* displays maximum temperature and depth of soil heating based on surface fuel loading.

Figure 3.11-5. Soil Heating



A temperature of 60 degrees (Celsius) or more are lethal for soil organisms (DeBano, 1998). Heating between 220 and 460 degrees (Celsius) combusts soil organic matter and, in doing so, affects soil properties dependent on organic matter. The destruction of organic matter can be beneficial, because it provides large amounts of readily available plant nutrients. However, it has the disadvantage of destroying soil structure, with the extent of damage depending largely on the rate at which organic matter replenishment occurs following fire. It could cause long-term damage in arid environments where organic matter is replenished slowly (DeBano, 1998), such as is the case for Fire Regime I, and to a degree Fire Regime IIIa, areas within the Eyerly Fire area.

Soil heating is a complicated process that depends on the burnout time of duff and woody material, removal of the insulating duff layer, and soil properties (Brown et al, 2003). Excessive soil heating is concentrated beneath large woody fuel pieces particularly in the vicinity of piece intersections.

Effects of Alternatives

Fuels Treatment

Fuels treatment are proposed in Alternatives 2 and 3. Fuels treatment is aimed at reducing fuel loading within units proposed for salvage harvest and small tree utilization.

Table 3.11-7. Proposed Fuels Treatments

Fuels Treatment	Alternative 1	Alternative 2	Alternative 3
Lop and Scatter	0	1877	785
Grapple Pile and Burn	0	2051	1524
Underburn	0	608	405
Hand Pile and Burn	0	310	179
Total	0	4846	2893
Note: specific fuels treatment units are listed in Appendix B, Tables B-3 & B-4.			

Areas Treated with Salvage and Fuels Treatment

Effects on general vegetation succession and fuels development.

0 to 10 Years After Eyerly Fire (2002 – 2012)

Vegetation succession and fuel development during this period would be similar for all alternatives.

During this period small diameter standing dead trees, those less than 3 inches dbh, will fall to the ground, while larger dead trees remain. Natural conifer regeneration would be sparse if any and likely would be a mixture of ponderosa pine, Douglas-fir and grand fir.

Fuel model 2 or 5 would characterize the fuel condition. Fire intensity would be low to moderate with flame lengths of 2 – 4 feet resulting under most weather conditions.

Wildfire would be a surface fire with no potential for crowning, and spotting would be minimal. Potential for suppression forces to control this type of wildfire would be high.

10 to 30 Years After Eyerly Fire (2012 – 2042)

Units treated with salvage and fuels treatment will have reduced surface fuel loading compared to untreated areas. Surface fuels loading would increase on in most stands to a total of 25 to 40 tons per acre. The graph below displays the likely surface fuel loading development over time for several representative stands.

Figure 3.11-6. Alternative 2 Surface Fuel Loading

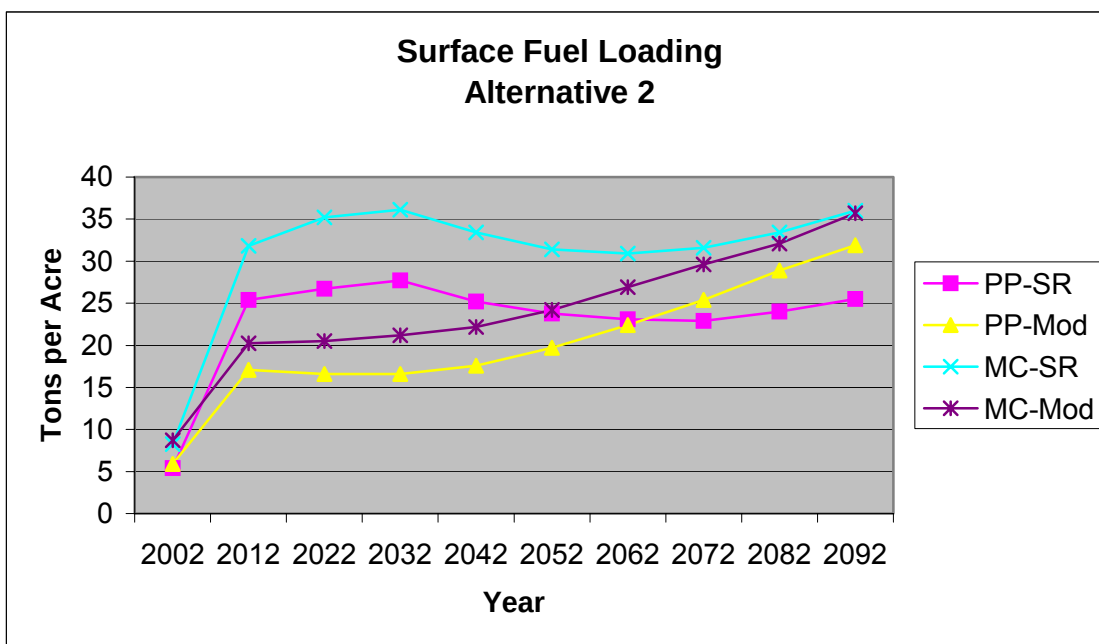
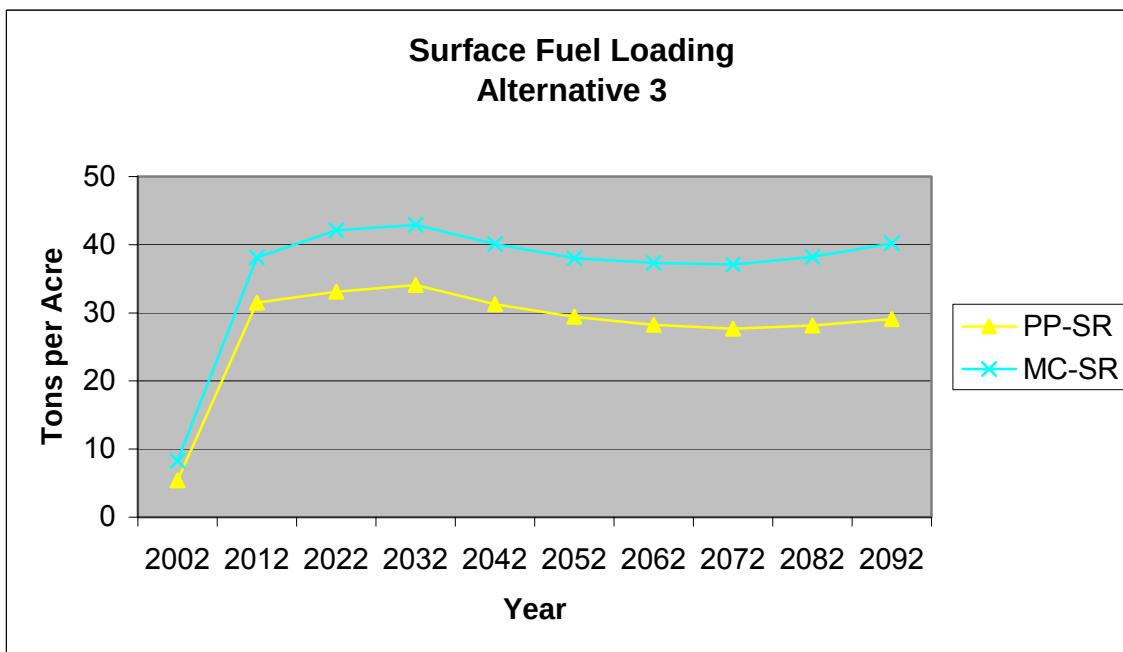


Figure 3.11-7. Alternative 3 Surface Fuel Loading



Figures 3.11-6 and 3.11-7 demonstrate that most treated stands will follow the same general trend and reach the maximum amount of surface fuels during the period between years 2025 and 2035. A few stands with low number of trees per acre at the time of the Eyerly Fire will likely maintain at low level of surface fuels. Under Alternative 3, no treatment is proposed for moderately burned areas. The graph for Alternative 3 only displays the effects of treatment within stand replacement areas.

Native grasses and shrubs would be well established, with shrub species dominating the understory. Shrub composition would likely be dominated by snowbrush with manzanita well represented especially on south facing slopes and areas of shallower soils (Volland, 1976).

Density of conifer planted trees would be expected to be 150 to 200 trees per acre. Early seral species dominated by ponderosa pine would be expected. The diameter and height of planted trees is expected to be greater than naturally regenerated trees because they have occupied the site for a longer period of time.

Downed CWD would exhibit some decay and support a longer burning period. A duff layer would not be well established and would be unable to contribute to soil heating (Brown et al, 2003). High severity fire could be substantial where a large proportion of the soil surface was directly overlain by large woody material (Brown et al, 2003). In areas where salvage and fuel treatments are accomplished a lower percentage of the area by large woody material.

Fuel model 6 (shrub) would characterize the fuel condition due to the anticipated dominance of shrubs. A portion of the area would also be characterized as fuel model 10 due to the relatively high level of larger woody fuels. Potential fire behavior increases during this period due to the increased fuel bed depth, fuel loading and arrangement, less area would support this condition under Alternative than Alternative 3. Potential flame lengths would be in excess of 10 feet under severe conditions and 2 - 4 feet under moderate conditions. Wildfires would tend to be surface fires, potential for tree torching and crowning would be high depending on the density and continuity of regenerated trees. Potential for spotting would be low to moderate due to reduced snag levels, however a higher snag level would result from Alternative 3. Fewer control problems would be experienced by suppression forces responding to wildfires primarily due to lower potential fire intensity 4 ft flame lengths, spread rate (high in fuel model 6) and less resistance to control due to lower levels of down fuel.

Table 3.11-8 displays the effects of the alternatives on average surface fuel loading over time by plant association group and burn severity. Effects on fuel loading are for treated acres.

Table 3.11-8. Predicted Average Surface Fuel Loading Over Time

Year	PP-SR			PP-MOD			MC- SR			MC-MOD		
	Alt. 1	Alt. 2	Alt. 3	Alt. 1	Alt. 2	Alt. 3	Alt. 1	Alt. 2	Alt. 3	Alt. 1	Alt. 2	Alt. 3
2002 (Post-Fire)*	5.42	5.42	5.42	5.9	5.9	5.9	8.26	8.26	8.26	8.7	8.7	8.7
2012	33.8	25.4	31.5	16.9	17.1	16.9	52.2	31.8	38.1	27.3	20.2	27.3
2022	35.6	26.7	33.1	17.9	16.6	17.9	57.6	35.2	42.1	28.6	20.5	28.6
2032	36.6	27.7	34.1	19.6	16.6	19.6	59.0	36.1	42.9	30.0	21.2	30.0
2042	34.3	25.2	31.3	21.1	17.6	21.1	55.6	33.4	40.1	31.0	22.2	31.0
2052	31.7	23.8	29.4	22.9	19.7	22.9	51.9	31.4	38.0	32.2	24.2	32.2
2062	29.4	23.1	28.2	24.9	22.4	24.9	49.0	30.9	37.3	33.8	26.9	33.8
2072	27.1	22.9	27.7	27.1	25.4	27.1	46.1	31.6	37.1	35.3	29.6	35.3
2082	25.4	24.0	28.2	29.4	28.9	29.4	43.7	33.4	38.2	36.7	32.1	36.7
2092	23.9	25.5	29.1	31.4	31.9	31.4	40.3	36.0	40.2	38.0	35.7	38.0

Note: * Display is in intervals of 10 years beginning with 2002, the year the Eyerly Fire occurred.

The fuel loading calculations shown in *Table 3.11-8* are averages however they do display the differences between the alternatives sufficiently to address some of the potential fuels related effects.

For both PP-SR and MC-SR the maximum amount of fuel loading occurs in 2032, for all alternatives. Average reduction compared to Alternative 1, is 8.9 tons per acre for Alternative 2 a reduction of 24% within the PP PAG. For Alternative 3 the average reduction is 2.5 tons per acre, a 7% reduction, within the PP PAG.

Average fuels reduction in 2032 within the MC PAG for Alternative 2 is 22.9 tons per acre, or 38%. Average reduction for Alternative 3 is 16.1 tons per acre, or 27%.

Differences between Alternatives 2 and 3 are attributable to:

- Fewer acres treated in Alternative 3,
- No treatment of moderate burn severity areas in Alternative 3, and
- A higher level of snags is retained on site in Alternative 3.

Acres of salvage and fuels treatment for each alternative is displayed in *Table 3.11-9*.

Table 3.11-9. Fuels Treatment by Salvage Acres

PAG and Burn Severity	Alternative 1	Alternative 2	Alternative 3
PP-SR			
Untreated Acres	13,234	9694	1116
Treated Acres	0	3540	2068
PP-Moderate			
Untreated Acres	1518	1395	1518
Treated Acres	0	123	0
MC-SR			
Untreated Acres	1345	454	520
Treated Acres	0	891	825
MC-Moderate			
Untreated Acres	1448	1125	1448
Treated Acres	0	292	0
Total Treatment Acres	0	4846	2893

Using the year 2032 for comparison, Alternative 2 reduces fuel loading by 24%, on 3,540 acres within the PP PAG areas that burned at a stand replacement severity, and a reduction of 38% on 891 acres within the MC PAG.

Using the same comparison year, Alternative 3 would result in a surface fuel reduction of 7%, on 2,068 acres within the PP PAG areas that burned at stand replacement severity, and a reduction of 27% on 825 acres within the MC PAG.

For moderate burn severity, also referred to as mixed severity stands. The differences between treated and untreated stand are not as pronounced as those with stand replacement severity. The moderate burn severity stands contain live trees.

The dynamics of surface fuel levels are different for the moderate intensity stands, reference the Table: Predicted Average Surface Fuel Loading Over Time. When viewed for a specific time period (Year 2032), the surface fuel loading estimated for both the PP PAG and MC PAG under Alternative 2 is less than for either Alternative 1 or Alternative 3. Only Alternative 2 proposes treatment within moderate burn severity stands. Under Alternative 2 surface fuels are reduced from 19.6 tons per acre (Year 2032) to 16.6 tons per acre for the PP PAG. For the MC PAG surface fuels are reduced from 30 tons per acre to 21.2 tons per acre for treated stands.

Generally there are two categories of surface fuels of interest: fuels less than 3 inches in diameter which influence spread rate and above ground intensity of fire, and fuels greater than 3 inches in diameter (large woody fuels) which have little influence on the spread and intensity of the initiating fire. These large fuels however, can contribute to development of large fires and high fire severity. Fire persistence, resistance to control, and burn out time, which affects soil heating are significantly influenced by loading, size, and decay state of large woody fuel (Brown et al 2001, and 2003).

Desired Fuel Conditions

In Brown 2003, an integration of the various sources of information was done to identify an optimum range of coarse woody debris (CWD) that provides an acceptable risk of fire hazard while providing benefits to soil and wildlife. Figures 3.11-8 and 3.11-9 display the results of this integration.

Figure 3.11-8. Optimum Range of Coarse Woody Debris-Warm Dry

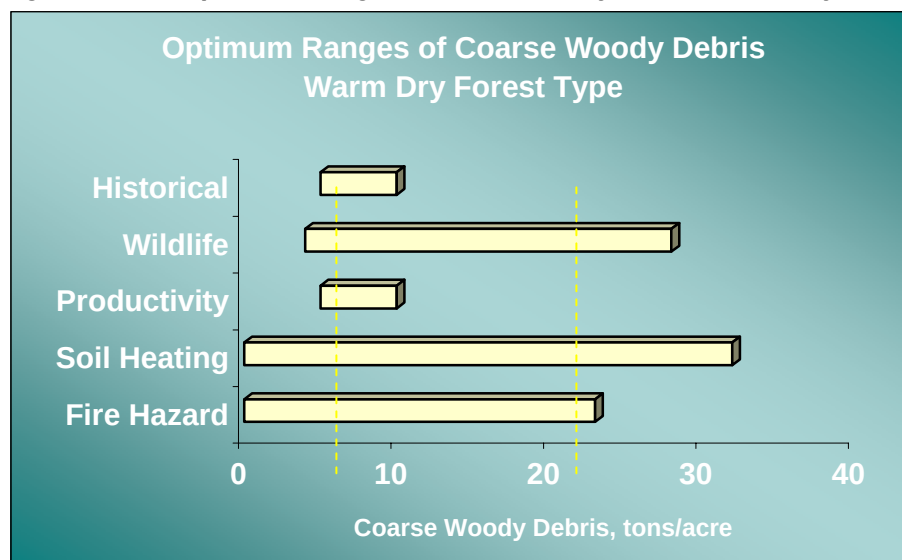


Figure 3.11-8 indicates that an optimum range for CWD in warm dry forest types would be 5 to 20 tons per acre.

Figure 3.11-9. Optimum Range of Coarse Woody Debris-Lower Subalpine

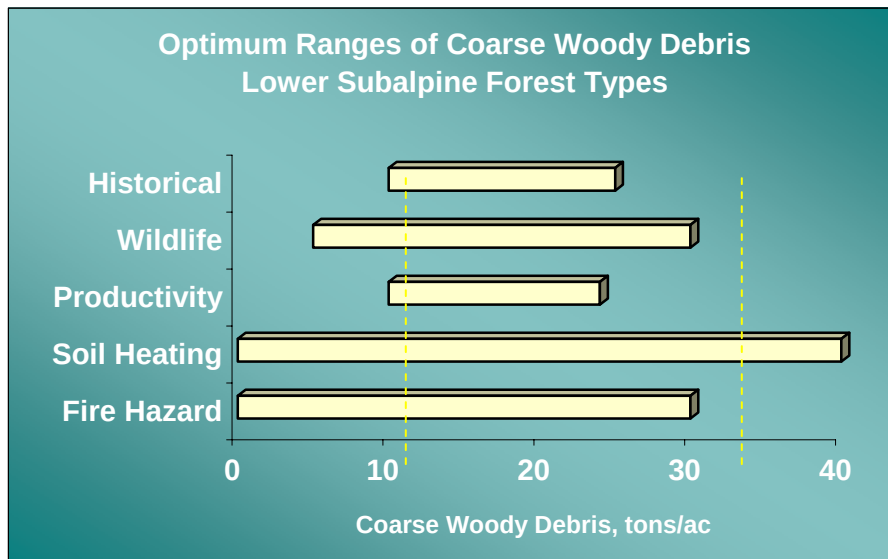


Figure 3.11-9 indicates that an optimum range for CWD in lower subalpine forest types would be 10 to 30 tons per acre.

Table 3.11-10 displays the number of acres by alternative which would have surface fuels conditions within the optimum ranges shown above, at Year 2032.

Table 3.11-10. Acres by Alternative with Future Fuels Loadings within Optimum Ranges

Plant Association Group (PAG)	Alternative 1	Alternative 2	Alternative 3
Ponderosa Pine	1518	5058	1518
Mixed Conifer	1345	2339	1345
Total	2863	7397	2863

There is little difference between Alternatives 1 and 3. Primarily due to the design of Alternative 3 which leaves a higher number of dead standing trees and fewer acres treated compared to Alternative 2. Alternative 2 reduces future fuel loadings to within optimum ranges on 4,534 acres more than either Alternatives 1 or 3.

❖ 3.12 Forest Vegetation and Timber Management_____

❖ 3.12.1 Introduction

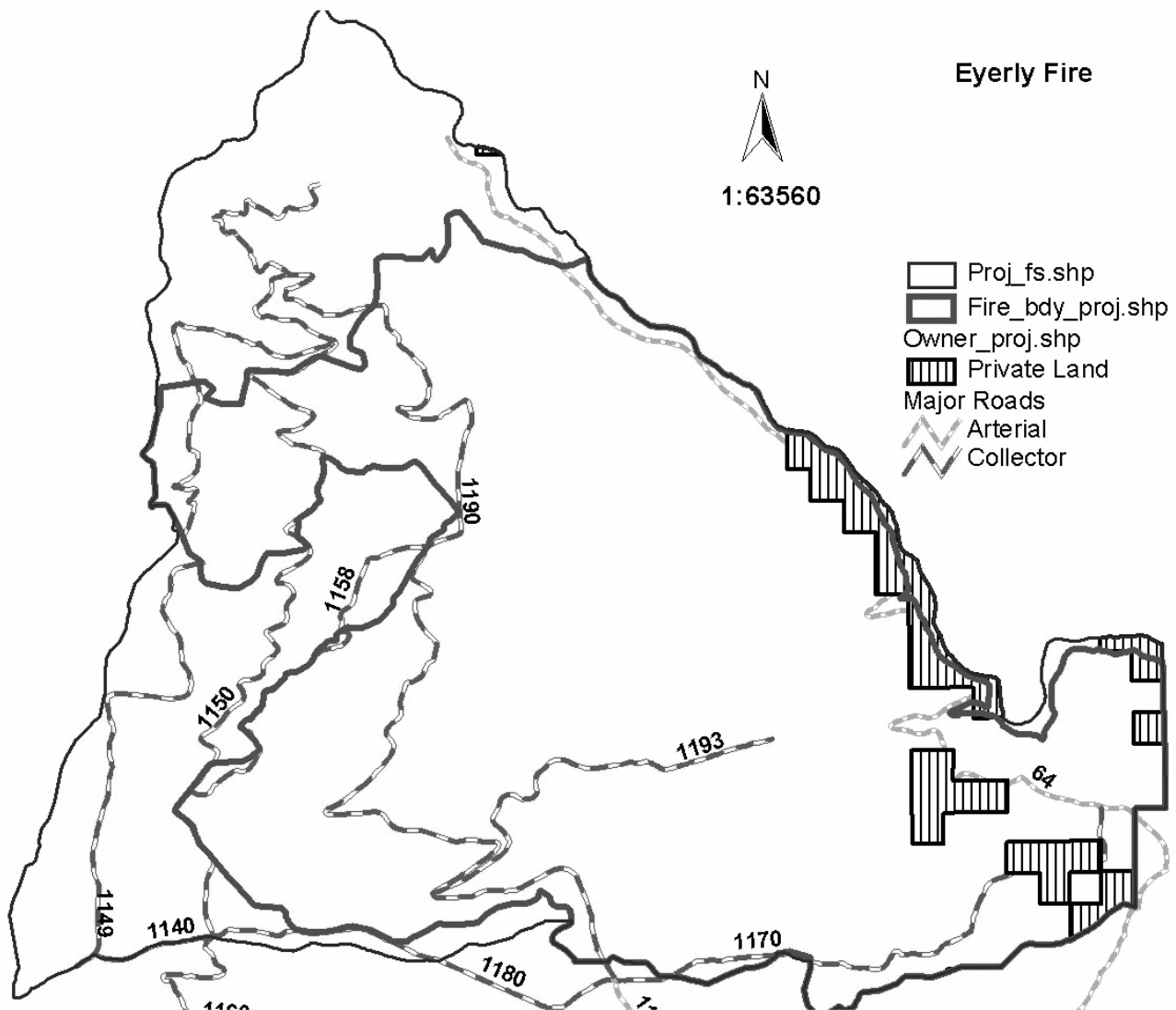
This section describes the existing condition of forest vegetation which was burned in the Eyerly Fire, and the environmental consequences to forest vegetation from proposed salvage, fuels treatment, and reforestation activities. This section is derived from the Eyerly Fire Salvage Project Silviculture Report – Existing Conditions and Effects Analysis. The existing condition segment describes the forest vegetation types affected by the fire and the degree of mortality, as well as management direction to achieve the desired future condition for the landscape. The Environmental Consequences segment of this section describes the effected environment of forest vegetation: these include a discussion of dying and healthy green trees; the effects of no action (insect infestation, restoring forest cover); and an explanation and discussion of effects specific to salvage harvest operations

❖ 3.12.2 Existing Condition

Forest Types Affected by the Fire

The Eyerly Fire affected a wide range of forest types. Elevations range from about 2000 feet along the Metolius River and Lake Billy Chinook, to 4800 feet in the NW corner of the fire on Green Ridge. The Ponderosa Pine Dry (PPD) plant association group (PAG) is found at elevations generally below 3200 feet, extending up to 3800 feet on south-facing slopes and ridges. The Ponderosa Pine Wet (PPW) plant association group (PAG) occurs at elevations generally above 3200 feet, with occurrences up to 4800 feet on steeper south-facing slopes. The Mixed Conifer Dry (MCD) PAG occurs from about 3100 feet on north-facing slopes to about 4500 feet on south-facing slopes, and the Mixed Conifer Wet PAG occurs from about 3500 feet on north-facing slopes to 4800 feet on flats and all aspects.

The lower elevation forest type (PPD/PPW), where stand replacement fire occurred almost exclusively, consisted of early seral larger (16-32 in.) ponderosa pine with an understory of pine and Douglas-fir ranging from 1-16 in. On north slopes, Douglas-fir was often co-dominant with the pine. Incense cedar was a minor component of the overstory, but was increasing in the understory due to fire exclusion. The fire regime here was historically of the frequent low severity type- fires occurred every 1 to 35 years, averaging 7-15 years.

Figure 3.12-1. Eyerly Fire Perimeter and Eyerly Project Area

The mid-elevation forest type (MCD) also consisted of larger early seral species in the overstory. Ponderosa pine is/was the major component of the overstory; Douglas-fir and western larch are/were minor components. The understory is/was composed of mainly white fir with some Douglas-fir and incense-cedar. The fire regime here historically, based on the preponderance of ponderosa pine in the overstory, was probably very similar to the lower elevation type (PPD/PPW).

The higher elevation forest type (MCW) differs from the mid-elevation type mainly in that there is/was a higher proportion of Douglas-fir, and in some cases, white fir in the overstory. The fire regime here was likely a 35 to 100 year frequency, with mixed severity effects to the stand. Evidence of fires in the early part of the 20th century are found nearby and within the Eyerly Fire perimeter, and these fires likely replaced stands over areas of 100 to 200 acres.

Along with these basic forest types, plant habitat is also provided by the courses of intermittent and permanent streams (riparian zones), seeps and springs, seasonally moist and dry meadows, forest fringes, scablands and large rock outcrops.

Effects from the Fire

The Eyerly Fire burned 17,786 acres of Forest Service lands. The estimated timber resource killed in the fire was approximately 108 million board feet on about 8,300 acres of stand replacement burn (greater than 75% dead by basal area) on suitable acres. Additional timber was killed on unsuitable areas and in the mixed severity and non-lethal burns- no estimate was made of the timber resources lost in these areas.

Stand Burn Intensity

Stands were placed into three post-fire mortality classes. *Figure 3.12-2* shows the distribution of these classes over the fire landscape. *Figure 3.12-3* provides a representation of the acres and percentages of the classes by plant association groups PAG. In general, stand replacement fire occurred on about two-thirds of the area in the pine and riparian PAG's, and on about one-third of the area of the mixed conifer PAG's.

Stand replacement acres are found throughout all plant association groups (PAG), but are heavily concentrated in the middle and lower elevation Ponderosa Pine Dry/Wet PAG's. In these PAG's, 56 to 86 percent of the acres experienced stand replacement fire. The fire advanced through these types very rapidly, incurring 75 to 100 percent stand mortality as a result of crown consumption and/or scorch. Litter and duff consumption was close to 100 percent throughout, while large down wood and stumps were completely consumed. Though not shown in Table 1, the Riparian PAG experienced stand replacement fire on 68 percent of the acres. In the mixed conifer PAG's, about one-third of the acres experienced stand replacement fire.

The mixed severity stands are primarily located in the Mixed Conifer Dry/Wet PAG. Lower fire intensity through these areas reduced the amount of crown scorch and produced a mortality range of 25 to 75 percent with needles remaining on many fire killed overstory trees. Generally, most of the understory trees were killed in these stands. Litter and duff consumption was slightly lower than in the stand replacement areas, but generally ranged from 70 to 100 percent. Large down wood and stump consumption was variable in these stands, with moderate charring of those that were not entirely consumed.

The non-lethal severity stands are also primarily located within the Mixed Conifer Dry/Wet PAG. The fire effectively underburned through these stands, killing less than 25 percent of the basal area, with minor crown and bole scorch on surviving trees, and variable consumption of litter and duff on the soil surface. Generally, 25 to 50 percent of the understory trees were killed in these stands. Down wood and stump consumption was highly variable, ranging from minor to almost total.

Figure 3.12-2. Eyerly Fire Stand Burn Severity

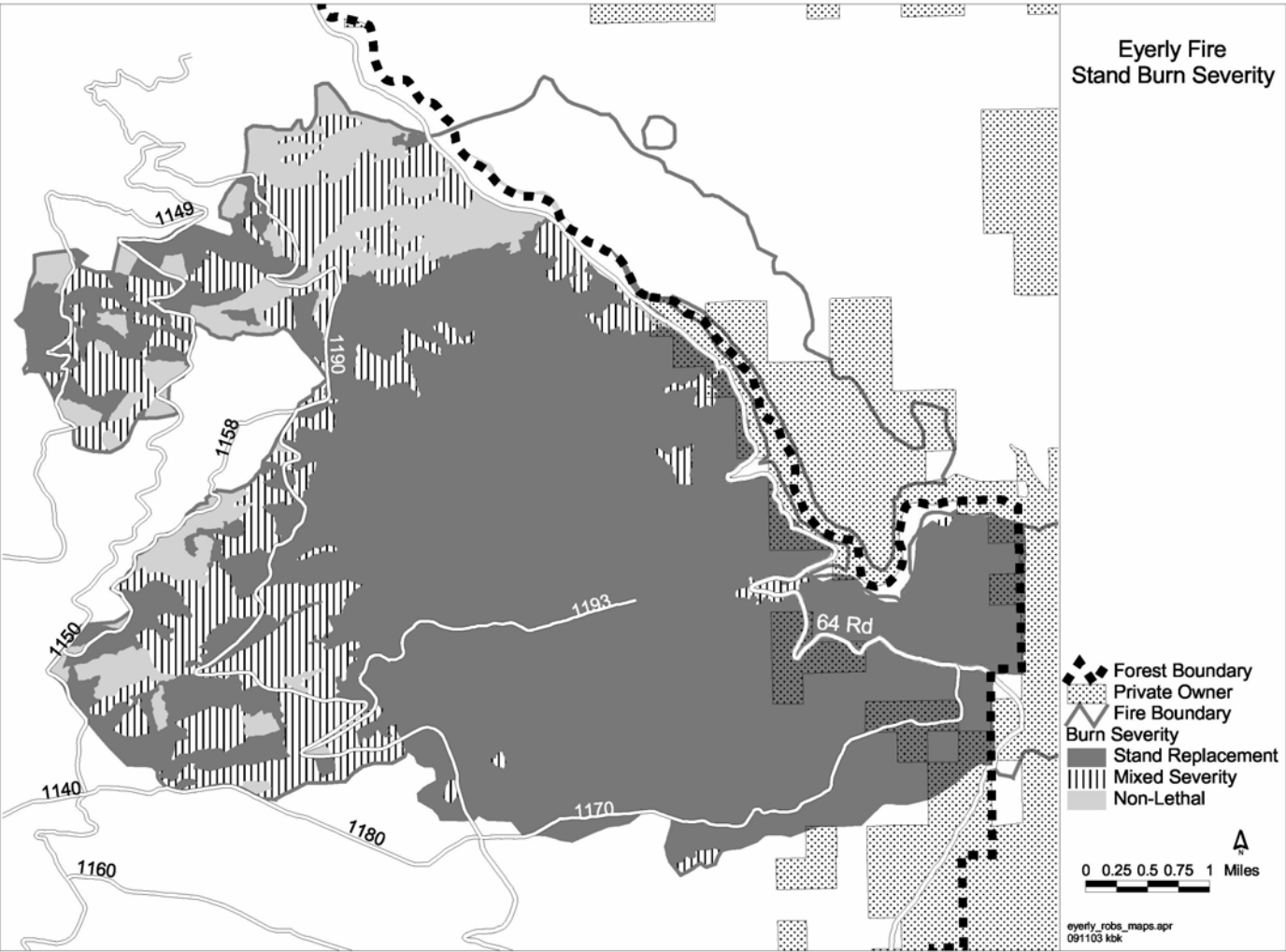
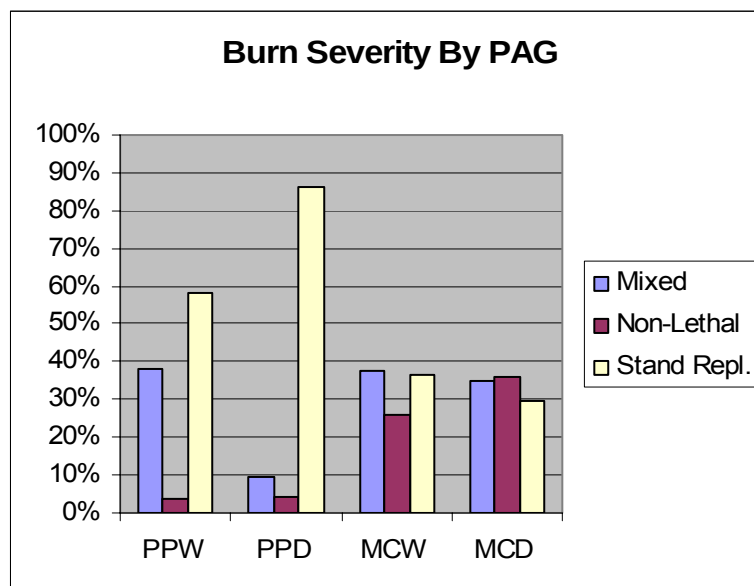


Figure 3.12-3. Degree of Burn Severity by Plant Association Group (PAG)

Stand Mortality and Timber Resources Affected by Fire

Table 3.12-1 displays the estimated loss of timber resources from the fire. Acres of stand replacement fire outside of plantations and unsuitable areas were grouped by plant association, and an average volume assigned to each plant association group. This average volume was derived from representative stand exams done within this area, and adjusted by field reconnaissance.

Table 3.12-1. Estimated Timber Resources Lost in Eyerly Fire

Estimate of Total Volume Killed in Stand Replacement Fire (Does not Include Plantations or Unsuitable Acres)			
Plant Assoc. Group	Acres Stand Repl.	MBF per Acre	TOTAL MBF
Ponderosa Pine Dry	6479	10	64790
Ponderosa Pine Wet	416	12.5	5200
Mixed Conifer Dry	359	25	8975
Mixed Conifer Wet	870	27.5	23295
Riparian	187	27.5	5142.5
TOTALS	8311		108,032.5

Post-Fire Stand Structure and Seral Stages by Plant Association Group

Plant Association Groups: Approximately 75 percent of the area burned by the Eyerly Fire lies within ponderosa pine plant associations, 20 percent within mixed conifer plant associations, and 5 percent within miscellaneous plant associations. *Table 3.12-2* displays the breakdown of plant associations groups (PAG) within the National Forest boundary of lands affected by the fire.

Table 3.12-2. Acres by Plant Association Group (PAG)

PAG	Acres	Percent
No Data	6	0.0%
Juniper	77	0.4%
Mixed Conifer Dry	1321	7.1%
Mixed Conifer Wet	2628	14.1%
Meadow	37	0.2%
Ponderosa Pine Dry	13191	70.6%
Ponderosa Pine Wet	886	4.7%
Riparian	350	1.9%
Rock	55	0.3%
Water	27	0.1%
Xeric Shrubland	94	0.5%
Totals	18672*	100.0%
Note: *includes 886 acres of private land within NF boundary		

Post-Fire Seral-Structural Stages by Plant Association Group: Post-fire seral-structural stages for the main PAG's are given in *Table 3.12-3* through *Table 3.12-6*. The definitions of these stages are found in *Appendix A Abbreviations and Terms*. A measure of the fire's effects on stand structure and species composition can be found in the percentages of grass/forb and seedlings. The pine PAG is now almost 90 percent grass/forb/seedling, the riparian is almost 70 percent grass/forb/seedling, the mixed conifer dry is almost 45 percent grass/forb/seedling, and the mixed conifer wet is about 50 percent grass/forb/seedling. These numbers also underscore the importance of the remaining older stand-types in terms of wildlife habitat, shade, seed source, etc.

Table 3.12-3. Post-Fire Seral-Structural Stages in Ponderosa Pine PAG

Size Class	Early Seral	Mid-Seral	Late Seral	Total
Grass/Forb	84.9%	0.0%	0.0%	84.9%
Seedlings	2.5%	0.2%	0.0%	2.7%
5-9 in.	2.5%	2.1%	0.0%	4.6%
9-21 in.	4.5%	3.1%	0.0%	7.6%
21 in.+	0.2%	0.0%	0.0%	0.2%
Total	94.7%	5.3%	0.0%	100.0%

Table 3.12-4. Post-Fire Seral-Structural Stages in Mixed Conifer Dry PAG

Size Class	Early Seral	Mid-Seral	Late Seral	Total
Grass/Forb	29.5%	0.0%	0.0%	29.5%
Seedlings	14.3%	0.0%	0.0%	14.3%
5-9 in.	7.3%	7.0%	0.0%	14.3%
9-21 in.	23.7%	16.6%	0.0%	40.3%
21 in.+	1.6%	0.0%	0.0%	1.6%
Total	76.4%	23.6%	0.0%	100.0%

Table 3.12-5. Post-Fire Seral-Structural Stages in Mixed Conifer Wet PAG

Size Class	Early Seral	Mid-Seral	Late Seral	Total
Grass/Forb	36.4%	0.0%	0.0%	36.4%
Seedlings	23.9%	0.5%	0.0%	24.4%
5-9 in.	5.6%	0.6%	0.0%	6.2%
9-21 in.	16.5%	15.1%	0.0%	31.6%
21 in.+	1.4%	0.0%	0.0%	1.4%
Total	83.8%	16.2%	0.0%	100.0%

Table 3.12-6. Post-Fire Seral-Structural Stages in Riparian

Size Class	Early Seral	Mid-Seral	Late Seral	Total
Grass/Forb	67.0%	0.0%	0.0%	67.0%
Seedlings	0.6%	0.8%	0.0%	1.4%
5-9 in.	2.6%	4.9%	0.0%	7.5%
9-21 in.	7.7%	16.4%	0.0%	24.1%
21 in.+	0.0%	0.0%	0.0%	0.0%
Total	77.9%	22.1%	0.0%	100.0%

Changes in Canopy Cover and Layers in Mixed Severity and Non-Lethal Burn Conditions: In areas that experienced underburning or mixed severity burning the canopy cover was also reduced below 30 percent (eastside dispersal habitat for spotted owls), and the number of canopy layers reduced to 1 or 2. Within the fire perimeter, only about 900 acres still were found to have at least 30 percent canopy cover. Smaller understory trees generally suffered between 25 and 100 percent mortality in these stands, due to the hot burning conditions. All spotted owl NRF habitat was eliminated by the fire, because understory and mid-story trees, as well as some overstory trees, were killed by the fire.

Post-Fire Dead and Live Tree Numbers and Distribution

Figure 3.12-4 shows the post fire distribution and average numbers per acre of dead trees 21 in.+, a key component of post fire wildlife habitat. Not surprisingly, the areas with higher numbers are tend to be located in the mixed conifer PAG's.

Figure 3.12-4. Post-Fire Average Dead Trees per Acre 21 in.+

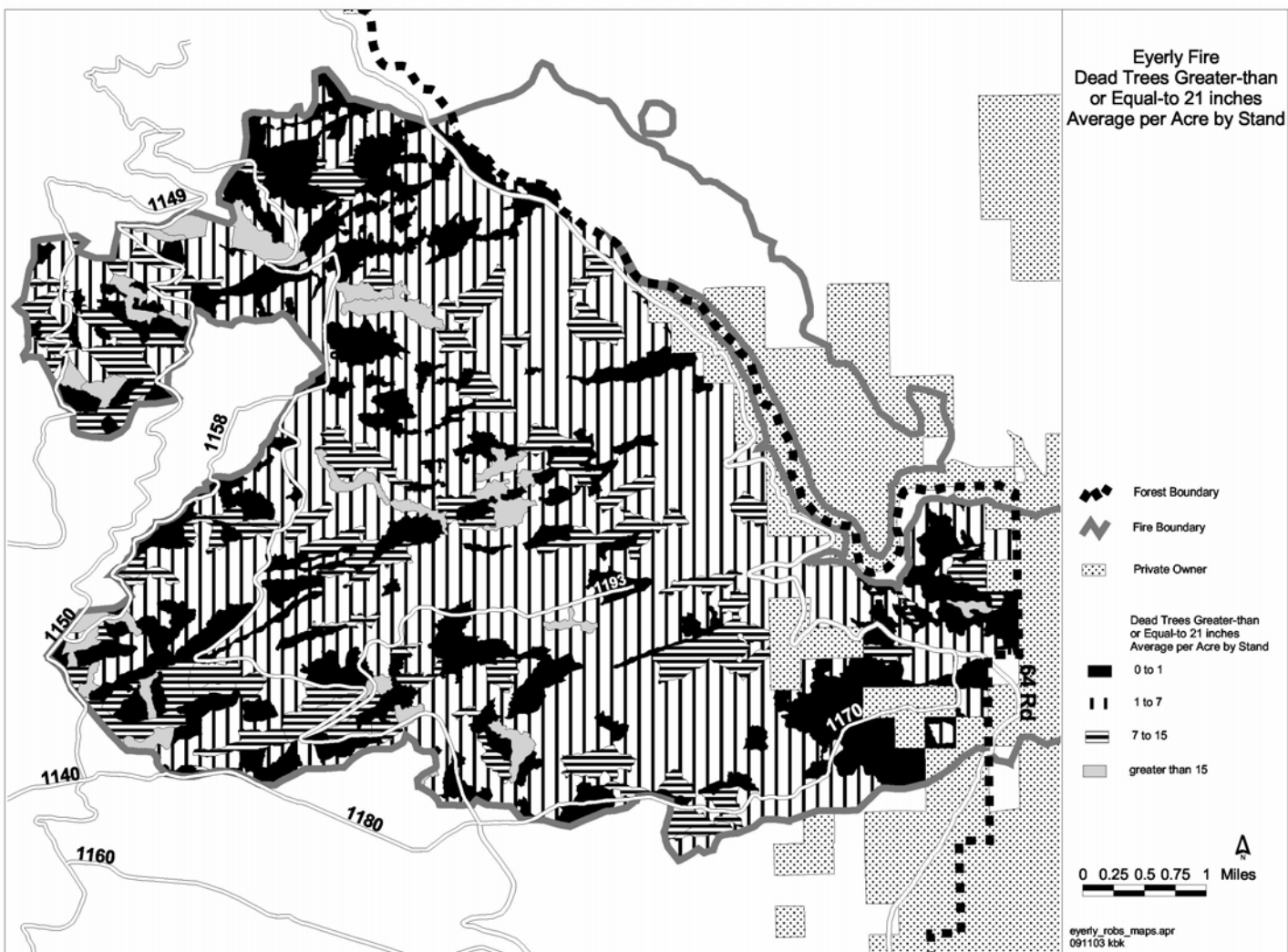


Table 3.12-7 displays the live and dead trees per acre post-fire averaged by subwatershed and PAG in several diameter groupings. These diameter classes represent close approximations of categories used for management of snags and green tree replacements (GTR's). Non-forest and private land were removed from this analysis. For further explanation of these numbers, and the process used in the analysis, refer to the Eyerly Fire Salvage Project Silviculture Report, located in the Eyerly Fire Salvage file on the Sisters Ranger District.

Table 3.12-7: Post-Fire Average Live and Dead Trees per Acre by Subwatershed

SWS	PAG*	SWS Acres	Live 9-16"	Dead 9-16"	Live 16-21"	Dead 16-21"	Live >21"	Dead >21"	Total Live > or = 9"	Total Dead > or = 9"
Lower Fly Creek	PPD	568	0.7	14.1	0.2	3.5	0.1	3.2	1.0	20.8
Lower LBC Metolius	PPD	582	0.3	14.2	0.0	3.4	0.1	3.0	0.5	20.6
Metolius	RIP	90	34.0	44.5	6.7	7.2	2.4	3.8	43.1	55.5
Metolius	PPW	465	5.3	24.9	1.1	5.4	0.6	6.6	7.0	37.0
Metolius	PPD	2983	10.4	32.5	2.3	6.7	1.2	3.2	14.0	42.4
Metolius	MCW	1039	21.9	29.0	4.0	6.0	2.5	3.4	28.3	38.4
Metolius	MCD	525	42.1	26.6	6.1	3.7	4.3	2.1	52.5	32.4
Metolius Horn	MCW	159	3.3	34.4	1.5	9.4	1.1	5.6	5.8	49.3
Spring Creek	RIP	58	4.2	64.0	0.9	8.7	0.1	3.2	5.2	75.9
Spring Creek	PPW	69	5.0	10.7	1.3	3.7	1.2	3.6	7.4	17.9
Spring Creek	PPD	5134	1.4	25.1	0.4	5.6	0.3	2.9	2.1	33.7
Spring Creek	MCW	375	8.7	27.1	1.9	4.8	1.8	4.7	12.4	36.6
Spring Creek	MCD	105	12.1	25.2	3.5	6.4	2.8	5.7	18.4	37.3
Street	RIP	186	6.4	53.6	3.3	14.9	0.8	5.3	10.5	73.9
Street	PPW	352	6.7	25.6	2.8	8.7	1.7	3.2	11.2	37.6
Street	PPD	2299	1.5	24.0	0.4	6.0	0.3	4.1	2.2	34.1
Street	MCW	1054	9.8	23.3	2.5	5.4	2.4	5.3	14.6	33.9
Street	MCD	663	10.1	24.2	2.3	5.2	2.2	4.6	14.7	34.0

Notes:
 * Plant Association Group (PAG): MCD – Mixed Conifer Dry; MCW – Mixed Conifer Wet; PPD – ponderosa pine dry; PPW – ponderosa pine wet; RIP - Riparian

❖ 3.12.3 Forest Vegetation Environmental Consequences

Effects Common to All Alternatives

Dying and Healthy Green Trees

Field marking of about 1100 acres of the proposed salvage has shown the majority of dying trees (especially the larger diameter trees) will be left in order to meet the guidelines for wildlife tree retention found in *Section 2.8.3* on pg. 40 of this document. These heavily damaged trees will serve as “green tree replacements” for existing snags once those snags fall over. This retention is in addition to the approximately 10,000 acres of stands that experienced stand replacement and mixed severity burning that will have no removal of dying trees.

Healthy green trees will be left within harvest units, even those with evidence of fire damage. Trees with low-moderate crown and bole scorch, trees with healthy live crowns at least 20 percent of the total height of the tree, and trees with little or no evidence of bark beetles, are the types of trees that are considered to be healthy and that are expected to survive for an extended period. These trees will provide genetic diversity, through their seed, to the regenerating stands. Some incidental cutting of healthy green trees may occur in order to facilitate the use of cables to move logs in units calling for skyline or cable logging systems.

Effects of Alternative 1 - No Action

Timber harvest would not occur if this alternative is implemented. The forested portion of the analysis area would remain as described under the *Forest Vegetation Existing Condition* section. Most areas would carry an unusual amount of fuel loadings into the next several decades.

Insect Infestation

Within moderate and low intensity burn areas, trees that were damaged (but not killed) by the fire would provide brood habitat for wood boring insects and bark beetles through the introduction of various fungi into the wood that they infest. The density of dead and damaged trees that would be left under Alternative 1 would result in decay of wood and provide a food source for future insect infestation. Please see the *Insect and Decay* section, 3.12, for additional analysis data.

Restoring Forest Cover

No tree planting would be done under Alternative 1. Without disturbances in a passive management scenario, it could take eighty (80) years for a conifer stands to grow to an average diameter of 10" dbh, however lack of seed source is a major concern for the Eyerly area and there would likely be large areas with no trees without tree planting.

The most critical factor in establishment of new forested stands through natural regeneration in stand-replacement burns will be the available seed source. In these areas regeneration could occur from seed from adjacent stands, seed from the surviving large trees, and/or dissemination by other means such as wind. Ponderosa pine seed is not easily disseminated over a large area due to its large size and heavy weight. Douglas-fir seed is lighter and disperses better from adjacent stands. In general, in the stand replacement burn areas, without an available seed source within 600 feet, or without planting, stand establishment and growth to a stand containing 5 to 9 in. trees is expected to take 80 years or longer. With planting, this would generally occur in 25 – 50 years.

Effects on Funding: Funding for planting and associated activities comes from two sources: appropriations from Congress and KV collections from timber sale receipts. In recent years, one budget item (TSI) has been used to fund thinning of small trees and reforestation outside of timber sales- there is essentially a direct trade-off between thinning and planting, i.e. if more planting is funded with this budget item, then less thinning will be funded. Given the large fire seasons of 2002/2003 (Eyerly Fire, Cache Mt. Fire, Link Fire, B and B Complex, Biscuit Fire, etc.), using only appropriated funds for reforestation could lead to a substantial reduction in funds available for fire-prevention thinning. KV funds collected from salvage sale receipts (following the implementation of either action alternative) would provide an additional source of needed funds for planting and reforestation activities.

Effects Common to Alternatives 2 and 3

Recovery of Economic Value

Units proposed for salvage harvest under either action alternative have measurable economic recovery potential due to the volume of timber. The action alternatives provide for the recovery of economic value in the harvesting of Special Forest Products (e.g. posts, poles, firewood, and house logs) but on a limited scale as compared to the volume of salvage harvest units.

A detailed discussion of the impacts related to recovery of economic value is contained in *section 3.9.3 Economic and Social Analysis Environmental Consequences*.

Restoring Forest Cover

All areas salvaged within the stand replacement fire severity would be reforested using a combination of KV collections from salvage sale receipts and appropriated monies.

Alternative 2 would reforest 3918 acres under the 5-year NFMA reforestation requirements at a cost of approximately \$1.6 million (\$406 per acre) for seedlings, planting, and overhead.

Alternative 3 would reforest 2532 acres under the 5-year NFMA reforestation requirements at a cost of approximately \$1 million (\$406 per acre) for seedlings, planting, and overhead.

Alternative 2 of this project would initiate reforestation on up to approximately 4,400 acres of salvage in stand replacement conditions. The remainder, about 7000 acres of stand replacement outside of existing plantations, would be left to regenerate naturally and would proceed through a longer period as grass/forb/shrub and eventually seedlings/saplings.

Alternative 3 would initiate reforestation on about 2,500 acres in stand replacement conditions. The remainder, about 10,000 of stand replacement outside of existing plantations would be left to regenerate naturally.

While fire is unquestionably a natural process in the forests at Eyerly, the type of fire that this area experienced was outside of the historic range of variability, and a seed source for natural regeneration is lacking in many areas. Because of this lack of seed source, and because of competition from the shrub communities found in this area, regeneration of forest cover would be a slow process (perhaps 60-100 years) over much of the area.

The objectives of conifer planting are to more quickly establish tree cover for species needing it, i.e. goshawks, spotted owls, and deer and elk, on about 4400 acres of the fire area. This would involve planting at a wide spacing (12 by 12 feet, or about 300 trees per acre) and using big game repellents as necessary. These sites are estimated to be about 80 percent plantable, so the actual number of trees planted would be about 240-250 per acre. Control of gophers is not expected to be necessary. Much of the Eyerly area is characterized as harsh sites with droughty soils and seedling survival is estimated to be relatively low at 50 – 60%. It is expected that planting at this density would eliminate the need for precommercial thinning, and leave about 100-150 trees per acre averaging around 14 in. diameter at age 80.

Alternative 2 proposes about 1,436 acres of reforestation treatments in LSR with a diversity of species including ponderosa pine, Douglas-fir, western larch, and sugar pine. Reforestation includes site preparation in the form of scalping sufficient to clear duff and litter from the planting site, about 12" by 12". Alternative 3 proposes about 1,050 acres of reforestation treatments within LSR.

The goal of reforestation treatments within LSR's is to hasten restoration of late successional forest habitat. A goal that is integrated with reforestation strategies is restoration of low intensity fire regimes. Restoration of low intensity fire regimes would help protect existing late successional forest habitat from high intensity stand replacement fires. Reforestation should not impede restoration of low intensity fire regimes, because protection of existing late successional forest habitat is more important than its restoration.

Balancing these two restoration goals, restoration of late successional forest and restoration of low intensity fires, could be accomplished through integration of both goals into treatment prescriptions and the appropriate timing of both reforestation and future prescribed burning activities. Plantations may be protected from or included in prescribed burning areas, dependant upon burning conditions and stand conditions.

Traditional reforestation practices, utilizing "tight" tree spacing and "weeding of non-crop trees," which are typical timber management objectives, are not appropriate for LSR's within the recovery area. The goal of traditional reforestation practices is to optimize conifer site-dominance and growth, while the goal of reforestation in LSR's is "beneficial to the creation of late-successional forest conditions." Traditional reforestation and other timber management practices are based on the assumption that fire exclusion would be successful - forever, and after the Eyerly Fire, it is clear that fire exclusion was not successful and will not be successful through time, especially in this large, and summer-dry area. Reforestation practices in LSR should minimize potential conflicts with natural fire processes and only help facilitate the establishment, survival, and growth of approximately 10-15 large (> 25" dbh) over-story conifer trees per acre.

For a conifer seedling to become a late-successional-sized tree (>25" dbh), the seedling would first have to become established, then grow and survive both extended competition and periodic wildland fires until it is large enough to have some physiological resistance to fire, such as thick bark. A commonly used model (Forest Vegetation Simulator) predicts adequate physiological resistance for fifty percent of Douglas-firs to survive low intensity fires when 6" dbh (8" dbh for ponderosa pine). Local experience would support what the models predict in regenerated stands.

The pattern of the burn area in the Eyerly Fire has resulted in few or no conifer seed sources available over large areas. Given this scenario, it is difficult to predict the amount of time that would pass before late successional or old growth forest habitat could develop with a passive management approach. One thing that is certain: if conifers are not present, either from natural seeding or planting, late successional or old growth forest habitat would be delayed for at least one century, or longer. Factors such as global climate change, and local cycles in wet and dry periods also weigh in as a consideration for establishment of a new forest.

The restoration rate of late successional forest habitat can be increased with planting and competition reduction treatments. Without disturbances in a passive management scenario, it could take eighty (80) years for a conifer to grow to 10" dbh. However lack of a seed source is a major concern for the Eyerly Fire area and there would likely be large areas with no trees without tree planting. With reforestation and active management such as low intensity prescribed fire, tree sizes are estimated to range up to 16" dbh in the same

timeframe, and the primary species composition would be ponderosa pine and Douglas-fir. ***It is estimated that a 25" tree would be available in 125 - 150 years with intermediate treatments such as thinning and prescribed burning.***

Planting densities and patterns should reflect potential natural regeneration and mortality expected over time. Spacing between planted trees could average 15 feet (193 trees per acre) depending on available protected micro-sites. Table 3.12-8 displays stand conditions for mixed conifer and ponderosa pine plant association groups at an estimated age of 60 years (Metolius LSRA, 1996). These represent sustainable conditions for short-interval fire return regimes.

Table 3.12-8. Estimated Stand Condition in 60 years

Plant Association Group	Estimated Size (average diameter, inches)	Trees Per Acre
Mixed Conifer	10	150 - 177
Ponderosa Pine	10	92 - 145

Planting would restore or increase certain species to areas where they were extirpated or their abundance severely reduced by exotic pathogens or the result of fire exclusion. Disease resistant sugar pine are proposed where they historically occurred, as well as ponderosa pine, western larch, and Douglas-fir. Other species such as incense cedar and true firs that were historically present in less abundance due to periodic low intensity fires would naturally regenerate over time and increase the species diversity.

Reforestation activities would benefit creation of late-successional forest conditions because they will hasten restoration of the appropriate amount of large conifer trees important for long term objectives while recognizing low intensity fire is integral to the healthy functioning of late successional forest habitat in the area. Reforestation would occur where natural regeneration could take decades to establish young conifers.

Changes in Dead Tree Numbers

The effects of dead trees per acre (snag numbers) on wildlife species depend on the species under consideration and its requirements, and the ability of species to exploit this transient habitat type. 3.5.2.1 Snags/ Cavity Excavators/ Down Woody Material Alternatives and The Eyerly Wildlife Report contain detailed discussions of these effects.

In order to evaluate the effects of the Eyerly Fire of 2002 on snag numbers, and the effects of proposed salvage alternatives on these numbers, a method of modeling was developed that used a District-wide photo-interpretation database, stand exams where available, burn severity from a post-fire Landsat change detection, and snag numbers from District-wide CVS inventory plots.

A summary of snag and green tree modeling is provided to display the effects each alternative would have “on the ground.” The complete derivation of these numbers, including data sources and methods, is contained in the Eyerly Fire Salvage Silviculture Report.

Tables 3.12-9, 3.12-10, and 3.12-11 show the expected changes in dead tree numbers as a result of salvage by the primary PAG's within the fire perimeter (including treated and non-treated acres).

Table 3.12-9. Changes in Average Dead Trees per acre 21 in.+ by PAG

PAG*	Existing Cond.	Alt. 2	% Change Alt. 2	Alt. 3	% Change Alt. 3
PPD	3.2	2.6	19%	2.9	9%
PPW	5.1	3.5	31%	3.7	27%
MCD	3.7	2.7	27%	3.1	16%
MCW	4.5	3.9	13%	4.0	11%
Notes: * Plant Association Group (PAG): MCD – Mixed Conifer Dry; MCW – Mixed Conifer Wet; PPD – ponderosa pine dry; PPW – ponderosa pine wet					

Table 3.12-10. Changes in Average Dead Trees per acre 16 to 21 in. by PAG

PAG*	Existing Cond.	Alt. 2	% Change Alt. 2	Alt. 3	% Change Alt. 3
PPD	5.8	3.9	33%	5.1	12%
PPW	6.6	3.2	52%	5.7	14%
MCD	4.7	2.8	40%	3.7	21%
MCW	5.8	3.1	47%	3.7	36%
Notes: * Plant Association Group (PAG): MCD – Mixed Conifer Dry; MCW – Mixed Conifer Wet; PPD – ponderosa pine dry; PPW – ponderosa pine wet					

Table 3.12-11. Changes in Average Dead Trees per acre 9 to 16 in. by PAG

PAG*	Existing Cond.	Alt. 2	% Change Alt. 2	Alt. 3	% Change Alt. 3
PPD	25.7	18.0	30%	21.7	16%
PPW	24.1	8.3	66%	17.2	29%
MCD	25.2	15.1	40%	18.1	28%
MCW	26.7	9.7	64%	12.8	52%
Notes: * Plant Association Group (PAG): MCD – Mixed Conifer Dry; MCW – Mixed Conifer Wet; PPD – ponderosa pine dry; PPW – ponderosa pine wet					

Salvage Harvest

Effects of Alternative 2

Salvage was considered on a unit basis in all stand replacement stands and mixed severity stands. Units were eliminated from salvage consideration where the land was not “capable and available,” or the landscape did not meet the project design elements. This alternative would salvage most of the most economically feasible dead stands outside of the roadless area and riparian reserves, treat mixed severity stands to reduce further mortality from bark beetles, and treat dead small diameter stands to meet desired future conditions for fuels and fire management.

Effects of Alternative 3

To address the soil and watershed issue, several things were changed from Alternative 2 to design Alternative 3. Riparian reserves and RHCA's were expanded from Alternative 2, and parts of units between roads and creeks were often dropped. Some units were totally

dropped and some logging systems were changed from skyline to helicopter. Temporary road construction would be approximately 1.4 miles.

Table 3.12-12, Table 3.12-13, and Table 3.12-14 compare the post-salvage conditions to the existing condition for each subwatershed and PAG within each subwatershed.

Alternative 3 would result in more dead trees being left on the landscape due to this alternative requiring higher numbers of snags to be left per unit as well as there being fewer units salvaged.

Table 3.12-12. Changes in Average Dead Trees per acre 21 in.+ by Subwatershed and PAG

SWS	PAG*	SWS Ac.	Ex. Cond. Dead 21 in.+	Alt2. Dead 21 in.+	Alt3. Dead 21 in.+
Lower Fly Creek	PPD	568	3.2	2.1	2.9
Lower LBC Metolius	PPD	582	3.0	3.0	3.0
Metolius	MCD	525	2.1	2.1	2.1
Metolius	MCW	1039	3.4	3.0	3.0
Metolius	PPD	2983	3.2	2.8	2.9
Metolius	PPW	465	6.6	3.8	4.4
Metolius	RIP	90	3.8	3.8	3.8
Metolius Horn	MCW	159	5.6	5.5	5.5
Spring Creek	MCD	105	5.7	4.8	5.3
Spring Creek	MCW	375	4.7	4.2	4.5
Spring Creek	PPD	5134	2.9	2.1	2.5
Spring Creek	PPW	69	3.6	1.7	1.7
Spring Creek	RIP	58	3.2	3.2	3.2
Street	MCD	663	4.6	2.9	3.5
Street	MCW	1054	5.3	4.5	4.5
Street	PPD	2299	4.1	3.5	4.0
Street	PPW	352	3.2	3.2	3.2
Street	RIP	186	5.3	5.3	5.3
Notes:					
* Plant Association Group (PAG): MCD – Mixed Conifer Dry; MCW – Mixed Conifer Wet; PPD – ponderosa pine dry; PPW – ponderosa pine wet; RIP - Riparian					

Table 3.12-13. Changes in Average Dead Trees per acre 16 to 21 in. by Subwatershed and PAG

SWS	PAG*	SWS Ac.	Ex. Cond. Dead 16 to 21 in.	Alt. 2 Dead 16 to 21 in.	Alt. 3 Dead 16 to 21 in.
Lower Fly Creek	PPD	568	3.5	2.1	3.3
Lower LBC Metolius	PPD	582	3.4	3.4	3.4
Metolius	MCD	525	3.7	3.1	3.3
Metolius	MCW	1039	6.0	3.4	4.0
Metolius	PPD	2983	6.7	5.8	6.3
Metolius	PPW	465	5.4	2.3	4.2
Metolius	RIP	90	7.2	7.2	7.2
Metolius Horn	MCW	159	9.4	3.1	3.2
Spring Creek	MCD	105	6.4	4.1	6.0
Spring Creek	MCW	375	4.8	2.9	4.0
Spring Creek	PPD	5134	5.6	2.7	4.5
Spring Creek	PPW	69	3.7	1.1	1.9
Spring Creek	RIP	58	8.7	8.7	8.7
Street	MCD	663	5.2	2.2	3.7
Street	MCW	1054	5.4	2.9	3.4
Street	PPD	2299	6.0	4.9	5.8
Street	PPW	352	8.7	4.9	8.5
Street	RIP	186	14.9	14.9	14.9

Notes for Tables 3.12-12, 3.12-13:
 * Plant Association Group (PAG): MCD – Mixed Conifer Dry; MCW – Mixed Conifer Wet;
 PPD – ponderosa pine dry; PPW – ponderosa pine wet; RIP - Riparian

Table 3.12-14. Changes in Average Dead Trees per acre 9 to 16 in. by Subwatershed and PAG

SWS	PAG*	SWS Ac.	Ex. Cond. Dead 9 to 16 in.	Alt. 2 Dead 9 to 16 in.	Alt. 3 Dead 9 to 16 in.
Lower Fly Creek	PPD	568	14.1	5.9	7.9
Lower LBC Metolius	PPD	582	14.2	14.2	14.2
Metolius	MCD	525	26.6	24.4	24.8
Metolius	MCW	1039	29.0	11.8	15.6
Metolius	PPD	2983	32.5	28.5	30.0
Metolius	PPW	465	24.9	7.0	14.1
Metolius	RIP	90	44.5	44.5	44.5
Metolius Horn	MCW	159	34.4	6.1	6.1
Spring Creek	MCD	105	25.2	12.1	19.6
Spring Creek	MCW	375	27.1	8.0	14.6
Spring Creek	PPD	5134	25.1	13.3	18.9
Spring Creek	PPW	69	10.7	4.0	5.2
Spring Creek	RIP	58	64.0	64.0	64.0
Street	MCD	663	24.2	8.3	12.6
Street	MCW	1054	23.3	8.6	10.4
Street	PPD	2299	24.0	19.2	22.4
Street	PPW	352	25.6	11.0	23.6
Street	RIP	186	53.6	53.6	53.6

Cumulative Effects

Silviculture and Timber Management History

Most of the roaded area within the fire perimeter had been under timber management before the fire. Partial cutting of the overstory trees on flatter terrain began early on using crawler tractors. Regeneration cutting began in the 1980's, with staggered-setting patch clearcuts ranging from 10 to 40 acres being the norm. Approximately 2186 acres were converted to plantations by this method. Cable logging systems were introduced with the advent of regeneration harvest cutting. On the flatter terrain, sanitation/salvage and overstory removal cuts were continued in the areas between the regeneration units.

The current high-density road system in the areas previously managed for timber reflect a density that was based on the use of short-span high lead systems (e.g. jammer systems with a 600 ft. reach) and skidding with crawler tractors (primarily downhill). Road spacing for these systems was based on a maximum external yarding distance (EYD) of approximately 600 ft. (measured as slope distance).

Another factor in the development of this high-density road system was the use of crawler tractors on slopes up to 40 percent. To facilitate downhill skidding, roads were often located in the bottoms, close to intermittent streams and draws. Many of these steeper areas would now be logged using cable systems, because of the concerns for soil disturbance, displacement, and compaction, and the bottom roads are no longer needed. In general, road access to the tops of future cable logging settings is available with the use of short temporary spur roads out to landing locations.

Fire History

Numerous small, non-prescribed, quickly suppressed fires have occurred in the area within the past several decades, but larger fires have been uncommon. A 5400 acre fire in 1941 burned portions of the eastern edge of the project area as did a 1300 acre fire in 1961. A 3000 acre fire occurred in the northwestern corner of the project area in 1926. Harvesting activities occurred over much of the roaded portion of the project area between the late 1970s and the early 1990s. These activities were most intense in the Mixed Conifer Plant Association Groups.

Fires that have occurred on land managed by the Sisters Ranger District since the Eyerly Fire (ex. Link and the B and B Complex) did not burn within the Eyerly Fire perimeter; however the effects of the most recent fires to the landscape, subwatershed, and their ecosystem are currently being evaluated.

Potential for Post-Fire Mortality from Insects

The effects of wildfire typically result in a large increase in the populations of certain forest insects. Recently dead wood is colonized by a wide variety of wood boring insects and bark beetles. These insects introduce various fungi into the wood that they infest and the fungi begin the decay process that eventually leads to the recycling of the dead material and the release of nutrients back into the system. The next section, *3.12 Insects and Decay*, provides a detailed discussion resulting from the analysis of insects and their effects on dead and damaged timber.

❖ 3.13 Insects and Decay

❖ 3.13.1 Introduction

After a wildfire, there is typically a large increase in the populations of certain forest insects. Recently dead wood is colonized by a wide variety of wood boring insects and bark beetles that sometimes come from great distances to take advantage of a new and abundant food source. These insects introduce various fungi into the wood that they infest and the fungi begin the decay process that eventually leads to the recycling of the dead material and the release of nutrients back into the system. Many of the same insects, particularly the bark beetles, will also infest trees that are not yet dead but that have been sufficiently wounded by the fire to have their defense systems impaired. In subsequent years, typically two to four years after the fire, the populations of bark beetles may become quite large and may move beyond the perimeter of the fire and infest trees that did not sustain any damage in the original fire event.

Management Direction

Guidelines for the assessment of tree survival

One of the many challenges that arise after a wildfire is making an assessment of the level of fire damage sustained by trees and judging how that damage relates to subsequent tree survival. These standards give the decision-maker a baseline from which to judge the number of currently live trees that may soon die and to incorporate that information into long-term planning. Some of these damaged trees may be left on site to serve as “green tree replacements” for existing snags once those snags fall over.

Many variables are involved in the survival of fire-damaged trees, including the following:

- Tree species
- Season of fire
- Fire intensity
- Pre-fire tree vigor and growth rate
- Site quality
- Arrangement and distribution of down woody material
- Post-fire moisture conditions
- Disease occurrence
- Bark beetle pressure

Similar levels of fire damage will produce different results in terms of tree survival from one wildfire event to another, depending on the factors named above. In many cases, the damage is unseen, occurring in the root zone or beneath the bark, making an accurate assessment very difficult.

Local guidelines were developed after an extensive literature review and field observations taken from numerous wildfires. Numerous case studies and publications are available to assist in the evaluation of fire damage and the likelihood of tree survival. Some very thoroughly developed guidelines relevant for the Pacific Northwest include two reports from the Blue Mountains (Scott and others 1996; Scott and others 2002).

In the first report (Scott and others 1996), the following standards of damage are used for judging survival of ponderosa pine and Douglas-fir:

Moderate severity, ponderosa pine is highly likely to die if 30-40% of the crown volume has been scorched and if the tree has sustained bole scorch exceeding 40% of the total tree height.

High severity, ponderosa pine is highly likely to die if more than 70% of the crown volume has been scorched and bole scorch exceeds 40% of the total tree height.

Moderate severity, Douglas-fir are highly likely to die if 20-30% of the crown volume has been scorched and if 30-50% of the bole circumference has been charred to a height of 5-8 feet.

High fire severity, Douglas-firs are highly likely to die if more than 40% of the crown volume has been scorched and >50% of the bole circumference has been charred for a height of 8 feet or more.

The second report (Scott and others 2002) also rates fire damage to individual trees, but first assigns a rating value to the parameters of the fire event itself (i.e., season of fire, growth rates and site quality for affected trees, arrangement of down wood material, etc.). Individual trees are then rated, evaluating factors such as crown volume scorch, bole char, total scorch height and duff consumption, assigning points according to the degree of damage. A composite rating score is derived from totaling each of the “event” variables and adding them to the points accumulated for the individual trees based on the damages they have sustained. The composite rating score then predicts the probability of the tree surviving.

A detailed discussion of recommended damaged tree guidelines for Eyerly salvage alternatives is contained in *chapter 2, section 2.8.1 Design Elements for Salvage Harvest: Damaged Tree Characteristics*.

❖ 3.13.2 Insects and Decay Existing Condition

According to aerial detection survey maps, there are numerous bark beetle species that have been active in the northern portion of the Green Ridge area in recent years. These beetle populations have fluctuated greatly from one year to another in response to changes in climatic factors and the activities of other disturbance agents. For example, the drought period of the early to mid-1990s led to a substantial increase in populations of the mountain pine beetle, western pine beetle, and fir engraver between 1992 and 1995 around Green Ridge. Once the drought subsided, these beetle populations declined to endemic levels. In 1994, several outbreak patches of Douglas-fir beetle were detected in the aftermath of a large outbreak of western spruce budworm that defoliated Douglas-firs and true firs in the Metolius Basin. The combination of the spruce budworm outbreak and the drought also produced a substantial increase in populations of the fir engraver in 1995 and 1996. More recently, bark beetle populations have been low, with small pockets of mountain pine beetle, fir engraver and western pine beetle mapped in the area in 2002. Across the Metolius River on the Warm Springs Reservation, there has been significant bark beetle activity in ponderosa pine stands in recent years.

Significant insects related to the Eyerly Fire

Dead wood from burned and damaged trees provide a food source for beetles and other insects. Generally, insects colonize freshly available burned wood and introduce various fungi into the wood that they infest, which begins the decay process that eventually leads to the recycling of the dead material and the release of nutrients back into the system.

Insects utilize trees whose cambial tissue is intact to support developing larvae. Many of the same insects, particularly the bark beetles, will also infest trees that are not yet dead but that have been sufficiently wounded by the fire to have their defense systems impaired.

Of particular concern are wood boring insects. Wood borers are the primary reason for the sense of urgency that accompanies the salvage of fire-killed wood. All wood borers appear to have a strong association with fungi. Some of these associations may be passive (insects creating holes for fungi to enter the wood) while others are active (vectoring of a symbiotic fungus into the wood). These associated fungi are ones that produce stains and decays. It has been recognized that wood infested by woodborers decays considerably faster than uninfested wood.

The wood-boring insects are also the main reason that woodpecker populations increase dramatically in a forest after a wildfire occurs. The larvae of all wood borers are a highly prized food source for woodpeckers; their feeding can be a diagnostic tool for recognizing infested wood. *Table 3.13-1* provides a detailed explanation of each insect species found within the Eyerly Project area, including suitable habitat and behavior within burned, damaged, and adjacent stands.

Table 3.13-1. Eyerly Insects by Species, Habitat, and Behavior

Significant Insects related to the Eyerly Fire		
Species	Habitat	Behavior
Western pine beetle, <i>Dendroctonus brevicomis</i>	Most commonly associated with large-diameter ponderosa pine. Primary mortality agent in trees that have lost more than half their crown from wildfire.	Will colonize trees that were killed in fire but still have their cambial intact to support developing beetle broods. Ability to complete two generations in one year when food source is available. In years 3 and 4 following a fire, may infest weakened pines that still retain live crown, fairly healthy trees outside fire perimeter or those left for green-tree replacement.
Mountain pine beetle, <i>Dendroctonus ponderosae</i>	Most commonly associated with second-growth ponderosa pine; commonly found on fire-damaged trees.	Will colonize damaged trees with cambial tissue intact, often responds shortly after a fire and may actually be attracted by odors emanating from burned trees. Infested trees are easily recognized by the thumbnail-sized globs of pitch on the bole where each point of attack has occurred.
Pine engraver, <i>Ips pini</i>	Typically small diameter ponderosa pine.	Prefer colonizing damaged trees with cambial tissue to support the developing larvae. May infest and kill the tops of larger trees, producing a spike top. Trees within the fire perimeter with a significant level of fire damage are vulnerable to infestation. Outbreaks have been known to occur in green stands shortly after the fire, but are usually confined to dense stands of pole-sized trees
Red turpentine beetle, <i>Dendroctonus</i>	Exclusively pine associations; usually confined to	The turpentine beetle is a good indicator that the host may be vulnerable for colonization by other more aggressive bark beetles.

Significant Insects related to the Eyerly Fire		
Species	Habitat	Behavior
<i>valens</i>	the basal portion of the boles of host.	The presence of pitch tubes resulting from turpentine beetle attack is an indicator that the host tree has been sufficiently wounded to produce pitch flow which serves as an attractant to these bark beetles.
Douglas-fir beetle, <i>Dendroctonus pseudotsugae</i>	Large diameter Douglas-fir; is known for infesting trees that have sustained light levels of fire damage	Outbreak populations typically arise a few years after the fire and, in a manner similar to the western pine beetle, can spread well beyond the perimeter of the fire.
<i>Coleoptera: Cerambycidae</i> (longhorned beetle)	Recently dead wood of varying species.	Wood borers*; feed on the cambial tissue between the bark and the wood before entering the sapwood.
<i>Coleoptera: Buprestidae</i> (flat-headed beetle)		The majority of wood borers usually infest trees within the first year after tree death.
<i>Hymenoptera: Siricidae</i> (woodwasps, horntails)		Roles as primary decomposers: strong association with fungi which produce stains and considerably faster rates of decay.
Note: * Wood-boring insects are the main reason that woodpecker populations increase dramatically in a forest after a wildfire occurs. The larvae of all wood borers are a highly prized food source for woodpeckers; their feeding can be a diagnostic tool for recognizing infested wood.		

Desired Condition for insect populations

Many of the forest insects such as wood borers and bark beetles are important agents in nutrient cycling, in producing the disturbances that are critical to the diversity of the forest, and in providing a food source for other organisms. As such, it is important to achieve a balance that allows for these ecological processes to continue, but that still limits insect populations to endemic levels. The populations of all of these insects are ultimately regulated by the amount of habitat (food source) that is available to them.

❖ 3.13.3 Insects and Decay Environmental Consequences

Opportunities and objectives regarding insect populations

A large-scale disturbance such as a 20,000-acre wildfire temporarily disrupts the balance of insect populations in the forest and can lead to even greater imbalance without some directed effort at reducing current and potential insect habitat. Salvage harvest of recently dead and dying trees can reduce insect habitat, and to some extent the insect populations themselves, by targeting those trees that are infested at the time of the harvest, and those that would likely be the next to be infested. However, it is important to note that we do not have the ability to entirely eliminate the possibility of insect outbreaks through salvage

activity because timing is critical and large areas of potential bark beetle habitat remain untreated in any project.

Effects Common to All Alternatives

The relationships between forest insects and the five issues are described as follows:

The effects of forest insects on Soils and Water are indirect. Trees that are killed by bark beetles will eventually fall over and, on steep slopes, may lead to increased soil movement and sedimentation into water sources.

Within riparian areas, insects may be important contributors to in-stream wood by killing trees that grow under dense conditions in these corridors. In this way, the relationship between forest insects and Fish Habitat is indirect as well.

The relationships between forest insects and Wildlife Habitat and Ecosystem Diversity are much more direct. As key disturbance agents, the bark beetles create gaps in the forest by infesting and killing certain species, ages and sizes of trees that represent the most appropriate host for each beetle species. As such, insects are directly responsible for snag levels within the forest and for their temporal and spatial arrangement.

Wildlife habitat can be affected by insects in either positive or negative ways, depending on the species under consideration. The conversion of live trees to dead trees may be positive for some species (e.g., woodpeckers), but extensive mortality can lead to loss of cover and/or a reduction in the large-tree stand component that might be critical for other species such as the northern spotted owl.

Bark beetles and wood borers introduce fungi into the wood they colonize and thus influence the rate at which dead wood decays and becomes usable by other organisms, either as food or as habitat.

Effects Common to All Action Alternatives

Even though the manager has limited ability to avoid outbreak populations of bark beetles (the greatest forest insect-related concern that arises after a wildfire), there are some opportunities. The removal of infested trees and soon-to-be-infested host material helps to limit bark beetles populations to a certain degree. The greatest gains are with the largest infested trees; removal of small infested trees, or trees colonized two years previously have no relevance to reducing bark beetle populations from within the fire area.

The more aggressive the salvage alternative is, regarding the removal of currently infested or soon-to-be-infested trees, the greater will be the potential benefit to live surrounding stands.

Formal monitoring will be done to determine tree survival with various levels of fire damage. District personnel tagged a number of trees and recorded the level of crown and bole damage that these trees had sustained in the fire. The condition of these trees will be examined for the next three or four years.

Cumulative Effects Common to All Alternatives

In the short term, wood-boring insects will colonize most of the trees killed in the fire. In the larval form, the wood borers will provide a nutritious food source for woodpeckers that congregate in the burned area. The colonized wood will begin to decompose quickly through the action of decay fungi brought in by the woodborers. In the medium to long term, these insects will be replaced by others such as carpenter ants that utilize wood in a more advanced state of decay. In general, the significance of these wood-boring insects will be confined to recently dead wood and will decrease as time goes on.

The bark beetles in ponderosa pine and Douglas-fir will be important as tree mortality agents in the short to mid term, causing the death at first of trees severely damaged by the fire and then subsequently infesting trees less severely damaged. Within three to four years small infestations may develop in stands outside the perimeter of the Eyerly Fire if weather conditions favor the buildup of these insect populations within the fire-damaged trees. Larger trees in surrounding stands may be infested and killed if bark beetle

❖ 3.14 Recreation Resources

❖ 3.14.1 Introduction

Recreation in the Eyerly project area consists of dispersed recreation (activities like hunting, camping, hiking, etc., not occurring at developed facilities) and developed recreation in either of the two fee campgrounds. The area of most concentrated recreation use is in the vicinity of Perry South Campground. The types of vegetation management activities that may effect recreation are salvage logging, slash disposal, reforestation and removal of hazard trees occurring in or near preferred/traditional use areas for individuals or groups. Change in road status (either development or closure), and activities adjacent to private lands and the Metolius Wild and Scenic River may also effect recreational activities.

Special-Uses permit areas include the Green Ridge Repeater Site (Jefferson Co.), two road permits to private lakeside parcels near Perry South Campground, a road and bridge permit for private lakeside parcels on Street Creek, the Cochran property along Co. Rd. 64 has a permit for a road, spring box, and water line, and the gaging station on the Metolius River near Monty CG is under permit. Salvage logging, slash disposal, reforestation and removal of hazard trees will have little effect upon these permitted activities.

❖ 3.14.2 Recreation Resources Existing Condition

As a whole, people use federal lands and roads to access areas and sites that will provide some form of leisure opportunities or recreation. In general, higher standard roads would access sites which lead to more developed recreation sites, such as campgrounds and resorts. Access to primitive areas, such as Wilderness, is normally through trailheads. Lower standard roads typically lead to more dispersed types of recreation such as

primitive camping, fishing, hiking, caving, collecting forest products and simply driving for pleasure or exploration.

Landscape Setting

Activities and Facilities

The recreational activities currently existing include developed camping, dispersed camping, picnicking hunting, fishing, hiking, mountain biking, horseback riding, snowmobiling, OHV use, sight-seeing, watching wildlife, nature study, driving for pleasure, collecting mushrooms and both non-motorized and motorized rafting/boating/water skiing/personal watercraft.

Recreational facilities include two fee campgrounds operated under permit by HooDoo Recreationl Services. Perry South Campground is located on the Metolius arm of Lake Billy Chinook. Monty Campground is located near the point at which the Metolius River enters the lake. These campgrounds operated for 110 days/season and generated \$42,374 in revenue in FY 2001. Perry South can accommodate a total of 505 people at one time (PAOT) when fully occupied and Monty can accommodate 125 people. Perry South is one of the most popular CG's on the Sisters RD. Perry South averages approximately 40% occupancy (16,615 total visitors in 2001) and Monty averages approximately 5% occupancy (366 total visitors in 2001). There are no vegetation management plans for these campgrounds and the hazard trees are removed on an annual basis.

There are no designated trails within the project area.

Much of the recreation use in the project area is of a dispersed nature. Approximately 15-30 sites currently exist for dispersed camping occurs along roads 1140, 1149, 1150, 1170, 1180, 1190, and 6400. One frequently used area was along 6400/400 near Balancing Rocks

The use of OHV's is often associated with dispersed camping. There is a number of user created OHV trails within the project area or on the adjacent private lands. An accurate inventory of these trails is needed to assess the extent and resource impacts of these uses. There is some evidence that OHV use and trails are proliferating in burned areas now bare of vegetation. A post-fire closure order is now in place restricting motorized use to open numbered roads.

Recreational mushroom collecting is expected to increase in the short term as a result of the fire.

Special Uses

An annual operating plan provides management direction for the two campgrounds (Perry South and Monty) under recreation special uses permit to HooDoo Recreational Services.

Permits are required for the gathering of special forest products, which include firewood, cones, mushrooms, transplants, rocks/minerals, and posts and poles.

Non-recreation special-Uses permits include the Green Ridge Repeater Site (Jefferson Co.), two road permits to private lakeside parcels near Perry South Campground, a road and bridge permit for private lakeside parcels on Street Creek, the Cochran property along Co. Rd. 64 has a permit for a road, spring box, and water line, and the gaging station on the Metolius River near Monty CG is under permit.

Lands and Minerals

The only designated mineral site within the analysis area is Sullivan Pit located at the junction of Roads 1180 and 1180900. This site is used for administrative purposes and for public landscaping rock.

Effects of the Eyerly Fire

The landscape has been drastically changed and the visiting public will find that over much of the project area conditions no longer meet their expectations. Many of the Dispersed Campsites were burned over by high intensity fire. All living vegetation, shade and screening has been destroyed. Most of these campsites will no longer be used by the public until the vegetation grows back. The fire burned through Perry South CG destroying two toilets and a picnic table. The landscape character in and around Perry South Campground was also modified by the fire but to a lesser degree. It is expected that use levels at this campground will remain high because of the amenities and proximity to the lake. Many of the trees in and around the campground were either killed or weakened by the fire. The majority of the smaller trees (under 10" DBH) have been felled, piled and burned. Larger trees considered to be an immediate hazard were also felled. Approximately 105 trees ranging up to 30" DBH remain to be dealt with.

Dispersed campsites within a twenty-minute drive of Perry South Campground and Lake Billy Chinook (off road 1170) were in areas "of high intensity" fire. Before the Eyerly fire, these sites served as an overflow area during holiday weekends when the campgrounds were full. Being fire blackened and bare of vegetation, these areas will no longer be attractive for dispersed camping in the short term.

A developed recreation facility which existed along Street Creek was closed and dismantled in the early 1980's. All that remains is a decommissioned boat ramp. This facility is no longer an inventoried recreation facility.

Recreation Resource Desired Future Condition

Recreation Opportunity Spectrum (ROS) and Inventoried Roadless

The majority of the project area (roaded from past logging) falls within the ROS of Roaded Modified. The experience goal is to provide visitors with an opportunity to get away from the sights and sounds of other people, but in an area with easy access. Visitors provided with some opportunity to practice self-reliance in building their own campsite and in the use of motorized equipment. This experience offers feelings of independence and freedom, but there is little risk and challenge. The environment is substantially modified except in the campsite itself. The immediate foreground in the campsite should be in a natural appearing state.

Within the project area, the un-roaded lands breaking off towards the Metolius Arm of Lake Billy Chinook fall within the ROS of Semi-Primitive Non-Motorized (except designated trails/routes). The experience goal is to provide a high probability of experiencing solitude, closeness to nature, tranquility, self-reliance, challenge and risk. There is a natural appearing environment. There is low interaction between users though

there is some evidence of others. On site controls are subtle and few. Access and travel is non-motorized on trails, some primitive roads or cross-country.

Small portions of the project area fall with the ROS of Roaded Natural. The experience goal for Roaded Natural is to provide visitors with an equal opportunity of meeting and enjoying other visitors and of being isolated from the sights and sounds of other people. Visitors interact with the natural environment but with low challenge and risk. Both motorized and nonmotorized forms of recreation take place. The environment is mostly natural appearing when viewed from sensitive roads and trails. Vegetation alterations are done to maintain the desired visual and recreation characteristics. Evidence of human activity usually harmonizes with the natural environment.

The project area east of the proposed salvage units contains portions of the Metolius Roadless Area. This area's experience goal is dispersed unroaded recreation in a natural appearing landscape setting. Inventoried Roadless emphasized the protection of cultural and heritage resources; high quality of undisturbed soil, water, and air; and habitat for fish, wildlife and plants.

A discussion of the proposed project effects on Recreation resources, including Semi-Primitive Non-Motorized Rec., Roaded Natural, Roaded Modified, and Inventoried Roadless areas is contained within the next section.

❖ 3.14.3 Recreation Resources Environmental Consequences

Effects to Forest Recreationists

Effects of Alternative 1 - No Action

Under the "No Action Alternative" there would be no impacts on recreationists and forest recreation settings from salvage activities, post-harvest activities and slash treatment (smoke and visuals). There would be no timber hauling from National Forest lands to conflict with recreational traffic. Some road management activities would continue under separate NEPA documents. One such action would decommission approximately 41 miles, and inactivate about 22.5 miles of roads within the Eyerly Fire area. An area closure restricting motor vehicle use to designated open roads is in place and would likely continue to be in effect for 3 – 5 years

Hazard trees in developed recreation sites and along major travel routes would be removed as needed to provide for public safety.

Effects Common to All Action Alternatives

Landscape fuel reduction and forest restoration activities in both action alternatives are predicted to reduce the risk of severe wildfire disturbances proportionate to the number of acres treated.

Under the action alternatives, the Deschutes National Forest LRMP directions for the various LRMP Management Areas (reference the Eyerly Salvage Recreation Report) within the Eyerly Fire Salvage Project would be moving closer toward the Desired Future Condition, while specifically addressing other issues, such as wildlife habitat management, soil productivity, and forest health.

Effects of Alternative 2

Alternative 2 would result in short-term negative impacts, such as displacement from forest settings during treatments, dust and noise from equipment, smoke from burning and conflicts with timber hauling along forest roads would be greatest under Alternative 2. The difference as perceived by the public would be proportionate to the acres treated.

Landscape fuel reduction and forest restoration activities are predicted to reduce the risk of severe wildfire disturbances, improve thermal cover and in the long term, create an aesthetic background for recreation activities. If the funds collected do not result in increased reforestation and fuel reduction over a greater number of acres, the difference between the action alternatives will be of less significance.

Effects of Alternative 3

This alternative treats the fewest acres and would salvage about half the volume. Short-term negative impacts, such as displacement from forest settings during treatments, dust and noise from equipment, smoke from burning and conflicts with timber hauling along forest roads would be present, but reduced by about half under Alternative 3. The difference as perceived by the public would be proportionate to the acres treated.

Because Alternative 3 treats fewer acres, it would take longer to return the treated acres to the DFC and a more aesthetic background for recreation activities

Recreation Opportunity Spectrum (ROS) and Inventoried Roadless

Approximately 2800 acres within the project area are designated as Semi-Primitive Non-Motorized Recreation. This area coincides with the Land and Resource Management Plan allocation of “Metolius Wildlife/Primitive”, and encompasses the majority of the Metolius Roadless Area. Actions that may affect the recreation experience in the Semi-Primitive Non-Motorized area are primarily the sights and sounds of motorized use, road development, and debris and slash resulting from harvest activities.

None of the Metolius Roadless Area within the project boundary is proposed for salvage. The values of natural appearing landscapes and tranquility could be temporarily impacted by the timber harvest, temporary roads, and burning activities on adjacent lands.

Effects of Alternative 1 - No Action

The wildfire altered all of the ROS settings by removing shading, and vegetative screening, changing some of the canopied, green forest to open landscapes of black and brown. Suppression activities also altered the setting by clearing of fire line and safety zones. Under the no action Alternative, the recreation settings would recover more slowly than under the Action Alternatives within in the areas proposed for treatment.

Within the Semi-Primitive Non-Motorized and Inventoried Roadless areas there would be no harvest activities, use of motorized equipment or development of temporary roads, and therefore the recreation setting would not be affected in the short-term as it would under the action Alternatives.

There would be no direct effects on the Inventoried Roadless Area under the no action Alternative. There would be no indirect effects on adjacent resources and habitats from harvest activities. However, it is predicted that the recovery of the visual quality of adjacent lands would be slower under the no action Alternative than under the action Alternatives.

Effects Common to All Action Alternatives

Proposed actions are consistent with the recreation settings and experiences in the Roaded Modified setting, and in the Roaded Natural setting given the current altered state of the setting by wildfire and suppression activities. Harvest *is not inconsistent* with the Semi-Primitive Non-Motorized recreation setting, but it is recommended that harvest activities be visually subordinate in the landscape.

There will be more short term effects from the sights and sounds of harvest activities under Alternative 2 than under Alternative 3. These effects would be short-term (during and within about 1 year after implementation). Harvest activities are expected to enhance the visual quality of the area over the long-term more quickly than under the No Action Alternative.

There would be no harvest or temporary roads proposed within the Inventoried Roadless Area, so there would not be any direct effects from proposed actions on this area. Indirect effects on the values described above would be minor, particularly given the current impacts from wildfire and suppression, and short-term. See the sections under this Chapter for additional discussions on effects to unroaded recreation opportunities; cultural resources; soil, water and air; and habitat for fish, wildlife and plants.

Effects of Alternative 2

Alternative 2 is less consistent with the Semi-Primitive Non-Motorized ROS than Alternative 3 since approximately 0.88 miles of temporary roads would be developed under Alternative 2. Though road development and use of motorized equipment is inconsistent with the Semi-Primitive Non-Motorized setting, this area already had approximately 23.9 miles of low-maintenance level Forest Roads. The addition of 0.88 miles of temporary roads in this area for the short-term (the roads would be decommissioned after project implementation), and temporary use of the roads by motorized equipment would not be a significant impact on the wildfire-altered setting within the Semi-Primitive Non-Motorized area, and would be consistent with Deschutes Forest Plan standards and guides.

Cumulative Effects

Closing access to areas during vegetation management activities does have a short term effect on recreationists. Harvest and post-harvest activities have the longest duration effect. They may prevent recreationists from visiting certain areas while these activities occur and can displace them in the short-term. Displacement during implementation of the activity might be from one day to several weeks.

In addition to displacing recreationists, trucks hauling timber along forest roads can also affect visitors by increasing the perceived hazard of sharing the narrow roads with log trucks. Vegetation management activities occurring during seasons other than summer generally impacts fewer recreationists. The timing of the timber haul might have less effect upon local residences though they may prefer weekdays in the off season.

Fuel reduction and removal of hazard trees has a positive effect on both the actual and perceived safety of recreation sites and travel routes. Timber salvage on flat ground can increase the temptation to drive off roads even though it may be illegal to do so.

❖ 3.15 Roads and Transportation



❖ 3.15.1 Introduction

The Eyerly project area covers 66.8 square miles of land and is accessed by 161.3 miles of roads. Within this area there are 146.23 miles of road under Forest Service jurisdiction, 14.83 miles of road under Jefferson County jurisdiction, and 0.23 miles of private road. Most of the Forest road system is on the northeast side of Green Ridge; however, there are some short segments adjacent to the Metolius River and Lake Billy Chinook on the east side of the analysis area. The existing Forest road system includes 87.3 miles of open road and 58.9 miles of closed or inactivated roads.

Following the Eyerly Fire of July, 2002, an analysis of the post-fire transportation system was identified as a priority. Preliminary transportation analysis for the Eyerly Fire Salvage Project began in the fall of 2002 and continued through the spring of 2003. The Interdisciplinary Team (ID Team) met on multiple occasions during that time to discuss salvage logging, reforestation, ecological restoration and road management. Following new Forest Service Transportation Policy, the ID Team conducted a Roads Analysis across the entire planning area during the winter of 2002 and spring of 2003. The purpose of the Roads Analysis was to examine all the roads within the project area and identify opportunities for future road management actions based on the benefits, problems, and risks associated with the existing road system.

As a result of public comments and management consideration, the decision was made that with the selection of either action alternative, the 1170800 road segment (approx. 3.8 miles) would be decommissioned following harvest operations.

Additional site specific road resource management recommendations are contained in the Roads Analysis Report: Eyerly Project Area (April 2003).

❖ 3.15.2 Transportation System Existing Condition

Arterial Road 11, collector Road 1170 and County Road 64 provide the primary access into the Eyerly Project Area. The 11 and 1170 roads are Highway Safety Act roads, suitable for mixed traffic including passenger vehicles. Road 11 is accessed from U.S. Highway 20 north of Sisters, and road 1170 connects to Jefferson County Road 64. County road 64 provides access to the community of Three Rivers, private lands, recreation residences, resorts, and the many recreational opportunities around Lake Billy Chinook. Collector roads 1490, 1140, and 1180 provide secondary access from the community of Camp Sherman to the project area. National Forest System Roads (NFSR) provide access to National Forest lands, and are classified as either arterial, collector, or local.

- ▶ An arterial road provides service to large land areas and connects with other arterials or public highways.
- ▶ A collector road serves smaller land areas than arterials and connects arterials to local roads.
- ▶ A local road is generally a single purpose facility and connects terminal facilities with collectors and/or arterials.

Most Forest roads in this area are currently open year-around to both motorized vehicles and non-motorized uses. Present uses include, but are not limited to, sightseeing, driving for pleasure, mushroom picking, biking, cross country skiing, hunting, off-highway vehicle use (ATVs, motorcycles, 4WD, snowmobiles), special use access, and Forest Service resource management. Because roads are not maintained during the winter, winter use is primarily limited to snowmobiles and skiers.

Desired Future Condition of Transportation System

The aggregate surfacing on arterial road 11, and collector roads 1150, 1158, 1170, 1180 and 1190 is thin and worn down to the sub-grade in many areas. Most of these road systems are currently in good condition structurally, and only fair to poor condition as far as having maintainable surface to support timber haul. This condition increases erosion and the loss of sub-grade materials, causes oversize rock to be exposed, reduces safety, and prevents the proper grading of the traveled way. Furthermore, roadside vegetation is encroaching at many locations, reducing sight distance and safety, and obstructing drainage. These roads are in need of resurfacing or reconstruction to stabilize the road surface and provide a safer and more efficient access for people and materials traveling in the Green Ridge area or to Lake Billy Chinook. In addition, the native surface portion of road 1190, from road 1190700 to road 1150, has many rocks and boulders protruding from the surface and also needs to be reconstructed and surfaced with crushed aggregate to prevent surface erosion and high sediment delivery into the Bean Creek and Metolius River drainage areas, and improve water quality and safety.

Many of the local forest system roads in the project area also need some maintenance, but it is relatively minor. This work typically involves grading and the addition of a few drain-dips or water-bars to improve surface drainage and reduce erosion, including brushing and limbing as needed to improve sight distance and safety. Road 1170800 (western 700 feet) is determined to be the only local road needing treatment to reduce sediment delivery into the adjacent Spring Creek intermittent tributary. This, in part, influenced management decision that with the selection of either action alternative

approximately 3.8 miles of the 1170800 road segment be decommissioned after salvage operations have been completed.

❖ 3.15.3 Roads and Transportation Environmental Consequences

Effects Common to All Alternatives

The Eyerly Roads Analysis and road management activities proposed by the IDT, could be implemented in separate environmental documentation, regardless of the Eyerly Fire Salvage Project alternative chosen. For this reason, the largest determining factor relating to proposed management activities could be the potential use of Forest roads for hauling of salvaged timber.

The Eyerly Fire Salvage Project includes three alternatives: Alternative 1 would not directly affect the transportation system; however, road restoration, monitoring and hazard tree activities could be accomplished separately with the implementation of a Roads Management EA. Alternative 2 would provide for the greatest return of economic value of merchantable timber, and therefore could provide for the greatest opportunity for transportation system enhancement to mitigate road system use. Alternative 3 focuses on ecological restoration issues, and minimizes post-fire disturbance within sub-watersheds, resulting in the harvest of less burnt or damaged timber. All action alternatives address issues of road reconstruction and maintenance. These project activities are summarized in *Tables 3.15-1 and 3.15-2*.

Table 3.15-1. Road Reconstruction Activities

Road No.	Termini	Alt. 1 – No Action (miles)	Alt. 2 – Proposed Action (miles)	Alt. 3 – Action Alternative (miles)
11	m.p. 10.0 (jct 1150) to m.p. 20.5 (jct 1170)	0.0	10.5	10.5
1150	m.p. 7.3 (jct 1180) to m.p. 13.0 (jct 1190800)	0.0	5.7	5.7
1158	m.p. 0.0 (jct 1150) to m.p. 1.0 (jct 1190469)	0.0	1.0	1.0
1170	m.p. 0.0 (jct 11) to m.p. 2.3 (jct 1170600)	0.0	2.3	2.3
1180	m.p. 0.0 (jct 11) to m.p. 3.5 (jct 1150)	0.0	3.5	3.5
1190	m.p. 0.0 (jct 1170) to m.p. 7.9 (jct 1190700)	0.0	7.9	7.9
1190	m.p. 7.9 (jct 1190700) to m.p. 10.4	0.0	2.5	2.5

The reconstruction activities on forest system roads listed in *Table 3.15-1* may include the reconditioning of the existing traveled way, surfacing and/or resurfacing with crushed aggregate, spot surfacing, and drainage restoration as required.

It is expected that the crushed aggregate surfacing material will be obtained from the new East Sullivan Rock Quarry on the east side of Green Ridge near the project area. An environmental assessment for this quarry has been prepared and a Decision Notice was signed on May 11, 1995. The initial clearing and overburden removal, for the first stage, has been completed by the Forest road crew.

Effects of Alternative 1 - No Action

There would be no changes to the current Forest Road transportation system under the no action alternative. Consequently, there would be no improvements to the roads or the drainage systems of the roads in this alternative. There would be no increase in log truck traffic on County and Forest roads. Activities affecting the road system under separate NEPA projects could proceed regardless.

Effects Common to All Action Alternatives

Implementing the Eyerly Fire Salvage Project would result in the decommissioning of 3.8 miles of road, which will reduce the overall transportation system mileage. Upon the selection of either of the action alternatives, a separate Eyerly Road Management Environmental Assessment (EA) document would be accomplished to assess the remaining activities specifically related to road management within the Eyerly Project Area as identified in the Road Analysis Report.

Approximately 33.4 miles of road are shown to need reconstruction in both action alternatives. However, this is only an estimate. When the road condition surveys and economic analysis has been completed, it is expected that this quantity will be adjusted as appropriate. It is also estimated that the 33.4 miles of road reconstruction may include up to 8 miles or more of surfacing, resurfacing or spot surfacing with crushed aggregate. The cost of reconstruction, including crushed aggregate surfacing, is estimated at this time to be \$40,000 per mile. Reconstruction activities without crushed aggregate surfacing would be considerably less.

The effects described previously are summarized in *Table 3.15-2*.

Table 3.15-2. Project Effects on Total Transportation System

Project Activity	Alt. 1 – No Action (miles)	Alt. 2 – Proposed Action (miles)	Alt. 3 – Action Alternative (miles)
Existing “National Forest System Roads” in the Project Area (NFSR)	146.2	142.4	142.4
New Road Construction	0.0	0.0	0.0
Road Reconstruction	0.0	33.4	33.4
Project Maintenance	0.0	107.6	89.6
Temporary Road	0.0	3.0	1.4
Road Closures	0.0	0.0	0.0
Road Decommission	0.0	3.8	3.8
* NFSR Density	2.19 mi./sq. mi.	2.13 mi./sq. mi.	2.13 mi./sq. mi.
<i>Note:</i> * Road density is higher in some areas. Density includes all system roads			

Table 3.15-3. Road Decommissioning

Road	Miles	Road	Miles	Road	Miles	Road	Miles
1170800	2.2	1170810	0.0	1170820	0.1	1170860	0.2
1170890	1.3						
					Total Miles		3.8

Effects of Alternative 2

Under Alternative 2, the roads listed in *Table 3.15-3* would be decommissioned after salvage operations have been completed. Additional opportunities to address current and future road system needs could be accomplished with a separate Roads Management EA document.

An estimated 107.6 miles of roads in alternative 2 could receive some level of haul maintenance (including pre & post haul) work associated with this project. Upon selection of Alternative 2, detailed road condition surveys would be accomplished, and this quantity would be updated to reflect current conditions in a separate Eyerly Road Management EA. The construction of short temporary roads, totaling 3 miles in alternative 2 would be required to provide access to timber harvest locations. Following timber harvest operations, the access routes would be obliterated and reconditioned to a natural state.

Effects of Alternative 3

Under Alternative 3, the roads listed in *Table 3.15-3* would be decommissioned after salvage operations have been completed. Additional needs addressed by management and recreation activities, would be addressed in a separate Roads Management EA document. Pre- and post-haul maintenance of an estimated 89.6 miles of roads could be associated with the implementation of Alternative 3. Road condition surveys completed after selection of this alternative would change to reflect actual conditions, and be evaluated in the Eyerly Roads Management EA document.

The construction of short temporary roads, totaling 1.4 miles would be required to provide access to timber harvest locations. These temporary roads would be obliterated and reconditioned post-harvest.

Cumulative Effects

Implementing any of the Eyerly Fire Salvage Project would result in no change to the overall transportation system mileage. A Roads Management Environmental Assessment (EA) document will be accomplished to independently assess the activities specifically related to the social, environmental, and administrative requirements within the Eyerly Project Area.

Opportunities to more effectively manage the Forest transportation system within the Eyerly Project Area have been identified and analyzed by the ID team. These issues, risks, priorities, and management decisions have been published in the Eyerly Roads Analysis Report. This report is a tool for decision-makers and the public to determine the risks and needs for future management activities.

❖ 3.16 Scenic Quality

❖ 3.16.1 Introduction

Cultural Values and Sense of Place

The Eyerly Fire Salvage Project Area has a history of being a unique area for people and wildlife alike. The pre-burned area has provided recreation opportunities to generations of people who have recognized its truly unique ecological quality and diversity of landscape. From the gentle rolling hills to crystal-clear flowing water, people have come to experience this special place for countless generations. In the past, visitors have been attracted to the radiant and lush-green forest, the open grassy meadows, and the picturesque vistas to distant hills and peaks that provide the visitors with a sense of natural awe.

People once sought and found seclusion, solitude, and closeness to nature within what is now the Eyerly Fire Salvage Project area. People have appreciated the sense of "visiting the woods," surrounded by beautiful scenery and varieties of outdoor recreation activities, including fishing, camping, hunting, and collecting special forest products.

Today, driving for pleasure is among the important recreational activities in the project area. Scenic view enhancements are important to the current (and future) aesthetic quality for visitors enroute to Lake Billy Chinook, Perry South and Monty Campgrounds, and dispersed camping and forest product collection sites.

❖ 3.16.2 Existing Condition of Scenic Quality

Landscape Setting

Landscape Character

The existing conditions exhibit a low to moderate cultural integrity rating within the project area.

The existing post-burn landscape is far from being "natural." The wildfire has severely damaged the forest structure and landscape character within the project area. In some areas, the forest has been severely and completely charred. Decades of fire suppression and other human intervention have led to the current state of forest health that led to such a severe fire regime. Such conditions do not meet social and ecological character expectations. The damage by this fire to the natural and cultural resources is a very serious concern. Thus, the ecological sustainable processes (natural processes) no longer occur as it once did.

The loss of a natural appearing forest to wildfire, especially within and around developed recreational sites, increasingly added to the deviation from the "natural appearing" landscape character expected by the concerned public.

Scenic Integrity

Presently, the existing landscape integrity has a low scenic integrity rating.

The existing scenic integrity has a mixed variety of disturbed and undisturbed areas as the wildfire naturally burned mosaic patterns within the forest landscape. In areas where the forest has been severely burned, the effects have intruded into the expected natural appearing landscape character. Some dead and down trees resulting from the wildfire

have degraded the area's scenic quality and scenic integrity level. In some part, the fire has created a clear and present hazard to travelers along both sides of a well travel route, such as Road 11, 64, 1190, 1180, and Road 1170. Coupled with past management activities (such as past timber harvest, wood cutting, and dispersed recreation development, access roads, and facility development), these human and natural caused appearances are highly visible from sensitive viewer locations. Charred trees, dead and down logs, and other residues all have contributed to negative deviations from a natural appearing landscape characteristic to which the public is expecting and valued within the Eyerly Fire Salvage Project.

Desired Future Condition of Scenic Quality

Landscape Character Goal

The landscape Character goal for Eyerly Fire Salvage Project is to achieve a natural appearing landscape, such as open park-like stands, where management directions, the desired future conditions, social and ecological framework of the Eyerly Fire Salvage Project Management Area are met (LRMP MA-9 and MA-19 through MA-28).

The scenic quality goal for the Eyerly Fire Salvage Project would present natural appearing character where various line, form, color, and texture elements can be found within the landscape. Human alterations, in general, would be subordinate and conform to natural appearing landscape characteristics. Character trees, snags, and small openings, to highlight special features within the landscape, are desirable and encouraged. Where biologically feasible, diversity in vegetation species, age and size classes would be encouraged. In general, these alterations to the landscape character would take place as a result of (and in conjunction with) salvage harvest activity or under separate environmental actions.

❖ 3.16.3 Scenic Quality Environmental Consequences

The effect on scenic resources from the proposed alternatives, specifically on landscape character, scenic quality, and scenic integrity level, can be classified into two specific categories. The effect on landscape character is a short-term effect (within landscape term of 0-5 years) or alteration on landscape character and scenic integrity level. The other is long-term effect (from 5 years and beyond) or alternation.

The effect from the proposed action alternatives is expected to be most evident to the visiting public within the immediate Foreground landscape (0-300 feet), Foreground landscape (300 feet to 1/2 mile corridor for road and 300 feet-1/4 mile corridor for trail and river corridor system), and some part of the Middleground landscape (1/2 to 4 miles zone from road system, 1/4 to 4 miles from trail system, and also view to and from Black Butte).

The areas-of-measure for the environmental effects, specifically on Scenic Resources from the proposed management activities under each alternative, can be categorized into two distinctive areas. They are:

1. Acre (or percentage) of alteration, including improvement or enhancement of scenery;
2. Acre (or percentage) of affected or alteration on short-term scenery within the Foreground and Middleground landscape as viewed from a travel corridor, such as road and trail, following implementation.

This effect analysis is taking into consideration for both short and long-term affect on landscape character, scenic quality, and overall scenic integrity level within the Eyerly Fire Salvage Project landscape.

Effects Common to All Alternatives

The proposed activities assume vegetative and fuel management direction that upon implementation would create an altered and different forest character than the existing character. The goal of the proposed management activities would be to salvage of merchantable timber (dead and damaged trees), provide for public safety, improve forest health, and enhance both short-term and long-term scenery.

The effect on scenic resources from the proposed alternatives, specifically on landscape character, scenic quality, and scenic integrity level, can be classified into two specific categories.

- Short-term effect (within landscape term of 0-5 years) or alteration on landscape character and scenic integrity level.
- Long-term effect (from 5 years and beyond) or alternation.

The areas-of-measure for the environmental effect(s), specifically on Scenic Resources from the proposed management activities under each alternative, can be categorized into two distinctive areas. They are:

1. Acre (or percentage) of alteration, including improvement or enhancement of scenery; and
2. Acre (or percentage) of affected or alteration on short-term scenery within the Foreground and Middleground landscape as viewed from a travel corridor, such as road and trail, following implementation.

This effect analysis is taking into consideration for both short and long-term affect on landscape character, scenic quality, and overall scenic integrity level within the Eyerly Fire Salvage Project landscape.

Effects of Alternative 1- No Action

Current management actions would continue. No actions taken to reduce risk at a landscape-scale. No salvage of burned or damaged forest would be treated under this alternative. Generally, natural and ecological processes would be allowed to run their own course.

Effects Common to All Action Alternatives

The removal of dead and damaged trees will help move the area more quickly toward the Desired Scenic Condition by allowing new forest to regenerate and grow more rapidly, while at the same time capturing and utilizing valuable wood fiber to meet social needs. The effect from the proposed management activities is expected to be most evident to the visiting public within the immediate Foreground landscape (0-300 feet), Foreground landscape (300 feet to 1/2 mile corridor for road and 300 feet-1/4 mile corridor for trail and river corridor system), and some part of the Middleground landscape (1/2 to 4 miles zone from road system, 1/4 to 4 miles from trail system, and also view to and from Black Butte).

❖ 3.17 Other Disclosures

❖ 3.17.1 Short-term Uses and Long-term Productivity

NEPA requires consideration of the relationship between short-term uses of man's environment and the maintenance and enhancement of long-term productivity. (40 CFR 1502.16). As declared by Congress, this includes using all practicable means and measures to foster and promote the general welfare, to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generations of Americans (NEPA Section 101).

An examination of productivity or long-term productivity in relation to both Forest Vegetation and Soil Quality, as well as some aspects of Wildlife Habitat, is presented in Chapter 3. An examination of short-term uses, as they pertain to the products that would be made available by the proposals is included in the Economics and Social Analysis section of Chapter 3. Specifically, economic returns to society from possible future management activity is presented under the subheading Social Analysis.

❖ 3.17.2 Unavoidable Adverse Effects

Several expected adverse effects, including some that are minimal and/or short term, were identified during the analysis. Resource protections measures or mitigations were identified and considered for each of these as a means to lessen or eliminate such effects of specific resources. See Chapter 2, *section 2.8 Project Design Elements*. Resource areas determined to have potential adverse effects (resulting from any of the alternatives – including No Action and the Action Alternatives) are documented within the appropriate Environmental Consequences sections of each resource in Chapter 3. See the following sections:

- Forest Vegetation and Timber Management
- Wildlife Habitat: Northern Bald Eagle, Northern Spotted Owl, Bufflehead, Pacific Fisher
- Fish Habitat: Columbia River Bull Trout, Interior Redband Trout
- Recreation Resources
- Scenic Resources

❖ 3.17.3 Irreversible and Irretrievable Commitment of Resources

NEPA requires that environmental analysis include identification of “. . . any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented.” Irreversible and irretrievable resource commitments are related to the use of nonrenewable resources and the effects that the use of these resources have on future generations.

- Irreversible effects primarily result from use or destruction of a specific resource (e.g., minerals) that cannot be replaced within a reasonable time frame.
- Irretrievable resource commitments involve the loss in value of an affected resource that cannot be restored as a result of the action (e.g., disturbance of wildlife habitat); or is lost as a result of inaction (e.g., failure to monitor and treat forest vegetation to prevent infestation of insects).

The proposed fire salvage project would result in few direct and indirect commitments of resources; these would be related mainly to timber harvest operations.

For the proposed alternatives, most resource commitments are neither irreversible nor irretrievable. Most impacts are short term, temporary, and are being mitigated as outlined in project design criteria and best management practices. Others that may have a longer effect can be reduced through appropriate measures. Those resources that may have a possible irreversible or irretrievable commitment are discussed below.

The Eyerly Fire Salvage Project proposes no activities that would result in irreversible commitments of resources.

With the implementation of any of the alternatives (including No Action), a variable portion of one primary resource (standing dead trees) would be irretrievably lost to use either as a natural resource for the harvest of commercial forest products or as a component of wildlife habitat, particularly cavity dependent species. These tradeoffs, as they relate to each of the alternatives, are explored in discussions of two of the Key Issues.:

- Economic and Social Analysis
- Wildlife Habitat

See Economic and Social Analysis and *Wildlife Habitat: Existing Condition and Environmental Consequences: Cavity Excavators/Down Woody Material* in Chapter 3 of this document. The analysis revealed no significant irreversible or irretrievable commitment of resources associated with implementing the alternatives that are not already identified in the Forest Plan EIS or the Regional FEIS for Managing Competing and Unwanted Vegetation.

❖ 3.17.4 Forest Plan Amendment

Both Alternatives 2 and 3 include an amendment for relocation of two areas currently allocated to the old growth management area (MA-F15) in the Deschutes National Forest Land and Resource Management Plan.

The need for this amendment is stated in the Deschutes Forest Plan, p. 4-150, Standard and Guideline M15-5: If the structure of an old growth area is significantly altered through a catastrophic event such as a fire, windstorm, or insect epidemic, another stand would be substituted that meets the minimum requirements for the indicator species. The original area could then be salvaged and reforested.

An old growth area will be considered significantly altered if it no longer meets the minimum habitat needs for the indicator species. (Forest Plan, p. 4-150). The conditions for this management area within the Eyerly Fire perimeter have been significantly altered. Minimum habitat needs cannot be met under current conditions; therefore, a Forest Plan amendment will re-designate the allocation of old-growth habitat impacted by wildfire.

Additional description of this amendment may be found in Chapter 2, under descriptions of Alternatives 2 and 3.

Timing

This amendment will take place immediately and is specific to this project. The Forest Service Planning Handbook (1909.12, 5.32) indicates that a change is less likely to result in a significant plan amendment if the change is likely to take place after the plan period (the first decade). This plan amendment would occur in the 14th year of the Forest Plan.

Location and Size

The existing old growth areas are 208 and 148 acres in size respectively, replacement old growth areas are 238 and 183 acres respectively. The replacement old growth areas are of the same plant association groups as the existing areas. One of the existing old growth areas is located within NWFP, Administratively Withdrawn allocation and one is outside the NWFP area. Both replacement areas would be located within the area covered by the NWFP and allocated to Administratively Withdrawn.

Goals, Objectives, and Outputs

An action is more likely to be a significant Forest Plan amendment if it alters the long-term relationship between the levels of goods and services projected by the Forest Plan. This amendment would not change management allocations where programmable timber harvest could occur. No programmed harvest would occur within either the old growth allocation in the Deschutes Forest Plan or in the Administratively Withdrawn allocation of the NWFP. Unprogrammed timber harvest may occur within lands classified as Administratively Withdrawn.

Management Prescription

The change in management prescription of this amendment would apply to future decisions within this area.

❖ 3.17.5 Northwest Forest Plan Standards and Guidelines Associated with Late Successional Reserves

Late Successional Reserves

A management assessment should be prepared for each Late Successional Reserve before habitat manipulation activities are designed and implemented.

The Metolius LSRA was completed and approved by the Regional Ecosystem Office in 1996. Relevant portions of the LSRA were used in the development of the Eyerly Salvage Project.

Guidelines for Salvage

Salvage of dead trees is based on the following standards and guidelines, and is subject to review by the Regional Ecosystem Office. REO may develop criteria that would exempt some activities from review. Salvage of dead trees is not generally considered a silvicultural treatment within the context of these standards and guidelines. Salvage guidelines are intended to prevent negative effects on late-successional habitat, while permitting some commercial wood volume removal. C13

1. The potential for benefit to species associated with late-successional forest conditions from salvage is greatest when stand-replacing events are involved. Salvage in disturbed sites of less than 10 acres is not appropriate because small forest openings are an important component of old-growth forests. In addition, salvage should occur only in stands where disturbance has reduced canopy closure to less than 40 percent, because stands with more closure are likely to provide some value for species associated with these forests. Treatments should be designed to provide effective fuel breaks wherever possible (C13-14).

The project does not propose to salvage in disturbed sites that are less than 10 acres. The preferred alternative proposes to salvage only in stands with post-disturbance crown closures that are less than 40 percent. Due to the topography of the Eyerly Fire area fuel breaks were not considered to be an effective treatment. The general topography of the area is a constant slope from the Metolius River to Green Ridge, mid-slope fuel breaks would likely not affect fire behavior nor afford a safe anchor point from which to engage a wildfire.

2. The scale of salvage and other treatments should not generally result in degeneration of currently suitable NSO habitat or other LS conditions (C-13).

There are no proposed treatment units within suitable northern spotted owl habitat or late successional forests. The preferred alternative will not result in the degeneration of

suitable spotted owl habitat or other late successional conditions. Within the Eyerly Fire area there is no suitable NSO habitat.

3. Management following a stand-replacement event should be designed to accelerate or not impede the development of late successional forests. In all cases, planning for salvage should focus on long-range objectives, which are based on desired future condition of the forest (C 13-14).

The Metolius LSRA specifies fuel levels that are suitable for late successional species and that are sustainable for fire-adapted ecosystems. The action alternative provides for rapid establishment of tree species and sizes important for the management of these species first, and attainment of the other attributes such as multiple canopy structure for NRF will develop over time. The action alternatives will meet or exceed the snag and down woody debris requirements described in the Metolius LSRA (see “6.” below).

4. Surviving trees will provide a significant residual of larger trees in the developing stand. In addition, defects caused by fire in residual trees may accelerate development of structural characteristics suitable for associated species. Also, those damaged trees that eventually die will provide additional snags. Consequently, **all standing live trees should be retained**, including those injured (e.g., scorched) but likely to survive. Inspection of the cambium layer can provide an indication of potential tree mortality. C14

Only dead trees will be removed. Fire injured trees will be left to meet LSRA guidelines for retention of large snags and to provide structural characteristics suitable for associated species.

5. Snags provide a variety of habitat benefits for a variety of wildlife species associated with late-successional forests. Accordingly, **following a stand-replacing disturbance, management should focus on retaining snags that are likely to persist until late-successional conditions have developed and the new stand is again producing large snags**. Late-successional conditions are not associated with stands less than 80 years old. Remove conservative quantities of salvage and retain management opportunities (C-14).

Page 31 of the FEIS describes snag retention levels by diameter class in harvest units under Alternative 2. In areas treated in the LSR within the mixed-conifer wet plant association group, 85% of the snags retained are over 15” dbh and within the mixed-conifer dry plant association 83% are over 15” dbh. In the ponderosa pine wet 78% are over 15’dbh and in the ponderosa pine dry 100% of the snags retained are over 15’dbh. Under Alternative 2, approximately 71% of the LSR within the Eyerly Fire area would remain untreated.

Table 3.17-1. Metolius LSR Snag Objectives

Size Class (diameter in inches)	Metolius LSRA Snag Levels			
	Mixed Conifer–Wet	Mixed Conifer–Dry	Ponderosa Pine–Wet	Ponderosa Pine–Dry
10 –14.9	1.92	1.04	.96	0
15-19.9	3.0	1.07	1.04	.74
20-24.9	3.0	1.07	1.04	.74
25+	5.0	3.33	1.33	1.0
Total	12.92	6.51	4.37	2.48

Estimates of the changes in average snag levels resulting from the preferred alternative are displayed in the table below. These are estimates for the entire Eyerly area and illustrates the level of salvage proposed. Salvage treatment within the LSR will retain snags at the levels shown above. The values shown below are an average per acre over the entire fire area, excluding non-forest types.

Table 3.17-2. Estimated Change in Dead Trees

PAG	Existing Condition			Alternative 2			% Change		
	9 – 16"	16-21"	>21"	9 – 16"	16-21"	>21"	9 – 16"	16-21"	>21"
PPD	25.7%	5.8%	3.2%	18.0%	3.9%	2.6%	30%	33%	19%
PPW	24.1%	6.6%	5.1%	8.3%	3.2%	3.5%	66%	52%	31%
MCD	25.2%	4.7%	3.7%	15.1%	2.8%	2.7%	40%	40%	27%
MCW	26.7%	5.8%	4.5%	9.7%	3.1%	3.9%	64%	47%	13%

Additional analysis of snag levels is provided in Appendix A. The analysis includes comparison using the DecAID wood advisor, projections over time and information over the entire Eyerly Fire landscape.

6. **Following a stand-replacing disturbance, management should retain adequate coarse woody debris quantities in the new stand so that in the future it will still contain amounts similar to naturally regenerated stands.** The analysis that determines the amount of coarse woody debris to leave must account for the full period of time before the new stand begins to contribute coarse woody debris. As in the case of snags, province-level specifications must be provided for this guideline. Because coarse woody debris decay rates, forest dynamics, and site productivity undoubtedly will vary among provinces and forest types, the specifications also will vary. Province-level plans will establish appropriate levels of coarse woody debris and decay rates to be used. Levels will be "typical" and will not require retention of all material where it is highly concentrated, or too small to contribute to coarse woody debris over the long timeframes discussed. This standard and guideline represents one item to be considered and may indeed result in no salvage following windthrow in low density stands. As for other management activities, it is expected that salvage standards and guidelines will be refined through the implementation and adaptive management processes. C14-15

Down woody material standards for the Metolius LSR are addressed in the Metolius LSRA (USDA 1996) as fuel loading in tons per acre for both suitable and sustainable conditions. Suitable habitat contains snags and down wood along with canopy cover, canopy layers, and live trees per acre. Sustainable fuel loading reflects a low to medium fire hazard (Metolius LSRA, p. 56).

Within the LSR down wood elements described for sustainable conditions under Fire Climax will be used as the standard and guideline for this analysis. Conditions for down wood relate to fuel loading and may have a direct effect on the potential for high intensity wildfire in the future as these stands develop. For analysis purposes tons per acre were converted to percent down wood cover to compare LSR standards against DecAID numbers.

Materials used for conversion of tons per acre to percent down wood cover:

- **Tons per acre were converted using linear regression tables from DecAID.**
- **The assumption used in the conversion of tons per acre to percent down wood cover is that the dry weight of down wood is 30 lbs/ft³.**
- **DecAID numbers for Mixed Conifer Dry and Wet were compared to the Eastside Mixed Conifer within the Blue Mountains small to medium tree forest inventory plots, while the ponderosa pine wet and dry used small to medium tree ponderosa pine and Douglas-fir.**

Table 3.17-3. Metolius LSRA down wood compared to DecAID percent down wood cover

PAG	LSRA Down Wood in tons per acre	LSRA Down Wood converted to percent down wood cover	30% TL for percent down wood cover	50% TL for percent down wood cover	80% TL for percent down wood cover
MCW (Climatic)	25 – 35 tons/ac	4.77	1.9	3.1	5.9
MCD (Fire Climax)	8 – 12 tons/ac	2.29	1.9	3.1	5.9
PPW (Fire Climax)	6 – 10 tons/ac	1.84	0.9	1.4	3.0
PPD (Fire Climax)	5 – 8 tons/ac	1.47	0.9	1.4	3.0
Note: Bold numbers indicate tons per acre that will be met as standards and guidelines for the LSR.					

Additional analysis of down wood is provided in Appendix A. The analysis includes comparison using the DecAID wood advisor, projections over time and information over the entire Eyerly Fire landscape. Salvage treatment within the LSR will retain coarse woody debris at the levels shown above.

7. **Some salvage that does not meet the preceding guidelines will be allowed when salvage is essential to reduce the future risk of fire or insect damage to late-successional forest conditions.** This circumstance is most likely to occur in the eastern Oregon Cascades, eastern Washington Cascades, and California Cascades Provinces, and somewhat less likely to occur in the Oregon Klamath and California Klamath Provinces. It is important to understand that some risk associated with fire and insects is acceptable because they are natural forces influencing late-successional forest development. Consequently, salvage to reduce such risks should focus only on those areas where there is high risk of large-scale disturbance. C15

All proposed salvage treatment meets the preceding guidelines.

8. **Removal of snags and logs may be necessary to reduce hazards to humans along roads and trails, and in or adjacent to campgrounds.** Where materials must be removed from the site, as in a campground or on a road, a salvage sale is appropriate. Also, material will be left where available coarse woody debris is inadequate. C15

The preferred alternative includes the conservative removal of hazard trees along main roads and haul routes in the project area. Down logs existing prior to the wildfire would remain.

9. **Where green trees, snags, and logs are present following disturbance, the green-tree and snag guidelines will be applied first, and completely satisfied where possible.** The biomass left in snags can be credited toward the amount of coarse woody debris biomass needed to achieve management objectives. C15

In units where green trees, snags, and logs are present, green tree and snag guidelines described in the Metolius LSRA will be met or exceeded.

10. These basic guidelines may not be applicable after disturbances in younger stands because remnant coarse woody debris may be relatively small. In these cases, diameter and biomass retention guidelines should be developed consistent with the intention of achieving late-successional forest conditions. C15

No commercial salvage activity would occur in these areas. However, proposed planting of species necessary for long-term objectives in these areas would achieve these conditions.

11. Logs present on the forest floor before a disturbance event provide habitat benefits that are likely to continue. It seldom will be appropriate to remove them. Where these logs are in an advanced state of decay, they will not be credited toward objectives for coarse woody debris retention developed after a disturbance event. Advanced state of decay should be defined as logs not expected to persist to the time when the new stand begins producing coarse woody debris.
12. *No CWD existing prior to the fire would be removed. Stands in the project area were fire adapted and activities are designed to replicate those conditions. Page 41 of the FEIS describes project design elements common to the action alternatives:*
 - *For all units within Matrix and Eastside Screens, leave a minimum of 120 linear feet of logs per acre greater than or equal to 16" in diameter and 16 feet long will be retained in regeneration units whenever possible. Down wood will represent the species composition of the stand. Decay class 1 and 2 logs can be counted toward this total (NWFP ROD C-40).*
 - *Down woody material already on the ground will be retained and protected to the greatest extent possible from disturbance during treatment (e.g. fuels treatments and yarding) which might otherwise destroy the integrity of the substrate (NWFP ROD C-40).*

In addition, large down logs will be provided as un-harvested snags fall over time.

13. **Coarse woody debris retained should approximate the species composition of the original stand to help replicate preexisting suitable habitat conditions.** C15

No CWD existing prior to the fire would be removed. Within salvage units, coarse woody debris levels will approximate preexisting suitable habitat conditions (see "6." above for more information).

Some deviation from these general guidelines may be allowed to provide reasonable access to salvage sites and feasible logging operations. Such deviation should occur on as small a portion of the area as possible, and should not result in violation of the basic intent that late-successional forest habitat or the development of such habitat in the future

should not be impaired throughout the area. While exceptions to the guidelines may be allowed to provide access and operability, some salvage opportunities will undoubtedly be foregone because of access, feasibility, and safety concerns. C15-16

The project's purpose is to facilitate development of LOS and protect the regenerated forests. Where access is limited, advanced systems were incorporated to minimize construction of temporary roads; however, about 1 mile of temporary road would be constructed in the LSR. The temporary road would be closed and rehabbed immediately after use and would not impair the development of LSR habitat.

4.0 PREPARERS AND CONTRIBUTORS

NEPA requires the listing of names of persons primarily responsible for providing analysis and preparing the DEIS, along with expertise, experience, and professional disciplines.

Preparers		
Name	Position/ Contribution	Background (Education/ Experience)
Kathy Baker-Katz	GIS Coordinator/ Creation of polygon maps and data query assistance for project analysis	
Todd Chaponot	Writer-Editor/ Assistant Writer & Editor	Studied Journalism and Technical Communications at Chemeketa CC 2000-2001, Central Oregon CC 2001-2002; Military service, writing-editing regulations and standards (8 years); Defense contractor, writing lesson plans and instructing military operations, writer-editor for scientific projects, and providing website support (4 years); Oregon Department of Transportation administrative and website support for NEPA and Highway Safety Act projects (1 year); Forest Service Writer-Editor (2 years).
Rick Dewey	Botanist/ Botanical Resource Analysis	B.S. in Zoology, San Diego State U., 1969; B.S. in Natural Resources, Humboldt State U., 1975; M.A. in Biology, Humboldt State U., 1980; Ph.D. in Botany, Texas A&M U., 1986. Member of faculties of Southwest Texas State U., TX, Ft. Hays State U., KS, and Central Oregon Community College, 1988-1996. Seasonal Biological Technician on Nez Perce N.F. 1976-1978. Assistant Forest Botanist on Deschutes N.F. 1997 to present.
Andris Eglitis	Entomologist/ Insect and Decay Input	B.S. degree in Forest Management from Colorado State University, 1969. Master of Science degree in Forest Entomology from University of Washington, 1974. Doctor of Philosophy degree in Forest Entomology from University of Washington, 1980. U. S. Peace Corps volunteer in Chile from 1969 to 1973 working at the University of Chile, Santiago, teaching forest entomology and establishing a national pest detection survey system. Has over 25 years of experience in forest entomology with the U.S. Forest Service including Alaska Region (1979-1989) and Pacific Northwest Region (1989-present). Currently provides technical assistance, training and technology transfer in forest entomology to four national forests (Deschutes, Ochoco, Winema, Fremont), two Bureau of Land Management Districts (Lakeview, Prineville), Warm Springs Indian Reservation, and Crater lake National Park. Has worked extensively on wood import pest risk assessments from several countries including Mexico, Chile, Argentina, Mexico and Australia.

Preparers		
Name	Position/ Contribution	Background (Education/ Experience)
Paul Engstrom	Recreation Planner/ Recreation Resource Input	B.S. degree in Recreation Land Management from Northern Arizona University, 1970. Has more than 30 years of experience with the Forest Service and the National Park Service. Assignments include Park Ranger at Kennesaw Mountain National Battlefield (3 years), Assistant Director and Director of the Lava Lands Visitor Center (11 years). Outdoor Recreation Planner and Wilderness, Trails, and Winter Sports Program Manager for the Sisters Ranger District (1985-2003).
Alan Heath	Hazard Tree Analysis/ Resource Analysis	
Kris Hennings	Wildlife Biologist/ Core IDT	B.S. degree in Wildlife Resources from the University of Idaho, 2001. Two years of professional forestry experience.
Ray Horgen	Road Manager/ Transportation Input	Associate Liberal Arts, Associate Technical Arts (Highway/Civil); 26 years professional engineering experience.
Brad Houslet	Fisheries/ Fish Habitat Input	B. S. degree in Water Resources and Aquatic Biology from Univ. Wis. Stevens Point, 1990. M. S. degree in Biology from Tennessee Technological University, 1996 Thesis title "Age, Growth and Stability of a mussel assemblage in Horse Lick Creek, Kentucky". Have worked on the Hiawatha, Deschutes and Ochoco National Forests. District fisheries biologist for Crescent Ranger District, Deschutes National Forest from 2000 to 2003, District fisheries biologist on Sisters Ranger District, Deschutes National Forest, 1999 to 2000. Currently, a fisheries biologist for the Deschutes and Ochoco National forests providing project support across the two forests.
Cari McCown	Hydrologist/ Core IDT	M.S. degree in Watershed Science from Colorado State University, 2001. B.A. degree in Earth Resources / Russian. USFS hydrologist from 2000 to present including assignments at the Umatilla and Deschutes National Forests. Currently serves as a Deschutes National Forest hydrologist out of the Sisters Ranger District.
Kirk Metzger	Fuels Technician/ Fuels Planner & Core IDT	Studied Forestry at Yavapai CC 1972-1975, Northland Pioneer CC 1979-1983, Has 33 years experience in Fire, Timber, Range, Cultural Resources, Special Forest Products, Wilderness Management, River Management and Fuels Management. Service included assignments on the Prescott National Forest, Apache-Sitgreaves NF, Mt Hood NF, Prineville BLM, and Deschutes NF. Currently serves as Fuels Planner for Central Oregon Fire Management, Cascade Division North.

Preparers		
Name	Position/ Contribution	Background (Education/ Experience)
Dave Owens	Project Lead/ Core IDT & Writer-Editor	B.S. degree in Forest Management from Utah State University, 1973. Certified Silviculturist from 1984 to 1999 after completing Silviculture Institute. Has over 30 years of experience with the Forest Service including assignments on the Cleveland, Coconino, Fremont, Umatilla and Ochoco National Forests. Fire Management Officer for Prineville Ranger District and Crooked River National Grassland from 1994 to 2000. Currently serves as Fire Planner for Central Oregon Fire Management.
Rob Schantz	Silviculturist/ Salvage Proposals, Unit Design, Logging Systems & Core IDT	B.S. Forest Management, Oregon State University, 1981. M.F. Forest Science (Silviculture), Oregon State University, 1986. Fire Regime-Condition Class Certification, USDA-USDI FRCC, May, 2004. Approx. 20 years experience in silvicultural prescription writing, logging systems, project design, NEPA, and large area analysis.
Peter Sussmann	Soil Scientist/ Soil Input & Core IDT	B.S. Agronomy/Soils University of Illinois, 1986. USDA Forest Service Soil Scientist, Deschutes National Forest, 1992-1998. Field Soil Scientist, Interagency Riparian Classification, 2000-2002. Soil Scientist, Deschutes National Forest, 2002-2004.
Dorothy Thomas	GIS Coordinator/ Creation of polygon maps and data queries for project analysis and Geodatabase data.	A.A. Geographic Information Systems, Central Oregon CC, 1996. B.S. Environmental Sciences: Natural Resource Mgmt., Oregon State University, 2000. 11 years professional experience in GIS systems.
Ronnie Yimsuit	Landscape Architect/ Scenic Views Input	B.S. Landscape Architecture; 15 years professional experience in public practice.
Donald Zettel	Archaeologist/ Cultural Resource Input	B.A. Anthropology; 16 years professional experience; 15 years with the Forest Service.

Contributors	
Name	Contribution
Robert Alvarado	Wildlife Resource Input
Sarah Crim	NEPA Input
Dick Cozby	Timber Sale Planning
Jill Dufour	NEPA Input
Louisa Evers	Project Design, Fire/Fuels Ecology Input
Jery Ferguson	NEPA Input
Bob Flores	Plan to Project, Project Design, ID Team Support
Shane Jeffries	Wildlife Resource Input
Tom Mafera	NEPA Input
Rod Kubitza	Transportation System Input
McCammon	Hydrology Input
Dave Heller	Fisheries/Hydro Input
Kris Martinson	Recreational Resource Analysis
Chris Mickle	Multiple Resource Input
Maret Pajutee	Botanical Resource Input
Dave Priest	Fuels and Landscape Input
Doug Shank	Soil Science, Geology Input, Unit Layout Assistance
Jon Stewart	Social Effects, Environmental Justice Input
Heidi Suna	Botanical Analysis
Lauri Turner	Wildlife Resource Input
Slater Turner	Timber Sale Planning
Deborah Quinlan	GIS Support
Jeff Uebel	Fisheries/Hydro Input
Audrey Watkins	Administrative Support, Project Mailing

APPENDIX A: GLOSSARY OF ABBREVIATIONS AND TERMS

❖ Abbreviations

AMP	Allotment Management Plan
ASQ	Allowable Sale Quantity
ATV	All Terrain Vehicle
AUM	Animal Unit Month
BA	Biological Assessment
BAER	Burned Area Emergency Rehabilitation
BMP	Best Management Practice
BO	Biological Opinion
CE	Categorical Exclusion
CFR	Code of Federal Regulations
CFWS	Confederated Tribes of Warm Springs
CVS	Current Vegetation Survey
CY	Calendar Year
DBH	Diameter Breast Height
DFC	Desired Future Condition
DNF	Deschutes National Forest
DOG	Designated Old Growth
DST	Dead Standing Tree
EA	Environmental Analysis
EIS	Environmental Impact Statement
ESA	Endangered Species Act
ESU	Evolutionary Significant Unit
EVG	Existing Vegetation
FLIR	Forward-Looking Infrared Radar
FR	Forest Road
FSEIS	Final Supplement Environmental Impact Statement
FSH	Forest Service Handbook
FSM	Forest Service Manual
FSR	Forest Service Representative
FY	Fiscal Year
GIS	Geographic Information System
GRT	Green Replacement Trees
HEI	Habitat Effectiveness Index
HRV	Historic Range of Variability
HUC	Hydrologic Unit Code
IIT	Implementation Monitoring Module
IIT	Interagency Implementation Team
KV	Knutson-Vandenberg Act
LAC	Levels of Acceptable Change
LOS	Late Old Structure
LRMP	Land Resource Management Plan
LWM	Large Wood Material
MAL	Malheur National Forest
MBF	Thousand Board Feet

MMBF	Million Board Feet
MEL	Most Efficient Level
MIS	Management Indicator Species
MMBF	Million Board Feet
MMCF	Million Cubic Feet
MOU	Memorandum of Understanding
NEPA	National Environmental Policy Act
NF	National Forest
NFMA	National Forest Management Act
NFMAS	National Fire Management Analysis System
NMFS	National Marine Fisheries Service
NOI	Notice of Intent
NRIS	Natural Resource Information System
ODEQ	Oregon Department of Environmental Quality
ODFW	Oregon Department of Fish and Wildlife
ORV	Off Road Vehicle
PAOT	Persons At One Time
PFC	Proper Functioning Condition
PIG	Columbia River Basis Anadromous Fish Policy Implementation Guide
POO	Plan of Operation
PVG	Potential Vegetation Group
RD	Ranger District
RHCA	Riparian Habitat Conservation Areas
RNA	Research Natural Area
ROD	Record of Decision
ROG	Replacement Old Growth
RPA	Forest and Rangeland Renewable Resources Planning Act
Rx	Prescribed
S&G	Standard and Guideline
SMO	State Management Objective
SMU	State Management Unit
SRD	Sisters Ranger District
T/E	Threatened and Endangered
TMDL	Total Maximum Daily Load
TSPQ	Total Sale Program Quantity
UMA	Umatilla National Forest
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
VQO	Visual Quality Objective
WAW	Wallowa-Whitman National Forest
WRS	Wilderness Resource Spectrum
WTY	Whole Tree Yarding

❖ Terms

Activity fuels – Fuels generated during implementation of various projects.

Age Class- A distinct group of trees recognized on the basis of age.

Allotment – Area of land on which grazing may be allowed by permit.

Allotment Management Plan – The document which contains the action program needed to manage the rangeland resource for livestock grazing with consideration given to soil, watershed, wildlife, recreation, timber, and other resources on lands within a range allotment.

Allowable Sale Quantity (ASQ) - The quantity of timber that may be sold from the area of suitable land covered by the Forest Plan for a time period specified by the plan. This allowable sale quantity (ASQ) is usually expressed on an annual basis as the "average annual allowable sale quantity" (FSM 1900). For timber resource planning purposes, the allowable sale quantity applies to each decade over the planning horizon and includes only chargeable volume. Consistent with the definition of timber production, do not include fuelwood or other non-industrial wood in the allowable sale quantity.

Anadromous Fish – Those species of fish that mature in the sea, and migrate in to streams to spawn.

Anchor Point – A location advantageous to a wildland firefighter from which to start fireline construction to minimize the chance of being out flanked by the fire while the line is being built. Generally, an anchor point should be, or have immediate access to, a safety zone.

Bark Beetle – An insect that bores through the bark of forest trees to eat the inner bark and lay its eggs.

Berm - A barrier, such as an earthen mound or concrete structure, placed across a road to permanently restrict the road from use by wheeled motorized vehicles.

Best Management Practices – Practice designed to prevent or reduce water pollution.

Big Game – Large mammal species (deer, elk, bear) normally managed for sport hunting.

Biological Assessment (BA) – A document prepared by a federal agency for the purpose of identifying any endangered or threatened species that is likely to be affected by and agency action. This document facilitates compliance with the Endangered Species Act.

Canopy - The more or less continuous cover of branches and foliage formed collectively by the crowns of adjacent trees.

Capability – The potential of an area of land/or water to produce resources, supply goods and services, and allow resource uses under a specified set of management practices and at a given level of management intensity.

Catastrophic Wildfire – Uncharacteristic wildfire events defined by excessive accumulation of vegetation that forms fuels for such fires. Fuels are accumulating, in large part, because for decades the agency has suppressed fire in forests where frequent, low-intensity fires historically removed such accumulations (USGAO/T-RCED-99-241). See also Uncharacteristic Wildfire

Classified Road – Roads wholly or partially within or adjacent to National Forest System Lands that are determined to be needed for long-term motor vehicle access, including State roads county roads, privately owned roads, National Forest System roads, and other roads authorized by the Forest Service.

Condition Class - Condition classes are a function of the degree of departure from historical fire regimes resulting in alterations of key ecosystem components such as species composition, structural stage, stand age, and canopy closure. Current Condition Classes are defined in terms of the relative risk of losing one or more key components that define an ecological system based on five ecosystem attributes: 1) Disturbance regimes (patterns and frequency of insect, disease, fire, etc); 2) Disturbance agents, smoke production; 3) hydrologic function (sedimentation, stream flow, etc); and 4) Vegetative attributes (composition, structure, and resilience to disturbance agents).

The three Condition Classes are categorized as:

Class- 1 Maintenance- Historical ecosystem attributes are largely intact and functioning as defined by the Historical Natural Fire Regime. Forested areas with an historically short fire return interval usually have frequent fires of low intensity. Areas with an historically long fire return interval have few fires.

Class- 2 Restoration- Historical ecosystem attributes have been moderately altered as defined by the Historical Natural Fire Regime. One or more fire return intervals have been missed, possibly resulting in increased fire sizes and intensities and decreased landscape mosaics and diversity.

Class- 3 Conversion- Ecosystem attributes have been significantly altered as defined by the Historical Natural Fire Regime. Multiple fire return intervals have been missed resulting in dramatic departure from historical conditions. (Hardy, et al.)

Conifer – A tree that produces cones, such as a pine, spruce or fir tree.

Consultation – A process required by Section 7 of the Endangered Species Act whereby federal agencies proposing activities in a listed species habitat confer with the U.S. Fish and Wildlife Service about the impacts of the activity on the species. Consultation may be informal, and thus advisory, or formal, and thus binding.

Crown – The part of a tree, or other woody plant, bearing live branches and foliage.

Crown Fire - A fire that advances through the crown fuel layer normally in direct conjunction with a surface fire. Three categories of crowning are recognized (passive, active, and independent): they are determined by three crown fuel properties (live crown base height, foliar moisture content and bulk density); and two characteristics of fire behavior (spread rate, and surface intensity). Alexander, M.E. 1987. Help With Making Crown Fire Hazard Assessments.

Cultural Resource – The physical remains (artifacts, objects, structures, etc.) of past human activities.

Cumulative Effects – The impact on the environment, which results from the incremental impact of the action when added to other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time or space.

Dead Fuels – Dry, dead parts of trees and vegetation classified according to the time it takes them to gain or lose moisture in response to wetting or drying cycles, which varies with size (diameter) and other factors of the fuel.

Decommission – In terms of this document, this term means to change a road so that it no longer functions as a road or trail.

Density (Stand) – The number of trees growing in a given area usually expressed in terms of trees per acre.

Desired Future Condition – Description of what the Forest should be like, given implementation of Forest Plan direction.

Developed Recreation – Recreation that requires facilities, resulting in a concentrated use of an area. An example of a developed recreation site is a campground. Facilities might include roads, parking lots, picnic tables, toilets, drinking water, and buildings.

Diameter Breast Height (DBH) – Tree diameter, measured 4.5 feet above the ground.

Direct Attack – A fire wildland firefighting suppression strategy. Line is constructed adjacent to the fire perimeter: usually the preferred method, because of immediate access to escape routes and safety zones. Used when fire behavior, weather and fuel permit. Directly related to individual experience, escape routes and safety zones. Usually involves burnout of interior fuels as the line construction progresses or the fire is allowed to burn into the fire line.

Direct Effect – Effects on the environment that occur at the same time and place as the initial cause or action.

Dispersed Recreation – Recreation use outside developed recreation sites. Scattered, individual outdoor recreation activities. This includes activities such as scenic driving, hiking, bicycling, backpacking, hunting, fishing, snowmobiling, horseback riding, cross-country skiing, and recreation in primitive environments.

Disturbance (Ecosystem) – Refers to events (either natural or human caused) that alter the structure, composition, or function of terrestrial or aquatic habitats.

Disturbance Regime – Natural patterns of periodic disturbances, such as fire or flooding.

Diversity – The distribution and abundance of different plant and animal communities and species.

Duff – The partially decayed organic matter on the forest floor, commonly less than 3-inches in diameter.

Early Seral – A stage of development of an ecosystem from a disturbed, relatively unvegetated state, to a plant community that is up to about 30 years old. Stand structure is seedling and sapling sized.

Eastside Screens – Regional Forester's Forest Plan Amendment (June 1995) designed to maintain options for old growth related and other species.

Ecological Integrity – The quality of a natural unmanaged or managed ecosystem in which the natural ecological processes are sustained, with genetic species and ecosystem diversity assured for the future.

Ecosystem – A functional unit consisting of all the living organisms in a given area, and all of the non-living physical and chemical factors of their environment, linked together through nutrient cycling and energy flow. An ecosystem can be of any size, but it always functions as a whole unit.

Edge Effects – Changes in ecological communities due to the rapid creation of abrupt edges in large patches of previously undisturbed habitat.

Effects – impacts resulting from actions that may have beneficial or detrimental consequences. Effects are ecological (such as the effects on natural resources and on the components, structures, and functioning of affected ecosystems), aesthetic, historical, cultural, economic, social, or health, whether direct, indirect, or cumulative.

Endangered species - A plant or animal that is in danger of extinction throughout all or a significant portion of its range. Endangered species are identified by the Secretary of the Interior in accordance with the Endangered Species Act of 1973.

Endemic – A species whose natural occurrence is confined to a certain region and whose distribution is relatively limited.

Environmental Assessment (EA) - EAs were authorized by the National Environmental Policy Act (NEPA) of 1969. They are concise, analytical documents prepared with public participation that determine if an Environmental Impact Statement (EIS) is needed for a particular project or action. If an EA determines an EIS is not needed, the EA becomes the document allowing agency compliance with NEPA requirements.

Environmental Impact Statement (EIS) – A document prepared by a Federal agency in which anticipated environmental effects of a planned course of action or development are evaluated. A Federal statute (section 102 of the National Environmental Policy Act of 1969) requires that such statements be prepared. It is prepared first in draft or review form, and then in a final form. An impact statement includes the following points: (1) the environmental impact of the proposed action, (2) any adverse impacts which cannot be avoided by the action, (3) the alternative courses of action, (4) the relationships between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity, (5) a description of the irreversible and irretrievable commitment of resources which would occur if the action were accomplished.

Escape Route - A means in wildland firefighting to access a safety zone.

Extreme Fire Behavior - "Extreme" implies a level of fire behavior characteristics that ordinarily precludes methods of direct control action. One or more of the following is usually involved: high rate of spread, prolific crowning and/or spotting, presence of fire whirls, strong convection column. Predictability is difficult because such fires often

exercise some degree of influence on their environment and behave erratically, sometimes dangerously.

Fine Fuels - Fast-drying fuels, generally with a comparatively high surface area-to-volume ratio, which are less than 1/4-inch in diameter and have a time lag of one hour or less. These fuels readily ignite and are rapidly consumed by fire when dry.

Fire Behavior – How fire reacts to the influences of fuel, weather and topography.

Fire Intensity - A general term relating to the heat energy released by a fire.

Fire Line - A linear fire barrier that is scraped or dug to mineral soil.

Fire Management Plan - A strategic plan that defines a program to manage wildland and prescribed fires and documents implementation strategies for the fire management program in the approved Forest Land and Resource Management plan alternative. The Fire Management Plan is supplemented by operational plans, such as preparedness, dispatch, prescribed fire and prevention plans.

Fire Regimes - The the ecological effects of frequency, intensity, extent, season, and synergistic interactions with other disturbances, such as insects and disease, classified into generalized levels of fire severity.

The five natural (historical) fire regimes are classified based on average number of years between fires (fire frequency) combined with the severity (amount of replacement) of the fire on the dominant overstory vegetation. These five regimes include:

- I** – 0-35 year frequency and low (surface fires most common) to mixed severity (less than 75% of the dominant overstory vegetation replaced);
- II** – 0-35 year frequency and high (stand replacement) severity (greater than 75% of the dominant overstory vegetation replaced);
- III** – 35-100+ year frequency and mixed severity (less than 75% of the dominant overstory vegetation replaced);
- IV** – 35-100+ year frequency and high (stand replacement) severity (greater than 75% of the dominant overstory vegetation replaced);
- V** – 200+ year frequency and high (stand replacement) severity.

Fire Risk – The probability or chance of fire starting determined by the presence and activities of causative agents.

Fire Severity – A relative measure of the post-fire appearance of vegetation as it relates to the intensity of the fire and the consumptive effects on vegetation.

Fire Suppression (Fire Control) - All of the work and activities connected with fire extinguishing operations, beginning with discovery and continuing until the fire is completely extinguished.

Firefighter Safety - A work environment where foreseeable risks have been minimized through the mitigation of known hazards associated with wildfire suppression.

Fish Habitat – The place where a population of fish species lives and the surroundings; includes the provision of life requirements such as food and cover.

Fishery – The total population of fish in a stream or body of water, and the physical, chemical and biological factors affecting that population.

Forbs - A plant with a soft, rather than permanent woody stem, that is not a grass or grass-like plant.

Forest Health – The condition in which forest ecosystems sustain their complexity, diversity, resiliency, and productivity while providing for human needs and values.

Forest Land and Resource Management Plan (FLRMP) – The Land and Resource Management Plan, which gathers and coordinates the direction to be followed in the overall management of the forest. Included in the plan are applicable national and regional management directions.

Forest Supervisor – The official who is responsible for administering the National Forest System lands in a Forest Service Administrative unit, which may consist of one or more National Forests.

Fuel - Combustible material that includes vegetation such as grass, leaves, ground litter, plants, shrubs and trees. (See Surface Fuels.) Includes both living plants; dead, woody vegetative materials; and other vegetative materials which are capable of burning.

Fuel Break - A zone in which fuel quantity has been reduced or altered to provide a position for suppression forces to make a stand against wildfire. Fuel breaks are designated or constructed before the outbreak of a fire. Fuel breaks may consist of one or a combination of the following: Natural barriers, constructed fuel breaks, man-made barriers.

Fuel Loadings - The oven dry weight of fuels in a given area, usually expressed in tons per acre. Fuel loadings may be referenced to fuel size or time lag categories; and may include surface fuels or total fuels. The amount of fuel present expressed quantitatively in terms of weight of fuel per unit area.

Fuel Management – Manipulation or reduction of flammable matter for the purpose of reducing the intensity or rate of spread of a fire, while preserving and enhancing environmental quality.

Fuel Reduction - Manipulation, including combustion or removal of fuels, to reduce the likelihood of ignition and/or to lessen potential damage and resistance to control.

Geographic Information System (GIS) – Computer software that provides database and spatial analytic capabilities.

Ground Fuels - All combustible materials below the surface litter layer. These fuels may be partially decomposed, such as forest soil organic layers (duff), dead moss and lichen layers, punky wood, and deep organic layers (peat), or may be living plant material, such as tree and shrub roots (Miller 1994).

Hazard - Any real or potential condition that can cause injury, illness, or death of personnel, or damage to or loss of equipment or property.

Hazard Reduction - Any treatment of a hazard that reduces the threat of ignition and fire intensity or rate of spread.

Heavy Fuels - Fuels of large diameter such as snags, logs, large limb wood, that ignite and are consumed more slowly than light fuels.

Herbivore – An animal that feeds on plants.

Heritage Resource – Any definite location of past human activity identifiable through field survey, historical documentation or oral evidence. This includes archeological and architectural sites or structures, and places of traditional cultural or religious importance to specified groups whether or not represented by physical remains.

Historic Range of Variability (HRV) – The natural fluctuation of ecological and physical processes and functions that would have occurred during a specified period of time. A range of conditions and processes likely to have occurred prior to settlement of the area by Euroamericans (about the mid-1800s).

Hydrologic – Pertaining to the quantity, quality, and timing of water yield.

Hydrologic Unit Code – A coding system used to map geographic boundaries of watersheds.

Indirect Effect – Secondary effects which occur in locations other than the initial action or significantly later in time.

INFISH - An inter-agency ecosystem management approach for maintaining and restoring healthy, functioning watersheds, riparian areas, and aquatic habitats within inland fishproducing watersheds in Eastern Oregon and Washington, Idaho, and portions of California.

Initial Attack – A wildland firefighting term describing aggressive suppression action consistent with firefighter and public safety and values to be protected.

Interdisciplinary Team (IDT) – A group of individuals with varying areas of specialty assembled to solve a problem or perform a task. The team is assembled out of recognition that no one discipline is sufficiently broad enough to adequately analyze the problem and propose action.

Interior Mature and Old Growth Forest Habitat – Mature habitat where the overstory is dominated by trees 21-32 inches dbh. For the sake of this analysis, interior mature and old growth forest habitat is in patches large enough to contain at least twenty acres that are a minimum of 400 feet from other habitat types.

Ladder Fuels - Fuels which provide vertical continuity between strata. Fire is able to carry from the surface fuels by convection into the crowns with relative ease.

Late Seral Stage – A later stage of development of an ecosystem. Forested stands are generally 12 to 20+ inches average DBH.

Light Fuels - Fast-drying fuels, generally with a comparatively high surface area-to-volume ratio, which are less than 1/4-inch in diameter and have a timelag of one hour or less. These fuels readily ignite and are rapidly consumed by fire when dry.

Limits of Acceptable Change (LAC) – Process to provide a framework for establishing acceptable and appropriate resource and social conditions (especially the amount and type of use) in wilderness settings.

Live Fuels - Living plants, such as trees, grasses, and shrubs, in which the seasonal moisture content cycle is controlled largely by internal physiological mechanisms, rather than by external weather influences.

Maintenance Levels (Transportation) - (operational and objective) as defined in Forest Service Handbook 7709.58- Transportation System Maintenance:

Level 1 - Assigned to roads of intermittent service during the period that they are closed to vehicular traffic. The closure period must exceed one year. Basic custodial maintenance is performed to keep damage to adjacent resources to an acceptable level and to perpetuate the road to facilitate future management activities. Emphasis is normally given to maintaining drainage facilities and runoff patterns. Planned road deterioration may occur at this level. Appropriate traffic management strategies are “prohibit” and “eliminate”.

Roads receiving level 1 maintenance may be of any type, class, or construction standard, and may be managed at any other maintenance level during the time they are open for traffic. However, while being maintained at level 1, they are closed to vehicular traffic, but may be open and suitable for nonmotorized uses.

Level 2 - Assigned to roads open for use by high-clearance vehicles. Passenger car traffic is not considered. Traffic is normally minor, consisting of one or a combination of the following: administrative, permitted, dispersed recreation, or other specialized uses. Log haul may occur at this level. Appropriate traffic management strategies are either to (1) discourage or prohibit passenger cars or (2) accept or discourage high-clearance vehicles.

Level 3 - Assigned to roads open and maintained for travel by a prudent driver in a standard passenger car. User comfort and convenience are not considered priorities.

Roads at this maintenance level are typically low-speed, single-lane with turnouts and spot surfacing. Some roads may be fully surfaced with either native or processed material. Appropriate traffic management strategies are either “encourage” or “accept”. “Discourage” or “prohibit” strategies may be employed for certain classes of vehicles or users.

Level 4 - Assigned to roads that provide a moderate degree of user comfort and convenience at moderate travel speeds. Most roads are double lane and aggregate surfaced. However, some roads may be single lane. Some roads may be paved and/or dust abated. The most appropriate traffic management strategy is “encourage”; however, the “prohibit” strategy may apply to specific classes of vehicles or users at certain times.

Level 5 - Assigned to roads that provide a high degree of user comfort and convenience. These roads are normally double lane, paved facilities. Some may be aggregate surfaced and dust abated. The appropriate traffic management strategy is “encourage.”

The distinction between maintenance levels is not always sharply defined. Some parameters overlap two or more different maintenance levels.

Management Action - Any activity undertaken as part of National Forest administration.

Management Area (MA) – An aggregation of capability areas that have common management direction, and may be dispersed over the Forest. Consists of a grouping of capability areas selected through evaluation procedures and used to locate decisions and resolve issues and concerns.

Management Strategy (MS) – Management practices and intensities selected and scheduled for application on a management area to attain multiple use and other goals and objectives.

Monitoring – The process of collecting information to evaluate if objectives and anticipated or assumed results of a management plan are being realized or if implementation is proceeding as planned.

Mosaic – A mix of stand structure and composition caused by disturbance. In the case of wildland fire the word depicts widely varying fire effects.

Municipal Supply Watershed – A watershed that provides water for human consumption where Forest Service management could have a significant effect upon the quality of water at the intake point and that provides water used by a community, or any other public water system that regularly serves at least 25 individuals at least 60 days out of the year or that provides at least 15 service connections.

National Environmental Policy Act (NEPA) of 1969 – An Act to declare a National policy which will encourage productive and enjoyable harmony between humans and the environment, to promote efforts which will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of humanity, to enrich the understanding of the ecological systems and natural resources important to the nation, and to establish a Council on Environmental Quality. (The Principal Laws Relating to Forest Service Activities, Agriculture Handbook NO. 453, USD, Forest Service, 359 pp.)

National Forest Management Act (NFMA) - A law passed in 1976 requiring the preparation of Regional Guides and Forest Plans and regulations to guide that development.

National Forest System – All national forest lands reserved or withdrawn from the public domain of the United States.

Native Species – Species that are indigenous to a region: not introduced or exotic.

Natural Regeneration – Renewal of a tree crop by natural seeding, sprouting, suckering, or layering.

Neotropical Migratory Birds – Migratory bird species that nest in North America and winter in Central or South America or in the Caribbean.

Notice of Intent (NOI) – A document required from any person proposing to conduct mineral related activities which might cause disturbance of surface resources.

Noxious Weed – A legal term, these are exotic plants regulated by law that are aggressive, difficult to manage, and invasive. These species may displace or significantly alter native plant communities.

Old Growth Forest – The Northwest Forest Plan (USDA, USDI, 1994) defines old growth forest habitat as stands with trees greater than 32-inch dbh, and significant amounts of dead wood and trees with large limbs, cavities and mistletoe brooms.

Off Road/Highway Vehicle (ORV, OHV) – Any vehicle capable of being operated off an established road or trail.

Outsloping – pulling road fill material back onto the roadbed to create an out-slope.

Overstory - The portion of the trees that form the uppermost canopy layer in a forest of more than one story.

PACFISH – An inter-agency ecosystem management approach for maintaining and restoring healthy, functioning watersheds, riparian areas, and aquatic habitats within the range of Pacific anadromous fish.

Partnership - In the context of these guidelines, partnerships are those alliances between individuals, groups and/or the Forest that enable road and trail maintenance or monitoring activities beyond those required for resource management access.

Partnerships:

1) Fosters good stewardship within the land management plan; 2) Are not exclusive but serve publics at large; 3) Benefit all parties involved.

Potential Vegetation Group – Groups of potential vegetation types (vegetation that will grow on a specific site), grouped on the basis of similar general moisture or temperature environment.

Prescribed Fire - The intentional application of fire to wildland fuels in either their natural or modified state under such conditions as allow the fire to be confined to a predetermined area and at the same time to produce the intensity of heat and rate of spread required to further certain planned objectives (i.e., silviculture, wildlife management, etc.). Any fire ignited by management actions under certain, predetermined conditions to meet specific objectives related to hazardous fuels or habitat improvement. A written, approved prescribed fire plan must exist, and NEPA requirements must be met, prior to ignition.

Prescription - Measurable criteria that define conditions under which a prescribed fire may be ignited, guide selection of appropriate management responses, and indicate other required actions. Prescription criteria may include safety, economic, public health, and environmental, geographic, administrative, social, or legal considerations.

Project – An organized effort to achieve an objective, identified by location, activities, outputs, effects, and time-period and responsibilities for execution.

Proper Functioning Condition (PFC) – Riparian-wetland areas are functioning properly when adequate vegetation, landform, or large woody debris is present to allow hydrologic processes to operate to provide aquatic and terrestrial habitat.

Protocol – A widely used and accepted device or technique. An acceptable and consistent way of doing something.

Public Involvement – A Forest Service process designed to broaden the information base upon which agency decisions are made by 1. Informing the public about Forest Service activities, plans and decisions, and 2. Encouraging public understanding about and participation in the planning processes leading to final decision-making.

Recontouring – pulling the excavated road back as near as possible to its original condition.

Reforestation – The renewal of forest cover by seeding, planting, and natural means.

Regeneration - The process of establishing a new tree crop on previously harvested land. The term also refers to the young crop itself.

Rehabilitation - The activities necessary to repair damage or disturbance caused by wildland fires or the fire suppression activity.

Riparian – A geographic area containing an aquatic ecosystem and adjacent upland areas that directly affect it. This includes floodplains, woodlands, and all areas within a specified distance from the normal line of high water of a stream channel, or from the shoreline of a standing body of water.

Road – A motor vehicle travelway over 50 inches wide, unless designated and managed as a trail. A road may be classified, unclassified, or temporary (36 CFR 212.1). Refer to Classified Road, Unclassified Road, and Temporary Road.

Road Construction, New – Activity that results in the addition of forest classified or temporary road miles. (36 CFR 212.1)

Road Decommissioning – To remove those elements of a road that reroute hill slope drainage, and present slope stability hazards. The road is stabilized to reduce potential for storm damage, and the need for maintenance. The road is no longer suitable for travel. Decommissioning includes putting a road in storage (storm proofing with dips, berms, waterbars, etc.) for later use. In some cases the road is obliterated, restoring the hydrologic function of the ground by decompacting the road surface, removing fills and culverts, revegetating etc. to never be used again.

Road Maintenance – The ongoing upkeep of a road necessary to retain or restore the road to the approved road management objectives. (FSM 7712.3)

Road Maintenance Levels – See *Maintenance Levels (Transportation)*.

Road Management Objective (RMO) – Defines purpose, use, operational and maintenance level of road based on resource management and access and travel management objectives.

Road Obliteration – Restoring the hydrologic function of the ground by decompacting the road surface, removing fills and culverts, re-vegetating, or other actions with the intent that the road will not be used again.

Road Reconstruction – Activity that results in improvement or realignment of an existing classified road.

Road Stabilization – A process to slope, dip and water bar roads thereby reducing run-off concentrations and alleviating the risk of erosion and landslides if designed drainage structures fail to carry storm runoff. This also includes grass-seeding slopes.

Road Upgrading – Includes erosion controls, road surface treatment to prevent dust and erosion, installing larger culverts and stabilizing fill slopes.

Roadless Area – A National Forest area which (1) is larger than 5000 acres, or if smaller than 5000 acres, contiguous to a designated wilderness or primitive areas; (2) contains no roads; and (3) has been inventoried by the Forest System for possible inclusion in the wilderness preservation system.

Redd – Spawning nest made by salmon or steelhead in the gravel bed of a river.

Safety Zone (SZ) - SZ are areas that are fuel free zones that are incapable of burning. They afford a very high degree of firefighter safety from advancing wildfire. They can be

natural or person made fire resistant areas such as lakes, dirt, gravel or asphalt parking lots, roads and areas burned to secure line.

Salvage – Harvest of trees that are dead, dying, or deteriorating due to fire, wind, insect or other damage or disease.

Scoping Process- Activities in the early stages of preparation of an environmental analysis to determine public opinion, receive comments and suggestions, and determine issues during the environmental analysis process.

Sediment – Solid material, both mineral and organic, that is in suspension, being transported, or has been moved from the site of origin by air, water, gravity, or ice.

Sensitive Species – Species that have appeared in the Federal Register as proposed for classification and are under consideration for official listing as endangered or threatened species, that are on an official State list, or that are recognized by the Regional Forester as needing special management to prevent their being placed on Federal or State lists.

Seral – A transitory stage in an ecological succession.

Silviculture – Generally, the science and art of cultivating (i.e. growing and tending) forest crops based on knowledge of silvics.

Site Preparation – A general term for a variety of activities that removes competing vegetation, slash, and other debris that may inhibit the reforestation effort.

Size Class – Intervals of tree diameters used to classify timber. Size class includes: seedling/sapling, pole timber, and saw timber.

Sixth Field Subwatershed – The purpose of Sixth field subwatersheds is to create a standard set of watershed boundaries that subdivide the existing fifth field watersheds based on a common set of criteria. These watersheds are used to define unique hydrologically based land units, and generally range between 10,000 and 40,000 acres. The sixth field lines are defined at 1:24,000 scale. Boundaries are delineated on drainage divides (ridges). Boundaries must be hydrologically based; therefore there is no isolated territory, and all areas are included.

Soil Resource Inventory (SRI) – An inventory of the soil resource based on landform, vegetative characteristics, soil characteristics, and management potentials.

Soil Productivity – The capability of a soil to produce a specific crop such as fiber and forage, under defined levels of management.

Special Use Permit – An arrangement whereby the Forest Service grants an individual, organization or agency the use of a specified area of Forest land for a water development, utility corridor, power transmission site, developed recreation site, etc.

Spotted Owl Habitat Area – An area containing the home range of one or more owl pairs established for the propagation and protection of the species in accordance with the Oregon Spotted Owl Management Plan.

Stand – A community of trees or other vegetative growth occupying a specific area, and sufficiently uniform in composition (species), age, spatial arrangement, and conditions as to be distinguishable from the other growth on adjoining lands, so forming a silvicultural or management entity.

Standards and Guidelines - Requirements found in a Forest Plan which impose limits on natural resource management activities, generally for environmental protection.

Sub-watershed – A drainage area of approximately 20,000 acres.

Summer range – Range, usually at higher elevations, used by deer and elk during the summer.

Suppression – The act of extinguishing or confining a fire.

Surface Fuels - Vegetative materials near the ground through which fire will spread. These materials range from downed woody material (leaf litter, dead branches and logs) to brush and grass. The amount, size and moisture content of surface fuels determines how fast a fire spreads, how hot it burns and how high its flames reach.

Temporary Road - Road needed only for the purchaser's or permittee's use. The Forest Service and the purchaser or permittee must agree to location and clearing widths. Temporary roads are used for a single, short-term use (e.g., to haul timber from landings to Forest development roads, access to build water developments, etc).

Threatened Species – A plant or animal identified and defined in accordance with the 1973 Endangered Species Act, and published in the Federal Register.

Threshold of Variability – The variation from the expected Forest Plan outputs or results that is permitted before corrective action is taken.

Winter range – Range, usually at lower elevations, used by migratory elk and deer during the winter months.

Trail – For purposes of travel by foot, stock, mechanized or motorized trail vehicle (less than 50" in width).

Trailhead – The parking, signing, and other facilities available at the start of a trail.

Uncharacteristic Wildfire - Wildfires that have effects and behavior that are outside the normal range of effects and behavior for the historical (natural) system. The normal range is considered to be within the 400 year historic range of variability minimum + 25% and maximum - 25% (Oregon BLM, Interior Columbia Basin Ecosystem Management Program).

Unclassified Road – Road on National Forest System lands not managed as part of the Forest transportation system, such as unplanned roads, abandoned travel ways, and off-road vehicle tracks that have not been designated and managed as a trail; and those roads that were once under permit or other authorization and were not decommissioned upon the termination of the authorization.

Underburn - A fire that consumes surface fuels but not trees or shrubs. See *Surface Fuels*.

Understory - The portion of vegetation that is underneath the dominate tree canopy.

Watershed – The drainage basin contributing water, organic matter, dissolved nutrients and sediments to a stream, lake or river.

Watershed Analysis (WA) – Identifies key processes, functions and conditions within a watershed and describes past and current conditions and trends. This is an analytical process, which creates a tool to help identify and prioritize actions that implement Forest plans. Watershed analysis is ecosystem analysis at the watershed scale.

Water Barring – Berm or ditch-and-berm combinations cutting across roads (and trails) at an angle such that all surface water running on the road and in the road ditch is intercepted and deposited over the outside edge of the road. These normally allow high clearance vehicles to pass.

Watershed Restoration – Improving current conditions of watersheds to restore degraded fish habitat and provide long-term protection for aquatic and riparian resources.

Wilderness – Federal land retaining its primeval character and influence without permanent improvements or human habitation as defined under the 1964 Wilderness Act. It is protected and managed so as to preserve the natural conditions, which (1) generally appear to have been affected primarily by forces of nature with the imprint of man's activity substantially absent; (2) has outstanding opportunities for solitude or a primitive and confined type of recreation; (3) has at least 5000 acres, or is of sufficient size to make practical its preservation, enjoyment, and use in an unimpaired condition, and (4) may contain features of scientific, educational, scenic, or historical value as well as ecologic and geologic interest.

Wildland Fire - A non-structure fire, other than prescribed fire, that occurs in the wildland. Any fire originating from an unplanned ignition.

Wildland Urban Interface (WUI) - Includes those areas of resident human population at imminent risk from wildfire, and human developments having special significance. These areas may include critical communications sites, municipal watershed, high voltage transmission lines, observatories, church camps, scout camps, research facilities, and other structures that if destroyed by fire, would result in hardships to communities. These areas encompass not only the sites themselves, but also the continuous slopes and fuels that lead directly to the sites, regardless of the distance involved.

APPENDIX B: PROPOSED ACTIVITY BY UNIT

❖ Timber Salvage

NOTE: Explanations of **Prescriptions (Rx) Used in Action Alternatives** and **Logging Systems Used in Action Alternatives** are described in detail in the Eyerly Silviculture report (Schantz, 2004).

Timber Salvage Notes:

Units represented on Map 6. Proposed Salvage Units

Rx (prescription) acronyms – HSV-SR: Salvage-Stand Replacement; HSV-M: Salvage-Mixed Severity; SFP-SR: Special Forest Products-Stand Replacement ; SFP-M: Special Forest Products-Mixed Severity
Logging Systems – G:Ground-based; C:Cable Yarding; H:Helicopter; S: Skyline; -TRC:includes temp. road construction

MBF – Thousand Board Feet

Table B-1. Alternative 2 Proposed Salvage by Unit

Alternative 2 Salvage				
UNIT	ACRES	Rx	LOG_SYS	TOTAL_VOL (MBF)
1	7.5	HSV-SR	G	75
2	110.5	HSV-SR	G	829
3	12.6	HSV-SR	G	63
4	21.9	HSV-SR	S	246
5	25.8	HSV-SR	G	258
6	12.4	HSV-SR	S	129
7	19.7	HSV-SR	S	98
8	171.7	HSV-SR	G	1680
9	11.1	HSV-SR	C	59
10	22.7	HSV-SR	C	114
11	12.3	HSV-SR	S	147
12	42.1	HSV-SR	S	471
13	27.4	HSV-SR	S-TRC	217
14	14.2	HSV-SR	G	72
15	21.7	HSV-SR	C	120
16	32.1	HSV-SR	G	170
17	12.5	HSV-M	G	63
18	4.8	HSV-SR	G	26
19	84.4	HSV-SR	G	426
20	23.3	HSV-SR	G	233
21	16.8	SFP-M	G	0
22	22.5	SFP-M	G	0
23	18.0	HSV-SR	S	180
24	27.6	HSV-SR	S	276
25	21.9	HSV-SR	G	164
26	26.6	HSV-SR	G	268
27	11.3	HSV-SR	H	85
28	12.2	HSV-SR	G	95
29	17.2	HSV-SR	S	129
30	23.6	HSV-SR	H	237
31	121.9	HSV-SR	S	915
32	26.2	HSV-M	H	198
33	17.4	HSV-SR	S-TRC	175

Alternative 2 Salvage				
UNIT	ACRES	Rx	LOG_SYS	TOTAL_VOL (MBF)
34	9.6	HSV-SR	S	72
35	16.6	HSV-M	S-TRC	166
36	130.2	HSV-SR	G	655
37	28.0	HSV-M	S-TRC	210
38	10.1	HSV-M	S	101
39	16.2	HSV-M	S-TRC	163
40	25.1	HSV-SR	G	126
41	40.5	HSV-M	G	202
42	52.7	HSV-M	G	132
43	26.1	SFP-SR	G	0
44	11.4	SFP-SR	C	0
45	36.3	SFP-SR	G	0
46	9.6	SFP-SR	G	0
47	75.0	SFP-SR	C	0
48	29.1	SFP-SR	G	0
49	31.8	HSV-SR	G	127
50	22.9	HSV-SR	G	229
51	11.9	HSV-SR	C	61
52	63.0	HSV-SR	G	252
53	32.0	SFP-SR	G	0
54	15.2	HSV-SR	G	38
55	6.4	HSV-SR	G	64
56	19.6	SFP-SR	G	0
57	10.1	SFP-SR	G	0
58	32.5	SFP-SR	G	0
59	31.0	SFP-SR	G	0
60	20.8	SFP-SR	G	0
61	38.8	SFP-SR	G	0
61	5.2	SFP-SR	G	0
62	19.6	HSV-SR	G	78
63	6.9	HSV-SR	G	28
64	20.7	HSV-SR	G	52
65	37.1	HSV-SR	G	186

Alternative 2 Salvage				
UNIT	ACRES	Rx	LOG_SYS	TOTAL VOL (MBF)
67	7.5	SFP-SR	G	0
68	37.6	HSV-SR	S-TRC	283
69	35.0	HSV-SR	G	140
70	25.9	HSV-M	G	65
71	5.4	HSV-M	C	14
72	9.4	HSV-M	S	24
73	24.5	HSV-SR	G	122
74	20.3	HSV-M	G	41
75	22.5	HSV-M	C	56
76	31.8	HSV-M	G	80
77	33.0	HSV-SR	C	83
78	50.6	SFP-SR	G	0
79	55.4	HSV-SR	G	277
80	21.9	HSV-SR	G	66
81	10.9	HSV-SR	G	33
82	77.1	SFP-SR	G	0
83	32.3	HSV-SR	G	162
84	17.3	HSV-SR	G	71
85	24.0	HSV-SR	G	121
86	76.1	HSV-SR	G	304
87	11.7	HSV-SR	C	47
88	27.5	HSV-SR	G	110
89	81.5	HSV-SR	G	246
90	46.4	HSV-SR	C	237
91	102.7	HSV-SR	G	413
92	20.7	HSV-SR	S	124
93	44.6	HSV-M	S-TRC	335
94	13.6	HSV-M	S	82
95	136.4	HSV-SR	G	546
96	88.2	HSV-SR	H	706
97	141.0	HSV-SR	G	564

Alternative 2 Salvage				
UNIT	ACRES	Rx	LOG_SYS	TOTAL VOL (MBF)
98	306.2	HSV-SR	G	1250
99	57.1	HSV-SR	G	228
100	141.6	HSV-SR	H	1064
101	22.5	HSV-SR	G	113
102	7.6	HSV-SR	C	30
103	58.4	HSV-SR	G	236
104	48.6	HSV-SR	G	243
105	19.2	HSV-SR	H	113
106	24.1	HSV-SR	G	96
107	8.9	HSV-SR	C	45
108	133.3	HSV-SR	G	402
109	51.1	HSV-SR	S	257
110	56.1	HSV-SR	G	224
111	20.2	HSV-SR	H	152
112	86.7	HSV-SR	G	350
113	44.8	HSV-SR	G	180
114	10.0	HSV-SR	G	40
115	147.9	HSV-SR	G	593
116	18.9	HSV-SR	G	96
117	60.6	HSV-SR	G	242
118	38.4	HSV-SR	S	230
119	15.6	HSV-SR	G	62
120	10.2	HSV-SR	S-TRC	41
121	19.4	HSV-SR	G	78
122	29.2	HSV-SR	G	118
123	27.1	HSV-SR	G	108
124	42.3	HSV-SR	G	170
126	11.4	HSV-SR	G	58
totals	4845.7			23323

Table B-2. Alternative 3 Proposed Salvage by Unit

Alternative 3 Salvage				
UNIT	ACRES	RX	LOG_SYS	TOTAL_VOL (MBF)
1	7.5	HSV-SR	G	75
2	110.5	HSV-SR	G	829
3	12.4	HSV-SR	G	37
4	20.1	HSV-SR	S	201
5	25.8	HSV-SR	G	258
6	12.0	HSV-SR	S	72
7	19.7	HSV-SR	S	98
8	165.7	HSV-SR	G	1243
9	10.5	HSV-SR	C	53
10	22.7	HSV-SR	C	114
11	10.7	HSV-SR	H	107
12	39.0	HSV-SR	H	234
13	24.2	HSV-SR	S-TRC	182
14	14.2	HSV-SR	G	71
15	12.3	HSV-SR	C	61
16	27.6	HSV-SR	G	138
19	77.2	HSV-SR	G	309
20	23.3	HSV-SR	G	140
23	12.0	HSV-SR	S	72
24	26.1	HSV-SR	S	261
25	21.4	HSV-SR	G	96
26	25.2	HSV-SR	G	252
27	11.3	HSV-SR	H	68
30	18.2	HSV-SR	H	145
31	110.8	HSV-SR	S	665
33	11.1	HSV-SR	S-TRC	111
34	6.0	HSV-SR	S	36
36	112.4	HSV-SR	G	562
40	19.8	HSV-SR	G	50
50	22.2	HSV-SR	G	111
51	6.1	HSV-SR	C	15
52	63.0	SFP-SR	G	202
53	32.0	SFP-SR	G	0
54	14.0	SFP-SR	G	35
55	6.3	HSV-SR	G	63
61	5.2	SFP-SR	G	0
61	38.8	SFP-SR	G	0
62	18.4	SFP-SR	G	37
63	6.0	SFP-SR	G	12
64	8.6	SFP-SR	G	17
64	9.1	SFP-SR	G	18
65	37.4	HSV-SR	G	187
67	7.5	SFP-SR	G	0
68	37.1	HSV-SR	H	167
69	34.9	HSV-SR	G	70
73	24.5	HSV-SR	G	61
77	22.2	HSV-SR	C	56
78	49.1	SFP-SR	G	0
79	55.1	HSV-SR	G	138
80	21.9	SFP-SR	G	33
81	10.5	SFP-SR	G	16
82	76.9	SFP-SR	G	0

❖ Fuels Treatment

Fuels Treatment Notes:

Units represented on Map 6. Proposed Salvage Units

Fuels Treatment Acronyms – MP: Machine Pile; UB: Underburn; LS: Lop and Scatter; HP: Handpile and Burn

Table B-3. Alternative 2 Proposed Fuels Treatment by Alternative

Alternative 2 Fuels Treatment		
Unit	Acres	Fuels Treatment
1	7.5	MP
2	110.5	MP
3	12.6	MP
4	21.9	UB
5	25.8	UB
6	12.4	UB
7	19.7	UB
8	171.7	MP
9	11.1	LS
10	22.7	UB
11	12.3	UB
12	42.1	UB
13	27.4	UB
14	14.2	UB
15	21.7	LS
16	32.1	MP
17	12.5	MP
18	4.8	LS
19	84.4	UB
20	23.3	MP
21	16.8	MP
22	22.5	LS
23	18.0	UB
24	27.6	UB
25	21.9	MP
26	26.6	LS
27	11.3	LS
28	12.2	MP
29	17.2	UB
30	23.6	UB
31	121.9	UB
32	26.2	UB
33	17.4	UB
34	9.6	LS
35	16.6	LS
36	130.2	MP
37	28.0	HP
38	10.1	HP
39	16.2	LS
40	25.1	MP
41	40.5	LS
42	52.7	LS
43	26.1	MP

Alternative 2 Fuels Treatment		
Unit	Acres	Fuels Treatment
44	11.4	LS
45	36.3	LS
46	9.6	LS
47	75.0	LS
48	29.1	MP
49	31.8	MP
50	22.9	LS
51	11.9	LS
52	63.0	MP
53	32.0	MP
54	15.2	MP
55	6.4	LS
56	19.6	MP
57	10.1	MP
58	32.5	LS
59	31.0	MP
60	20.8	MP
61	5.2	MP
61	38.8	MP
62	19.6	MP
63	6.9	MP
64	20.7	LS
65	37.1	LS
67	7.5	MP
68	37.6	LS
69	35.0	MP
70	25.9	MP
71	5.4	MP
72	9.4	HP
73	24.5	LS
74	20.3	MP
75	22.5	HP
76	31.8	MP
77	33.0	MP
78	50.6	MP
79	55.4	MP
80	21.9	MP
81	10.9	MP
82	77.1	MP
83	32.3	LS
84	17.3	MP
85	24.0	LS
86	76.1	UB

Alternative 2 Fuels Treatment		
Unit	Acres	Fuels Treatment
87	11.7	UB
88	27.5	UB
89	81.5	LS
90	46.4	HP
91	102.7	LS
92	20.7	LS
93	44.6	LS
94	13.6	LS
95	136.4	LS
96	88.2	LS
97	141.0	MP
98	306.2	MP
99	57.1	LS
100	141.6	HP
101	22.5	MP
102	7.6	LS
103	58.4	MP
104	48.6	LS
105	19.2	LS
106	24.1	LS

Alternative 2 Fuels Treatment		
Unit	Acres	Fuels Treatment
107	8.9	LS
108	133.3	MP
109	51.1	LS
110	56.1	LS
111	20.2	LS
112	86.7	LS
113	44.8	LS
114	10.0	LS
115	147.9	LS
116	18.9	LS
117	60.6	MP
118	38.4	LS
119	15.6	LS
120	10.2	HP
121	19.4	LS
122	29.2	LS
123	27.1	LS
124	42.3	LS
126	11.4	MP

Table B-4. Alternative 3 Proposed Fuels Treatment by Alternative

Alternative 3 Fuels Treatment		
Unit	Acres	Fuels Treatment
1	7.5	MP
2	110.5	MP
3	12.4	MP
4	20.1	UB
5	25.8	UB
6	12.0	UB
7	19.7	UB
8	165.7	MP
9	10.5	LS
10	22.7	UB
11	10.7	UB
12	39.0	HP
13	24.2	UB
14	14.2	UB
15	12.3	LS
16	27.6	MP
19	77.2	UB
20	23.3	MP
23	12.0	UB
24	26.1	UB
25	21.4	MP
26	25.2	LS
27	11.3	LS
30	18.2	UB
31	110.8	UB
33	11.1	UB
34	6.0	LS
36	112.4	MP
40	19.8	MP
50	22.2	LS
51	6.1	LS
52	63.0	MP
53	32.0	MP
54	14.0	MP
55	6.3	LS
61	5.2	MP
61	38.8	MP
62	18.4	MP

Alternative 3 Fuels Treatment		
Unit	Acres	Fuels Treatment
63	6.0	MP
64	8.6	LS
64	9.1	LS
65	37.4	LS
67	7.5	MP
68	37.1	LS
69	34.9	MP
73	24.5	LS
77	22.2	MP
78	49.1	MP
79	55.1	MP
80	21.9	MP
81	10.5	MP
82	76.9	MP
83	32.3	LS
84	16.4	MP
85	24.1	LS
89	52.2	LS
92	20.7	LS
95	125.3	LS
96	88.2	LS
97	141.0	MP
98	287.5	MP
99	57.1	LS
100	140.0	HP
101	21.5	MP
102	6.6	LS
103	33.2	MP
104	48.6	LS
105	18.6	LS
106	23.7	LS
111	19.2	LS
117	60.5	MP
118	38.4	LS
119	13.6	LS
126	7.6	MP

❖ Soil Condition

Table B-5. Alternatives 2 and 3 Proposed Activity Unit Soil Summaries

Soil Condition by Unit (Alternatives 2 & 3)												
Unit	Alt. 2 acres	Subs hed	Silvi - RX	Past Harvest Activity	% Detr. Burned	Exist.* Disturb/ compaction	Log_ sys	Sensitive soil	Vol_Ac	Fuels_ RX2	Est. Detr. after Harvest/ fuels	Acres to be subsoiled
1	7.5	MET		small mill		est. <5%	G	XR	10	mp	25%	0.4
2	110.5	MET	SR	small mill	<1%	3-5%	G		8	mp	25%	1.0
3	12.6	STR		small mill		est. <5%	G	79	5	mp	25%	0.6
4	21.9	STR	SR	small mill	<1%	<1%	S	79	10	ub	10%	0
5	25.8	STR	SR	small mill	<1%	3-5%, road & firelines	G		10	ub	25%	1.3
6	12.4	STR	SR	small mill	<1%	3-5%, road & firelines	S	79	10	ub	10%	0
7	19.7	STR	SR	small mill	<1%	3-4% firelines	S	79	5	ub	10%	0
8	171.7	MET		????		est.10-15%	G	79	8	mp	25%	4.1
9	11.1	STR	SR	none	<1%	0	C		5	ls	10%	0
10	22.7	MET	M	small mill	<1%	2-3%	C	XR	5	ub	10%	0
11	12.3	MET		small mill		est. <5%	S	XR	10	ub	10%	0
12	42.1	MET	SR	small mill	<1%	1% steep fireline	S		10	hp	10%	0
13	27.4	MET	SR	small mill	<1%	2-3% firelines	S-TRC		8	ub	10%	0
14	14.2	MET	SR	HFR, 1989	2-3%	<1% (est. 15%)	G		5	ub	25%	1.3
15	21.7	MET	M	HFR, 1989	<1%	<2% (est. 15%)	C		5	ls	20%	0
16	32.1	MET	M	small mill	1-2%	5-10%	G	52	5	mp	25%	1.1
17*	12.5	STR	M	HOR, 1985, (5%)	<1%	<5%	G	52	5	mp	20%	0
18*	4.8	STR	SR	HSH, 1985, HFR, 1993, (5%)	1-2%	<5%	G	52	5	ls	20%	0
19	84.4	STR	SR	HOR, 1985	3-5%	5-10%	G	52	5	ub	20%	0
20	23.3	STR	SR	small mill	<1%	<2%	G		10	mp	20%	0
21*	16.8	STR	M	HOR, 1985	<1%	10-15%	G	52	0	mp	25%	1.1
22*	22.5	STR	M	HOR, 1985		25%	G		0	ls	30%	1.7
23	18	STR	SR	small mill	<1%	<2%	S		10	ub	10%	0
24	27.6	STR	SR	HOR, 1985 (10%)	<1%	est. <5%	S	51	10	ub	10%	0
25	21.9	STR	SR	HCR, 1985	4-8%	10-15%	G	51	8	mp	25%	1.3
26	26.6	STR	SR	HPR, 1985	3-6%	0	G	52	10	ls	20%	0
27	11.3	SPR	SR			est. <5%	H	52	8	ls	10%	0
28*	12.2	STR	SR		3-5%	10-15%	G	52	8	mp	25%	1.1
29*	17.2	STR	SR	small mill	2-5%	<5%	S	52, 51	8	ub	10%	0
30	23.6	SPR	M	small mill	<1%	2-4%	H	51, 52	10	ub	10%	0

Soil Condition by Unit (Alternatives 2 & 3)												
Unit	Alt. 2 acres	Subs hed	Silvi - RX	Past Harvest Activity	% Detr. Burned	Exist.* Disturb/ compaction	Log sys	Sensitive soil	Vol_Ac	Fuels_RX2	Est. Detr. after Harvest/ fuels	Acres to be subsoiled
31	121.9	SPR	SR	HOR, 1985	4-7%	10-15%	S	52	8	ub	15%	0
32*	26.2	STR	M	small mill	<1%	2-4%	H	51, 52	8	ub	10%	0
33	17.4	SPR	SR	none	3-5%	<2%	S-TRC	52	10	ub	10%	0
34	9.6	STR		none		est. <5%	S	52	8	ls	10%	0
35*	16.6	SPR		none		est. <5%	S-TRC	52	10	ls	10%	0
36	130.2	STR	SR	HOR, 1985	1-3%	5-15% variable in unit	G	51, 52	5	mp	20%	0
37*	28	SPR	M	HOR, 1985	<1%	10-15%	S-TRC	52, 51	8	ls	15%	0
38*	10.1	STR	M	small mill	3-5%	<4%	S	52	10	ls	10%	0
39*	16.2	SPR	M	small mill	1-3%	<4%	S-TRC	52	10	ls	10%	0
40	25.1	STR	SR	HOR, 1985	3-6%	5-10%	G	52, 51	5	mp	20%	0
41*	40.5	SPR	M	HOR, 1985	<1%	10-15%	G	52, 51	5	ls	25%	0.8
42*	52.7	SPR	M	HCC, 1985	<1%	12-17%	G		3	ls	25%	6.5
43*	26.1	SPR		HOR, 1986		est. 10-15%	G		0	mp	25%	1.4
44*	11.4	SPR		HOR, 1985		est. 10-15%	C		0	ls	20%	0
45*	36.3	SPR		HOR, 1985		est. 20%	G		0	ls	25%	0.8
46*	9.6	SPR		HOR, 1985		est. 10-15%	G	52	0	ls	25%	1.2
47*	75	SPR	SR	HOR, 1985	2-3%	15-20%	C	52	0	ls	25%	2
48*	29.1	SPR		HOR, 1986		est. 15-20%	G	50	0	mp	25%	2.6
49*	31.8	STR	SR	HOR, 1986	1-3%	15-20%	G		4	mp	25%	1.3
50	22.9	STR	SR	HPR, 1977	1-3%	<5%, est. 10-15%	G		10	ls	25%	0.5
51	11.9	STR		HPR, 1977		est. 10%	C	52	5	ls	15%	0
52	63	STR		HPR, 1977		est. 10%	G		4	mp	20%	0
53	32	STR		HOR, 1986		est. 15%	G		0	mp	25%	3.7
54	15.2	STR	SR	HOR, 1986	2-4%	6-9%	G		3	mp	20%	0
55	6.4	STR	SR	small mill	<1%	0	G		10	ls	20%	0
56*	19.6	STR	Pink	HOR, 1986	<1%	5-10%	G		0	mp	20%	0
57*	10.1	STR	Pink	HOR, 1986	<1%	5-10%	G		0	mp	20%	0
58*	32.5	STR	Pink	HCC, 1988	<1%	<5%, est. 15-20%	G		0	ls	30%	6.3
59*	31	STR	Pink	HOR, 1986	2-4%	10-15% spotty	G		0	mp	25%	1.6
60	20.8	STR	Pink	HOR, 1986	1-3%	10-15%	G		0	mp	25%	0.75
61	44	STR	Pink	HCC, 1988	<1%	5-10%, est. 15-20%	G		0	mp	30%	0.6
62	19.6	MET	SR	HOR, 1986	0-3% varies	<5%, est. 10-15%	G		4	mp	25%	0.2
63	6.9	STR	SR	HOR, 1986	0-3% varies	<5%, est. 10-15%	G		4	mp	25%	0.85
64	20.7	MET	SR	HOR, 1977	<1%	15-20%	G		3	ls	25%	0.5
65	37.1	MET	M	HOR, 1977	<1%	15-20%	G		5	ls	25%	1.6
67	7.5	MET	M	HOR, 1977	1-2%	15-20% with fire lines	G		0	mp	30%	2
68	37.6	MET	SR	none	2-4%	<5%	H	89, 52	8	ls	10%	0
69	35	MET	SR	small mill	2-4%	5-10%	G	89	4	mp	25%	1
70*	25.9	MET	M	HOR, 1977	<1%	5-10%	G		3	mp	25%	0.4
71*	5.4	MET	M	none	<1%	<1%	C	52	3	mp	10%	0

Soil Condition by Unit (Alternatives 2 & 3)												
Unit	Alt. 2 acres	Subs hed	Silvi - RX	Past Harvest Activity	% Detr. Burned	Exist.* Disturb/ compaction	Log_sys	Sensitive soil	Vol_Ac	Fuels_RX2	Est. Detr. after Harvest/ fuels	Acres to be subsoiled
72*	9.4	MET	M	none	<1%	0	S	52	3	hp	5%	0
73	24.5	MET	SR	small mill	1-2%	6-10%	G		5	ls	25%	1.1
74*	20.3	MET	Red	HFR, 1989	1-3%	15-25%	G		2	mp	30%	0.7
75*	22.5	MET	Blue	HFR, 1989	2-4%	0-1%	C		3	hp	10%	0
76*	31.8	MET	Blue	HFR, 1989	2-4%	0-1%	G		3	mp	20%	0
77	33	MET		HFR, 1989		est. 10-15%	C		3	mp	20%	0
78	50.6	MET	Pink	HOR, 1986	1-2%	10-15%	G		0	mp	25%	0.3
79	55.4	MET	SR	HOR, 1986	1-3%	2-4%	G	50	5	mp	20%	0
80	21.9	MET	SR	HOR, 1986	<1%	5-10%	G		3	mp	25%	1.2
81	10.9	MET	SR	??????	<1%	12-18%	G		3	mp	25%	1
82	77.1	MET	Pink	HOR, 1986	1-2%	15-20%	G		0	mp	30%	2.2
83	32.3	MET	SR	HOR, 1986	1-3%	5-10%	G	50	5	ls	25%	1.6
84	17.3	MET	Pink	??????	3-5%	5-10%	G	50	4	mp	25%	1.6
85	24	MET	SR	small mill	1-3%	<1%	G	50	5	ls	20%	0
86*	76.1	MET	SR	HOR, 1986 (50%), HPRX, 1973 (50%)	1-3%	4-8%, est. 15%	G	51, 52	4	ub	25%	2.7
87*	11.7	MET	SR	HPRX, 1973	1-3%	4-8%	C	51, 52	4	ub	15%	0
88*	27.5	MET	SR	HPRX, 1973	1-3%	4-8%	G	51, 52	4	ub	20%	0
89	81.5	MET	SR	HPRX, 1973	2-4%	5-10%, est. 10-15%	G	51	3	ls	25%	3.8
90*	46.4	MET	SR	HOR, 1985 (55%)	2-4%	5-10%	C	51	5	hp	15%	0
91*	102.7	MET	SR	HPRX, 1973	2-4%	8-12%	G	51	4	ls	25%	0.8
92	20.7	MET	SR	HSH, 1985	2-4%	5-10%	S	52	6	ls	15%	0
93*	44.6	STR	SR	HPRX, 1973	1-3%	10%	S	52	8	ls	15%	0
94*	13.6	SPR		HPRX, 1973		est. 5%	S	52	6	ls	10%	0
95	136.4	STR	SR	HPRX, 1973	2-4%	4-8%	G	52	4	ls	20%	0
96	88.2	SPR	SR	HPRX, 1973	2-4%	<3%	H	52, 51	8	ls	10%	0
97	141	SPR	SR	HOR, 1980, (50%)	1-3%	8-12%, est. 15-20%	G		4	mp	30%	2.7
98	306.2	SPR	SR	HOR, HPR, 1980	2-5%	15-20%, est. 10-15%	G		4	mp	25%	4
99	57.1	SPR	SR	HFR, 1980	1-3%	8-12%	G		4	ls	25%	2.3
100	141.6	SPR	SR	HPRX, 1973	3-6%	5-10%	H	52, 50	8	ls	15%	0
101	22.5	SPR	SR	HPRX, 1973	3-6%	5-10%	G	52, 50	5	ls	25%	1
102	7.6	SPR		HPRX, 1973		est. 5%	C	51, 52	4	ls	10%	0

Soil Condition by Unit (Alternatives 2 & 3)												
Unit	Alt. 2 acres	Subs hed	Silvi - RX	Past Harvest Activity	% Detr. Burned	Exist.* Disturb/ compaction	Log sys	Sensitive soil	Vol_Ac	Fuels - RX2	Est. Detr. after Harvest/ fuels	Acres to be subsoiled
103	58.4	SPR	SR	HPRX, 1973	1-2%	3-7%	G	52, 51	4	ls	20%	0
104	48.6	SPR		HPRX, 1973		<5%	G	51, 52	5	ls	20%	0
105	19.2	SPR	SR	HPRX, 1973	2-4%	5-10%	H	52	6	ls	15%	0
106	24.1	SPR		HPR, 1980		est. 10%	G	TB	4	ls	20%	0
107*	8.9	FLY		HPR, 1980		est. 5%	C	TB	5	ls	10%	0
108*	133.3	SPR	SR	HPR, 1980, HPRX, 1973	1-3%	20-25%	G	52	3	mp	30%	22.1
109*	51.1	FLY	SR	HPRX, 1973	2-5%	4-7%	S	52	5	ls	10%	0
110*	56.1	SPR	SR	HPRX, 1973	3-6%	<1%	G	51, 52, 50	4	ls	20%	0
111	20.2	SPR	SR	HPRX, 1973	2-5%	0	H	52	8	ls	10%	0
112*	86.7	SPR	SR	HPRX, 1973	1-3%	5-10% variable	G	51	4	ls	25%	1.1
113*	44.8	SPR	SR	HPRX, 1973	1-3%	7-12%	G	51, 52	4	ls	25%	0.4
114*	10	SPR	SR	HPRX, 1973	1-3%	5-10%	G		4	ls	25%	2.9
115*	147.9	SPR	SR	HPRX, 1973	1-3%	7-12%	G	51	4	ls	25%	2.4
116*	18.9	SPR	SR	?????	1-3%	<5%, existing road	G	50	5	ls	20%	0
117	60.6	FLY	SR	HPRX, 1973	1-3%	0, est. <5%	G	TB	4	mp	20%	0
118	38.4	SPR		HPRX, 1973		est. <5%	H	52, 51	6	ls	10%	0
119	15.6	SPR		HPRX, 1973		est. <5%	G	51, 52	4	ls	20%	0
120*	10.2	FLY	SR	none	4-6%	0	S	51	4	hp	10%	0
121*	19.4	SPR	SR	small mill	3-5%	5-8% widely disperse	G	51	4	ls	20%	0
122*	29.2	SPR	SR	HPRX, 1973	1-2%	<5% roads	G	51	4	ls	20%	0
123*	27.1	SPR	SR	HOR, 1986	1-3%	15-20%	G	50	4	ls	25%	1
124*	42.3	SPR	SR	HCC??, 1985	1-3%	8-13%	G	51, 52	4	ls	25%	4.3
126	11.4	STR		????		est. 10-15%	G	XR	5	mp	25%	1.8
Notes: * Alternative 2 includes all units listed in table. Units with (*) are Alternative 2 only. ** Units with (est.) in front of the % detrimental compaction have combined field measurements, past harvest activity and photo interpretation to estimate detrimental conditions. ? Unknown												

APPENDIX C: EYERLY FUELS TREATMENT AND FUEL LOADINGS GUIDANCE

References from the LRMP & other pertinent documents; i.e. Species Recovery Plans, Veg EIS, INFISH, PACFISH, Eastside Screens etc.

Deschutes National Forest Land and Resource Management Plan: Standards and Guidelines:

Goal

To provide a well managed fire protection and prescribed fire program that is cost efficient responsive to the land stewardship needs and resource management goals and objectives.

Management Area 7, Deer Winter Range

Wildfire

M7-24 High and low intensity burns can help maintain diversity. Fires within 300 feet of guzzlers shall be extinguished and the improvements protected. Snags that do not present a hazard to life or a threat to successful suppression action should not be felled.

M7-25 Annual low intensity burn objectives will be developed as a part of the Fire Management Action Plan

Prescribed Burning

M7-26 The prescribed use of fire will be necessary to maintain diversity within the plant communities. Burning prescriptions will provide for the reestablishment of bitter brush within 20 years. Approximately 2.0 – 2.5 percent of this management area could be burned annually.

Fuel Treatment other than Prescribed Burning

M7-27 In that portion of the management area designated non suitable for timber, the preferred slash treatment method is to lop and scatter. In heavy slash, machine piling and burning may be necessary, Crushing is the least preferred method for treating slash

Fuel Loading

M7-28 Optimum fuel loading will be guided by the photo series listed in *Table C-1*.

Table C-1. M7-28 Optimum Fuel Loading Photo Series

Activity	Series	Photo #	< 3" Dia	> 3" Dia	Total Tons / Acre
Natural fuels PP	PNW-105	8-PP-4	4.50	44.00	48.50
Natural fuels PP	PNW-56	3-PP-3	1.80	3.20	5.00
Thinning fuels PP	PNW-52	4-PP-1-TH	6.80	5.30	12.10
Thinning fuels MC	PNW-95	1-MC-3-PC	2.90	1.50	4.40
Partial cut MC	PNW-95	1-MC-3-PC	2.90	1.50	4.40
Clearcut LP	PNW-52	1-LP-3-PC	2.50	.90	3.40

"Photo Series for Quantifying Forest Residues" a cooperative publication by the Pacific Northwest Forest Range and Experimentation Station. USDA FS

Fuel loading will be revised as new data, methods or research indicates that a new profile would improve resource management programs.

Management Area 8 General Forest

Wild Fire

M8-22 Suppression practices will be designed to protect the investment on managed tree stands and to prevent loss of large acres to wildfire.

M8-23 Snags that do not present a hazard to life or threat to successful suppression action should not be felled.

M8-24 In Ponderosa pine stands (except for reproduction stands) emphasis should be placed on burning out from existing roads and natural barriers rather than constructing new firelines.

Prescribed Fire

M8-25 Prescribed fire may be used to protect maintain, and enhance timber and forage production. The broadest application of prescribed fire will occur in the Ponderosa pine type. Criteria for utilizing fire are as follows:

To reduce the risk of conflagration fire

To increase soil productivity by cycling bound nutrients.

To prevent encroachment of less desirable competing species.

To increase palatability and cover of desired forage species.

To prepare sites for reforestation.

Fuel Treatment other then prescribed fire

M8-26 the lowest cost option which meets the Silviculturist, soil, water, and fire objectives should be selected.

Fuel Loadings

M8-27 Slash will be treated to reduce the chances of fire starts and rates of spread to acceptable levels, but will not be cleared to a point that the forest floor is devoid of all slash and log. Some slash and larger dead material will be left for ground cover for soil protection, microclimates, for establishment of trees, and small mammal habitat. Optimum fuel loadings should be guided by the photo series listed in *Table C-2*.

Table C-2. M8-27 Optimum Fuel Loadings Photo Series

Activity	Series	Photo #	< 3" Dia	> 3" Dia	Total Tons / Acre
Thinning PP	PNW-95	1-MC-3-PC	2.90	1.50	4.40
Thinning PP	PNW-52	4-PP-1-TH	6.80	5.30	12.10
Thinning LP	PNW-95	1-MC-3-PC	2.90	1.50	4.40
Thinning LP	PNW-52	1-PP-1-TH	8.20	2.30	10.50
Thinning MC-MH	PNW-95	1-MC-3-PC	2.90	1.50	4.40
Thinning MC-MH	PNW-52	1-PP-1-TH	8.20	2.30	10.50
Partial Cut PP	PNW-95	4-TF-4-RC	10.80	17.90	28.70
Partial Cut PP	PNW-52	2-LP-3-PC	7.00	7.50	14.50
Partial Cut LP	PNW-52	2-LP-3-PC	7.00	7.50	14.50
Partial Cut MC-MH	PNW-95	2-MC-4-PC	13.10	13.50	26.60
Partial Cut MC-MH	PNW-95	2-TF-4-RC	5.50	1.40	6.90
Clearcut PP	PNW-95	2-MC-4-PC	13.10	13.50	26.60
Clearcut PP	PNW-52	1-LP-3-PC	2.50	.90	3.40
Clearcut LP	PNW-52	1-LP-3-CC	6.80	9.20	16.00
Clearcut MC-MH	PNW-95	3-TF-4-RC	16.00	10.5	26.50
Clearcut MC-MH	PNW-95	2-MC-4-RC	17.90	18.50	36.40
Notes: "Photo Series for Quantifying Forest Residues" a cooperative publication by the Pacific Northwest Forest Range and Experimentation Station. USDA FS Fuel loading will be revised as new data, methods or research indicates that a new profile would improve resource management programs.					

Management Area 15, Old Growth

Wild Fire

M15-15 In Mountain Hemlock, mixed conifer, and lodgepole pine forest types, aggressive suppression which uses a minimum of heavy equipment wherever possible will be emphasized.

M15-16 In Ponderosa pine forests, when existing and predicted burning conditions favor low intensity fires, containment suppression tactics are appropriate. This may include burning out from existing barriers and scratch lines.

M15-17 High intensity fires will be suppressed

M15-18 The low intensity burn acre objective for each old growth area will be the same as the adjacent management area with the lowest burn acre objective.

Prescribed Fire

M15-19 Prescribed fire is not appropriate in lodgepole pine stands. In Ponderosa pine and mixed conifer stands, prescribed fire may be used to achieve old growth characteristics. It may also be used to reduce unacceptable fuel loading that could result in high intensity wildfire.

Fuel Treatment other than prescribed fire

M15-20 Prescribed fire is a preferred method of fuel treatment. However if prescribed fire cannot reduce unacceptable fuel loading, other methods will be considered.

Fuel Loadings

M15-21 Natural fuel loading will normally be the standard.

Management Area 20 Metolius Wildlife – Primitive

Wildfire

M20-26 Within the bald eagle portion of this management area: Protection of bald eagle nest trees and adjacent snags will be the highest priority in the bald eagle emphasis portion of this Management Area. Suppression efforts within ¼ mile of an active bald eagle nest during the nesting season will be based on minimizing the disturbance to the nesting species. The use of mechanical equipment such as pumps, chainsaws to reduce the exposure time is acceptable; however the use of helicopters and aerial retardants should be undertaken with caution near active nests.

Low intensity fires outside the nesting season do not conflict with habitat objectives. In high intensity fire situations the objective will be to minimize acres burned. The use of heavy equipment and retardant aircraft is acceptable. Fire camp should be located at least one mile from an active nest.

Standard suppression efforts may be used during the non-nesting season but with increased emphasis on saving large snags.

The maximum low intensity burn acre objectives are 10 acres per year and 1 acre per occurrence. Maximum high intensity burn acres objectives are 5 acres per year and 1 acre per occurrence.

M20-27 Within the remainder of the Management Area, fire is considered to play a natural role in the ecology of the area. In order to assure that the natural role of fire is allowed, all fire accidentally started by humans activity will be declared a wildfire and suppressed. However, lightning caused fires that meet preplanned prescription parameters outlined in the Fire Management Action Plan, may be managed as prescribed fire.

Prescribed Fire

M20-29 Prescribed fire may be used to improve or maintain wildlife habitat or for other ecological purpose. Burns during the bald eagle nesting should be restricted to areas at least one quarter mile away from active nests.

Fuel Loadings

M20-30 Fuel Treatment must be appropriate to the goals and objectives for this Management Area and must be adequate to meet the fire suppression objective.

Fuel will be achieved through intensive utilization of material to the extent possible.

Fuel Treatment other than prescribed fire – No LRMP Direction

APPENDIX D: BEST MANAGEMENT PRACTICES

Application of Water Quality BMPs, NWFP, INFISH, and LRMP Standards & Guidelines

A number of the design elements described in Chapter 2 of the EIS, and procedural steps done in development of these projects, are identified as Best Management Practices (BMPs). BMPs also include requirements such as Forest Service manual direction, timber sale contract provisions, environmental documents, and Forest Plan standards and guidelines. The Forest Plan was amended by the Northwest Forest Plan (NWFP) in 1994, and Inland Native Fish (INFISH) Strategy in July 1995.

The Forest Plan, as amended, guides natural resource management activities and establishes management standards and guidelines for the Deschutes National Forest. The Forest Plan requires compliance with State requirements in accordance with the Clean Water Act through the application of BMPs. The Environmental Protection Agency has certified the Oregon Forest Practices Act and regulations as BMPs. The State of Oregon has compared Forest Service practices with the State practices and concluded that Forest Service practices meet or exceed State requirements.

Table D-1 summarizes design elements and other aspects of the project development process and identifies those design elements which are applied as site-specific BMPs and INFISH standards.

Table D-1. Eyerly Project Best Management Practice/ INFISH applicability

Eyerly Project - Design Element or Procedural Requirement	BMP/INFISH Reference
Analysis and alternative design for salvage timber sale activities to avoid potential effects on water quality. For the Eyerly Fire Salvage project, consideration was given to protection of riparian resources and to reduce potential effects on water quality and fish habitat.	T-1: Timber Sale Planning Process Objective: To introduce water quality and hydrologic considerations into the timber sale planning process. INFISH RF-2a: Roads Management Completing watershed analysis prior to construction of new roads or landings in RHCA's within priority watersheds.
Timber harvest units and other activities were evaluated to estimate the response of the watershed. The IDT reviewed each treatment unit including factors influencing potential for impacts to water quality such as ECA, soil erosion hazard, slope, distance to stream, logging method, and effects to forest vegetation. Adjustments were made to silvicultural prescriptions and fuel treatments.	T-2: Timber Harvest Unit Design Objective: To ensure that timber harvest unit design will secure favorable conditions of water flow, water quality, and fish habitat.

Eyerly Project - Design Element or Procedural Requirement	BMP/INFISH Reference
The potential for erosion and mass wasting for the area was evaluated by examining the soil, topography, rock type, drainage patterns, water conditions, and plant community. Reference Hydrology Resource Report, and Soils Resource Report. Areas with high erosion potential were identified leading to design treatments which reduced erosion potential.	T-3: Use of Erosion Potential Assessment for Timber Harvest Design. Objective: To prevent downstream water quality degradation by the timely identification of areas with high erosion potential and adjustment of harvest unit design.
Based on data collected during the planning process and sale layout, the location of stream courses, springs, wet meadows, Riparian Reserves, and RHCAs would be delineated on the sale area map. In addition, sites identified during implementation will be reviewed by applicable IDT members for protection needs.	T-4: Use of the Sale Area Map for designating Water Quality Protection Needs Objective: To delineate the location of protection areas and available water sources as a guide for both the purchaser and the sale administrator, and to ensure their recognition and proper consideration and protection on the ground.
The IDT addressed normal operating season for timber harvest operations, during which, operations may generally proceed without resource damage. Design elements also describe road conditions which would restrict timber hauling. Reference Hydrology Resource Report, and DEIS Chapter 2, Design Elements Common to All Action Alternatives.	T-5: Limiting the Operating Period of Timber Sale Activities Objective: To ensure that purchasers conduct operations in a timely manner and conduct operations within the time period specified in the timber sale contract. INFISH RM-2 c5: Regulate traffic during wet periods to minimize erosion and sediment delivery and accomplish other objectives.
Unstable lands that are unsuitable for timber management were identified through satellite imagery, aerial photos, and field reconnaissance. Soils Resource Report.	T-6: Protection of Unstable Lands Objective: To provide for identification and appropriate management prescriptions for unstable lands.
Salvage harvest, skid trails, landings, and other timber harvesting activities would be kept at a prescribed distance from designated stream courses. INFISH RHCAs and NEFP Riparian Reserves have been identified for all streams within the Eyerly Salvage area. Reference DEIS, Chapter 2, Alternative Descriptions and Design Elements Common to all Action Alternatives, Hydrology Report, and Fisheries Report.	T-7: Streamside Management Unit (SMU) Designation Objective: To designate a riparian area or zone along streams and wetlands where prescriptions are made that will minimize potential adverse effects of nearby logging and related land disturbance activities on water quality and beneficial uses. INFISH: RHCA Designation NWFP TM-1: Prohibit timber harvest, including firewood cutting, in Riparian Reserves. INFISH TM-1b: Apply silvicultural practices for RHCAs to acquire desired vegetation characteristics where needed to attain RMOs. Apply silvicultural practices in a manner that does not retard attainment of RMOs and that avoids adverse effects on inland native fish.

Eyerly Project - Design Element or Procedural Requirement	BMP/INFISH Reference
DEIS Design Elements - Water Quality/Fisheries The road system to access sale units was designed so no stream crossings were needed. DEIS Design Elements - Soils Skid trails would be designated and approved prior to logging and would be located on already disturbed areas where possible.	T-8: Streamcourse Protection a. Location, method, and timing of streamcourse crossings must be agreed to prior to construction Objective: (1) To protect the natural flow of streams, (2) to provide unobstructed passage of streamflow, and (3) to prevent sediment and other pollutants from entering streams.
DEIS Design Elements - Water Quality/Fisheries The road system to access sale units was designed so no stream crossings were needed. DEIS Design Elements - Soils Skid trails would be designated and approved prior to logging and would be located on already disturbed areas where possible.	T-8: Streamcourse Protection b. Location, method, and timing of streamcourse crossings must be agreed to prior to construction Objective: (1) To protect the natural flow of streams, (2) to provide unobstructed passage of streamflow, and (3) to prevent sediment and other pollutants from entering streams.
DEIS Design Elements - Water Quality/Fisheries Skid trails and the use of ground-based machinery for logging operations would not be allowed within RHCAs or Riparian Reserves. Avoid locating temporary roads within RHCAs. Or Riparian Reserves.	T-8: Streamcourse Protection d. Equipment shall not operate within SMUs (RHCAs) or protected streamcourses, as identified on the sale area map. Objective: (1) To protect the natural flow of streams, (2) to provide unobstructed passage of streamflow, and (3) to prevent sediment and other pollutants from entering streams.
DEIS Design Elements - Water Quality/Fisheries Adequate drainage would be established on roads. Filter strips below drainage structures would be of sufficient size to catch sediment before runoff enters streams. Temporary roads would be designed with relief drainage (drivable dips, outslope, no berms). Drainage will be maintained during operations and be fully functional going into the winter and when roads are decommissioned or inactivated.	T-8: Streamcourse Protection f. Water bars and other erosion control structures will be located so as to prevent water and sediment from being channeled into streamcourses, and to dissipate concentrated flows. Objective: (1) To protect the natural flow of streams, (2) to provide unobstructed passage of streamflow, and (3) to prevent sediment and other pollutants from entering streams.
DEIS Design Elements - Water Quality/Fisheries Proposed units were evaluated by the IDT for suitability for tractor logging based on slope, soil erosivity, geologic stability, and distance from streams.	T-9: Delineating Tractor Loggable Ground Objective: To protect water quality from degradation caused by tractor logging ground disturbance
DEIS Design Elements - Water Quality/Fisheries The IDT tried to avoid placing landings in RHCAs where practical.	T10: Log Landing Location Objective: To locate landings in such a way as to minimize creation of hazardous watershed condition.

Eyerly Project - Design Element or Procedural Requirement	BMP/INFISH Reference
DEIS Design Elements - Soils Skid trails would be designated and approved prior to logging and would be located on already disturbed areas where possible. Skid trails, landings, and roads would be designed to minimize the aerial extent of the activity. Objective is 20% or less of activity area in a detrimental soil condition.	T-11: Tractor Skid Trail Location and Design Objective: To minimize the area compacted, erosion, and runoff water.
DEIS Design Elements - Soils Skyline and helicopter yarding is proposed in both action alternatives. Increased use of helicopter yarding is proposed in Alternative 3 which emphasizes a design which reduces potential for adverse impacts to water quality and fish habitat.	T-12: Suspended Log Yarding in Timber Harvesting Objective: 1. To protect soils from excessive disturbance, and 2. to maintain the integrity of SMU (RHCA) and other sensitive watershed areas.
DEIS Design Elements - Water Quality/Fisheries Effective ground cover would be established on deactivated and decommissioned roads within RHCAs and Riparian Reserves to minimize sedimentation. An erosion control plan would be developed that incorporates applicable erosion control actions for all action alternatives and made part of the timber sale contract.	T-13: Erosion Prevention and Control Measures During Timber Sale Operations Objective: To ensure that the purchaser's operations shall be conducted to minimize soil erosion.
DEIS Design Elements - Water Quality/Fisheries When consistent with other management actions, slash may be placed on skid trails, temporary roads, roads proposed to be decommissioned, and roads proposed to be inactivated when yarding is completed. DEIS Design Elements - Noxious Weeds Revegetate temporary roads, landings, and other disturbed areas as soon as possible to reduce the potential for weed establishment and soil erosion.	T-14: Revegetation of Areas Disturbed by Harvest Activities Objective: To establish a vegetative cover on disturbed sites to prevent erosion and sedimentation.
DEIS Design Elements - Water Quality/Fisheries Landings and temporary roads will be ripped, water barred, and seeded as needed to prevent and control erosion.	T-15: Log Landing Erosion Prevention and Control Objective: To reduce the impacts of erosion and subsequent sedimentation, on log landings, by use of mitigation measures. T-16: Erosion Control on Skid Trails Objective: To protect water quality by minimizing erosion and sedimentation derived from skid trails.

Eyerly Project - Design Element or Procedural Requirement	BMP/INFISH Reference
Meadows, seeps, and springs have been identified through satellite imagery, aerial photos, and field verification. Wet meadows are afforded protection. Dry meadows are protected from impacts from harvest and road activities.	T-17: Meadow Protection During Timber Harvesting Objective: To avoid locating roads, landings, and skid trails in meadows.
DEIS Monitoring Common to All Action Alternatives Timber sale administration will include monitoring for implementation of activities as planned including: harvest operations, road work, erosion control, and fuels treatment. Inspections of road drainage conditions following storm/runoff events would be done under the action alternatives. Maintenance would be scheduled as needed.	T-18: Erosion Control Structure Maintenance Objective: To ensure that constructed erosion control structures are stabilized and working. INFISH RF-2 c4: Requirements for pre-, during, and post-storm inspections and maintenance.
These BMPs are included in the action alternatives for timber sale activity. T-19 and T-21 are considered normal operating procedures and are included in timber sale contract language. T-20 is required per Forest Service Manual requirements. T-22 is provided for through monitoring and evaluation of conditions throughout the life of the timber sale contract.	T-19: Acceptance of TS Erosion Control Measures Before Sale Closure T-20: Reforestation T-21: Servicing and Refueling of Equipment T-22: Modification of TSC INFISH RA-4: General Riparian Area Management Prohibit storage of fuels and other toxicants within RHCAs.
DEIS, Chapter 2, Alternatives Alternative 2 proposes building 3 miles of temporary road and reconstructing 33.4 miles, Alternatives 3 proposes 1 mile of temporary road reconstruction and 33.4 miles of reconstruction. As a result of road analysis a separate road management proposal includes inactivation and decommissioning of 63.1 miles of existing road.	R-1: General Guidelines for the Location and Design of Roads a. Basic requirement for transportation facility development which best meets management objectives with least effect on environmental values.
Road management activities including: reconstruction, inactivation, decommission, temporary roads, and use are identified as key factors affecting water quality and fish habitat (Reference DEIS, Chapter 1, Key Issues - <u>Water Quality</u>). During development of the DEIS and road analysis the design and location of existing and proposed roads was evaluated by the IDT.	R-1: General Guidelines for the Location and Design of Roads b. Interdisciplinary team evaluates effects of transportation system design and road location. INFISH RF-2 c1: Road design criteria, elements, and standards that govern construction and reconstruction are identified.
DEIS Design Elements - Water Quality/Fisheries An erosion control plan is required.	R-2: Erosion Control Plan Objective: To limit and mitigate erosion and sedimentation through effective planning to initiation of road construction activities and through effective contract administration during construction.
DEIS Design Elements -Water Quality/Fisheries Cut and fill slope design, surface and subsurface	R-4: Road Slope Stabilization Objective: To reduce sedimentation by

Eyerly Project - Design Element or Procedural Requirement	BMP/INFISH Reference
drainage, and surfacing needs were considered in the development of the road designs.	minimizing erosion from road slopes and minimizing the chances for slope failures along roads.
DEIS Design Elements - Water Quality/Fisheries Road associated sediment is identified as a key factor affecting stream sedimentation. The alternatives include several design elements aimed at reducing the potential for sediment delivery from roads.	R-7: Control of Surface Road Drainage Associated with Roads Objective: 1. To minimize the erosive effects of water concentrated by road drainage features, 2. to disperse runoff from or through the road, and 3. to minimize the sediment generated from the road. INFISH RF-2d: avoiding sediment delivery to streams from the road surface.
DEIS Alternative Development, Chapter 2 As a result of road analysis a separate road management proposal includes inactivation and decommissioning of 63.1 miles of existing road.	R-12: Control of Construction in Streamside Management Units (RHCAs) Objective: To reduce the adverse effects of sediment from nearby roads on slope stability, vegetation, and aquatic resources along a designated stream zone. INFISH RF-3c: Closing and stabilizing or obliterating, and stabilizing roads not needed for future management activities.
DEIS Design Elements - Water Quality/Fisheries A water conservation plan was developed for the forest to maintain base flows. This plan would be followed under the action alternatives.	R-17: Water Source Development Consistent with Water Quality Protection Objective: To supply water for roads and fire protection while maintaining existing water quality.
DEIS – Alternative Description Road reconstruction and maintenance is described for Alternatives 2 and 3.	R-18: Maintenance of Roads Objective: To maintain roads in a manner which provides for water quality protection by controlling the placement of waste material, keeping drainage facilities open, and by repairing ruts and failures to reduce sediment and erosion.
DEIS Design Elements - Water Quality/Fisheries Obliteration of temporary roads, skid trails and landings is included in the action alternatives.	R-23: Obliteration of Temporary Roads and Landings Objective: To reduce sediment and restore productivity of the land at the completion of intended use.
DEIS Design Elements - Water Quality/Fisheries Evaluate proposed road reconstruction for designs that would reduce the potential for sediment delivery.	INFISH RF-3a: reconstructing road and drainage features that do not meet design criteria or operation and maintenance standards, or do not protect the watershed from increased sedimentation.
Fire severity regimes are described for the area in the in the Fire/Fuels Resource Report. The effects of the alternatives are described for fire, fuels, in the DEIS, Chapter 3.	F-1: Fire and Fuels Management Objective: An objective of fire management activities is to reduce the potential public and private losses which could result from wildfire and/or subsequent flooding and erosion, by reducing the intensity and destructiveness of wildfire.
DEIS Design Elements - Water Quality/Fisheries	F-2: Consideration of Water Quality in Formulating Prescribed Fire Prescriptions

Eyerly Project - Design Element or Procedural Requirement	BMP/INFISH Reference
Alternatives 2 and 3 include design elements which reduce the effects of prescribed fire on water quality.	Objective: To provide for water quality protection while achieving the management objectives through the use of prescribed fire.
Following the Eyerly Fire a Burned Area Emergency Restoration plan was completed. Projects were identified and implemented aimed at reducing the potential for soil erosion and impacts to water quality.	W-1: Watershed Restoration Objective: To repair degraded conditions and improve water quality and soil stability.
DEIS – Alternative Descriptions The action alternatives afford protection to riparian areas and stream courses, including floodplains through implementation Riparian reserves and RHCA's.	W-2: Conduct Floodplain Hazard Analysis and Evaluation Objective: To avoid, where possible, the long- and short-term adverse impacts to water quality associated with the occupancy and modification of floodplains.
DEIS – Design Elements – Water Quality/Fisheries The action alternatives would avoid any activities within springs, seeps, or wetlands.	W-3: Protection of Wetlands Objective: To avoid adverse water quality impacts associated with destruction or modification of wetlands.
A hazardous materials contingency plan has been completed by the forest and is in-place.	W-4: Oil and Hazardous Substance Spill Contingency Plan and Spill Prevention Control & Countermeasure Plan Objective: To prevent contamination of waters from accidental spills.
Cumulative effects of proposed actions, past actions, and reasonably foreseeable future actions are included in the analysis. Reference Hydrology Report, Fisheries Report, and EA Chapter 3.	W-5: Cumulative Watershed Effects Objective: To protect the beneficial uses of water and streams from the cumulative effects of multiple management activities which may result in adverse (degraded) water quality or stream habitat conditions.
DEIS Design Elements - Soils If slopes should exceed 35 percent on portions of tractor units, end lining would be required to minimize detrimental soil impacts.	VM-1: Slope Limitations for Tractor Operations Objective: To reduce gully and sheet erosion and associated sediment production by limiting tractor use.
DEIS Design Elements - Water Quality/Fisheries Wetlands and meadows are delineated within the project area. Springs, seeps, streams, and wet meadows have associated RHCA's applied. No off road ground-based harvest operations are proposed within RHCA's.	VM-2: Tractor Operation Excluded from Wetlands and Meadows Objective: To limit turbidity and sediment production resulting from compaction, rutting, runoff concentration, and subsequent erosion.
DEIS Design Elements - Noxious Weeds Revegetate roads, landings, and other disturbed areas as soon as possible to reduce the potential for weed establishment and soil erosion.	VM-3: Revegetation of Surface Disturbed Areas Objective: To protect water quality by minimizing soil erosion through the stabilizing influence of vegetation.
DEIS Monitoring Common to All Action Alternatives Implementation monitoring and Water Quality monitoring to evaluate the effectiveness of BMP's and INFISH and NWFP standards and guidelines is included for all the action alternatives.	W-7: Water Quality Monitoring Objective: To determine effects of land management activities on the beneficial uses of water; to monitor baseline watershed conditions for comparison with State Water Quality standards, Forest Plan standards, and estimation of long-term trends; to ensure the health and

Eyerly Project - Design Element or Procedural Requirement	BMP/INFISH Reference
	safety of water users; to evaluate BMP effectiveness; and to determine the adequacy of data, assumptions, and coefficients in the Forest Plan.
EA, Alternative Description, Chapter 2 Alternatives 2, 3, and 4 include riparian restoration actions: Aspen/Cottonwood Treatment: Alternative 2 & 4: 53 acres Alternative 3: 52 acres Long-term improvement in water quality is also expected, under Alternatives 2 and 4, due to the proposed road inactivation and decommissioning.	INFISH Watershed Restoration Watershed restoration comprises actions taken to improve the current conditions of watersheds to restore degraded habitat, and to provide long-term protection to natural resources, including riparian and aquatic resources. INFISH WR-1: Watershed and Habitat Restoration Design and implement watershed restoration projects in a manner that promotes the long-term ecological integrity of ecosystems, conserves genetic integrity of native species, and contributes to attainment of RMO's.

APPENDIX E: DETERMINATION OF EFFECTS SUMMARY

BIOLOGICAL EVALUATION for SENSITIVE SPECIES

and

BIOLOGICAL ASSESSMENT for LISTED SPECIES SUMMARY OF CONCLUSION OF EFFECTS

Species:	Listing	Alt. 1	Alt. 2	Alt. 3	Occurrence
American Peregrine Falcon	S	NI	NI	NI	HN
Northern Bald Eagle	T	LAA	LAA	LAA	HD, D
Northern Spotted Owl	T	NLAA	NLAA	NLAA	HD, D
Horned Grebe	S	NI	NI	NI	HN
Red-necked Grebe	S	NI	NI	NI	HN
Bufflehead	S	MIIH	MIIH	MIIH	HD, D
Harlequin Duck	S	NI	NI	NI	HD
Yellow Rail	S	NI	NI	NI	HN
Tri-colored Blackbird	S	NI	NI	NI	HN
Western Sage Grouse	S, SOC	NI	NI	NI	HN
Canada Lynx	T	NE	NE	NE	HN
California Wolverine	S, SOC	NI	NI	NI	HD
Pacific Fisher	S, SOC	MIIH	MIIH	MIIH	HD
Pygmy Rabbit	SOC	NI	NI	NI	HN
Oregon Spotted Frog	PT	NE	NE	NE	HN
Columbia River Bull Trout	T	NLAA	NLAA	NLAA	HD, D
Interior Redband Trout	S	MIIH	MIIH	MIIH	HD, D
Chinook Salmon ¹	MS	NE	NE	NE	HD
Tall agoseris	S	NI	NI	NI	D
Peck's penstemon	S	NI	NI	NI	D
Ground cedar	S	NI	NI	NI	D
Artemisia ludoviciana ssp. estesii	S	NI	NI	NI	N
Gorman's aster	S	NI	NI	NI	N
Peck's milk-vetch	S	NI	NI	NI	HN
Long-bearded mariposa-lily	S	NI	NI	NI	HN
Porcupine sedge	S	NI	NI	NI	N
Green-tinged paintbrush	S	NI	NI	NI	N
Mt. Mazama collomia	S	NI	NI	NI	N
Water lobelia	S	NI	NI	NI	HN
Adder's-tongue	S	NI	NI	NI	HN
American pillwort	S	NI	NI	NI	HN
Columbia cress	S	NI	NI	NI	N
Howell's thelypody	S	NI	NI	NI	N

Note:

¹ Chinook Salmon waters are designated Essential Fish Habitat by the Mangson-Stevens Act

Species Listing Categories:	Determination for Federally Listed Species:	Occurrence:
E Endangered T Threatened S USFS Region 6 Sensitive C USFWS candidate species SOC USFWS Species of Concern PT Proposed threatened MS Magnuson-Stevens Act designated Essential Fish Habitat	NE No Effect LAA may effect - Likely to Adversely Affect NLAA may effect - Not Likely to Adversely Affect BE Beneficial Effect Determination for Sensitive Species: NI No Impact MIIH May Impact Individuals or Habitat, but will not likely contribute to a trend towards federal listing or loss of viability to the population or species WIFV* Will Impact individuals or habitat with a consequence that the action may contribute to a trend towards Federal listing or cause a loss of Viability to the population or species BI Beneficial Impact <i>*Trigger for a Significant Action As Defined In NEPA</i>	HD Habitat Documented or suspected within the project area or near enough to be impacted by project activities HN Habitat Not within the project area or affected by its activities D species Documented in general vicinity of project activities S species Suspected in general vicinity of project activities N species Not documented in general vicinity of project activities

Prepared by:

/s/ Kristopher Hennings

/s/ Brad Houslet

/s/ Rick Dewey

Kristopher Hennings
Wildlife Biologist

Brad Houslet
Fisheries Biologist

Rick Dewey
Botanist

Note: Rationale for conclusion of effects is contained in the draft environmental impact statement.

APPENDIX F: RESPONDING TO RECOMMENDATIONS OF BESCHTA ET AL. (1995) AND OTHER VIEWPOINTS ON POST-FIRE SALVAGE



The Eyerly Fire Salvage Interdisciplinary Team (IDT) considered the general principles and recommendations provided by Beschta et al in their paper “Wildfire and Salvage Logging”, 1995. In addition, response is provided for the Eyerly Fire Salvage Project to comments made by Jerry Franklin to the Biscuit Recovery Project.

Based on considerable academic experience, the authors of Beschta et al provide their opinions on the issue of salvage following wildfires in the form of general principles and recommendations. The authors present their suggested policy principles and land management recommendations as generally applicable to federal lands throughout the western United States, or at least the interior Columbia and upper Missouri basins. The recommendations presented in the paper are not focused on the specific ecological, social, and economic characteristics of the post-fire conditions of the Eyerly Fire area. Additionally, the authors do not consider the multiple-use goals, objectives and standards of the Deschutes Forest Plan. Thus, the IDT considered the authors’ suggested principles and recommendations in the context of specific post-fire conditions for the Eyerly Fire Area and Forest Plan management direction of the Deschutes National Forest.

The following is a summary of how the IDT and Eyerly Fire Salvage FEIS addresses the issues raised by Beschta et al (1995). It focuses on the Beschta recommendations pertaining to post-fire practices since that is the subject of the actions proposed with the Eyerly Fire Salvage project. All bold text is from the Beschta document.

“Ongoing human activity and the residual effect of past activity continue to threaten watershed ecosystem integrity.

a. “The ability of ecosystems to recover has been substantially compromised.”

b. “Attempting to continue to manage fire and its consequences without altering or controlling other threats to ecosystems integrity, including logging, grazing, road building, and mining is scientifically and pragmatically unsound.”

It is recognized by the team that the subwatersheds within which proposed salvage would occur have degraded conditions incurred as a result of past management activities. Existing conditions for watershed health, soils, stream channels and fisheries are summarized within the Affected Environment of the EIS. Although past management has caused some levels of environmental stress, land management agencies have made significant progress toward a holistic ecosystem approach in recent years (Everett, 1995).

The Metolius Watershed Analysis (1996) and the Metolius Late Successional Reserve Analysis (1996) both describe ecosystem system conditions, function, and processes in comparison to historic conditions for portions of the Eyerly Fire Salvage Project Area.

Both of these analyses were considered in designing alternatives, and in describing the effects of the salvage proposal documented in the Eyerly Fire Salvage FEIS. The effects of the proposed salvage and alternatives on watershed, soils and other resources are described in the FEIS.

Analysis of post-fire conditions does reveal that cumulative effects as a result of the Eyerly Fire may have placed some of the ecosystem components at risk for degradation, specifically erosion susceptibility, sediment yield and channel integrity. The risks identified, however, are short-term when considering vegetative recovery following the fire. Field reconnaissance of burn severity and vegetative recovery in the first year has shown that re-growth has not been inhibited as a result of the fire and that the ability of this ecosystem to recover has not been compromised beyond repair.

Proposed salvage activities cover a small percentage of the subwatersheds in question and would be implemented in conjunction with Best Management Practices intended to reduce detrimental impacts capable of exacerbating watershed conditions. The project also extends protection for riparian areas and stream courses beyond that specified by Riparian Habitat Conservation Areas (RHCA) and Riparian Reserves in order to reduce disturbance from proposed activities on slopes within a sediment delivery distance from these channels.

The proposed salvage described in the Eyerly Fire Salvage FEIS is a one of several projects being considered in a larger context of fire restoration and recovery for the Eyerly Fire. A road analysis has been completed and a road management proposal has been developed which proposes to reduce the number of miles of open road within the Eyerly Fire Area. Many road locations proposed for closure and/or obliteration are within or along intermittent stream channels that were identified as direct sediment and runoff sources to these streams. Burned Area Emergency Rehabilitation (BAER) projects such as slope stabilization, contour felling and culvert repair and replacement have been completed within the fire perimeter, while several other projects aimed at recovery and restoration of the resources are in various stages of development and planning.

“Fires are an inherent part of the disturbance and recovery patterns to which native species have adapted.

a. “Fires are part of the pattern of disturbance and recovery that provides a physical template for biological organization at all levels.” Fires reset temporal patterns and processes that, if allowed to proceed undisturbed by additional human impacts, provide dynamic and biologically critical contributions to ecosystems over long time frames.”

In significantly altered ecosystems, natural disturbance processes may no longer be operating within historical ranges of variability (Agee 1994b, Hessburg et al. 1994), and their effects may be as foreign to the functioning of the ecosystem as human activities (Everett, 1995). The role of fire as a natural disturbance process within the Eyerly Fire area is described in the Metolius LSRA and in the Eyerly Fire Salvage FEIS.

The action alternatives in the Eyerly Fire FEIS were crafted to retain the ecological benefits of the fire while responding to the needs of society and goals of the Forest Plan. The historic role of fire as a disturbance process within the Eyerly Fire is described in both the Eyerly Fire Salvage FEIS and Metolius LSRA. Additionally, historic fire

regimes are described in the Metolius Watershed Analysis, for Mixed Conifer Dry PAG on pages 54 and 55, and for the Ponderosa Pine PAG on pages 63 and 64.

Though fire is recognized as an important disturbance process within the Eyerly area several points must be considered in the management of the area.

- The conditions present within the Eyerly fire area prior to the fire reflected past management history including fire suppression. These conditions include four major vegetation trends (Metolius LSRA, 1996):
 - Greatly increased stand densities
 - Mortality of larger trees, insect and disease damage, catastrophic fire risk are increasing.
 - Species composition has been shifting from early to late seral species.
 - Stand structure has been shifting from larger tree sizes to smaller tree sizes, and from single or two canopy layers to multi-canopy layers.
- Given that the pre-fire vegetation conditions were outside the historic ranges of variability, the fire itself was of such an intensity and size that also was outside the range of historic of variability.
- The effects of the Eyerly Fire may include post-fire conditions that are uncharacteristic of historic fires.
- The design of the action alternatives in the Eyerly Fire salvage FEIS includes actions that would restore vegetation and fuels to sustainable conditions within treated areas.

In a study he conducted of fire history in the Jefferson Wilderness Area east of the cascade crest, approx. 7 miles west of the Eyerly Fire Area, Steve Simon, Area Fire Ecologist, made the following observation for the Grand Fir Zone “Without periodic burning there has been a marked increase in fuel loading and ladder fuels capable of carrying fire into the upper crowns” (Simon, 1991).

b. “The ‘patchiness’ of fire is a desirable characteristic, and many species depend on the environmental influences that fires create.”

The area of National Forest lands within the perimeter of the Eyerly Fire totals 17,786 acres. Table F-1 displays, by burn severity, the amount of area proposed for salvage activity for Alternative 2, the preferred alternative.

Table F-1. Eyerly Fire Burn Severity and Salvage Treatment

Burn Severity	Acres Within Eyerly Fire Perimeter	Acres Proposed for Treatment in Alternative 2	Percent of Area Proposed for Treatment	Percent of Area Where No Treatment Would Occur
Mixed	3050	416	14	86
Non-Lethal	1915	0	0	100
Stand Replacement	12821	4430	35	65
Total	17786	4846	27	73

The amount of area left untreated with either salvage or special forest product utilization represents the majority of the Eyerly Fire area. Areas left untreated would recover at

natural rates. Units selected for treatment are distributed within the fire area so that a patchwork of treated and untreated areas would result in a “mosaic” of conditions, resembling the patchiness associated with fire.

“There is no ecological need for immediate intervention on the post-fire landscape.”

The ecological need for salvage and fuels treatment within the Eyerly Fire area is based on the opportunity which exists to move some of the landscape toward vegetation and fuels conditions more reflective of those which supported a short interval fire-adapted fire regime (Fire Regimes I and IIIa, described in the Fire and Fuels Section, Chapter 3, FEIS). This fire regime occurs on approximately 83% of the Eyerly Fire area. Implementing activities which restore appropriate species composition, stand density, and fuels conditions that are consistent with these fire regimes would result in a more fire resilient forest (Agee 2002).

Included in the purpose and need of the Eyerly Fire Salvage project is the recovery of economic value of burned timber. In order to recover this value, burned trees need to be harvested within two to three years in order to remain economically viable under the proposed prescriptions.

The recovery of economic value from burned trees also generates a source of funding to plant trees within activity units considered to be in the Stand Replacement mortality class (Mortality >80%). This would jump-start the return of conifer cover in approximately 20 and 30% of the two primary subwatersheds within the fire perimeter. Proposed activities would enter approximately 5,000 or 3,000 acres, respectively, for salvage operations under Alternatives 2 and 3 out of a total of 23,000 acres burned.

Immediate intervention was implemented following the fire in order to reduce the risk of increased water yield and storm flows under low cover conditions. BAER response included contour felling and seeding of approximately 2,499 acres of slopes exceeding 30% considered to have an elevated risk of erosion from overland flows created by convective storm events. Culverts on the primary forks of Spring and Street Creeks were repaired at the major mid-watershed locations and re-designed and replaced at the lower road crossings of these same streams in order to accommodate increased storm flows generated by the burned landscape. Improved fish passage was also accomplished on lower Street Creek as a result of these activities.

Existing condition should not be used as “baseline” or “desired” conditions upon which to base management objectives.

Management objectives are not based on the existing conditions following the Eyerly Fire. Existing conditions are used as a baseline upon which to measure the effects of the propose activities. Desired conditions and management objectives are described in the Deschutes Forest Plan. Effects of the Eyerly Fire and proposed activities, as well as cumulative effects are described in the FEIS, Chapter 3 for all resources affected.

No change to desired conditions described in the Forest Plan are being proposed. Forest Plan standards and guidelines are adhered to for the activities proposed.

“Fire suppression throughout forest ecosystems should not automatically be a management goal of the highest priority.”

General fire suppression goals, and standards and guidelines are described in the Deschutes Forest Plan and Fire Management Plan. Fire management goals and forest wide standards and guidelines are described in the Forest Plan pages 4-73 through 4-74. Fire suppression is beyond the scope of this salvage proposal and analysis.

“The region’s ecosystems, not just forests, are under severe strain. From a watershed perspective, the region suffers an ecosystem health problem, but the primary cure rests in curtailing human activities known to be damaging and counterproductive, and repairing or restoring roads that act as permanent sources of adverse impact.”

The analysis conducted for the Eyerly Fire Salvage is landscape based and borrows from both the Metolius LSR Assessment and the Metolius Watershed Analysis. Both of these documents describe historic and current conditions based on ecosystem processes, conditions and functions. There are other scientific views which support an active role in restoring vegetation and fuels conditions following a fire event (Fitzgerald, 2002 and Brown 2003).

The Eyerly IDT conducted a road analysis containing recommendations for road obliteration (decommissioning) and road closures (inactivation). These recommendations are being carried forward to a road management proposed action. The road management proposed action has completed the scoping process and will be documented in a separate environmental document. The road management proposal is considered in the Eyerly Fire salvage FEIS as a reasonably foreseeable future action.

“We recommend that management of post-fire landscapes should be consistent with the following principles.”

- a. **“Allow natural recovery and recognize the temporal scales involved with ecosystem evolution.” “Human intervention on the post-fire landscape may substantially or completely delay recovery... or accentuate the damage.”**
 - b. **“There is little reason to believe that post-fire salvage logging has any positive ecological benefits, particularly for aquatic ecosystems.”**
- “There is considerable evidence that persistent, significant environmental impacts are likely to result from salvage projects... These impacts include soil compaction and erosion, loss of habitat for cavity nesting species, loss of structurally and functionally important large woody debris.”**

Analysis of the potential effects of the Eyerly Fire Salvage project within the EIS does not indicate that primary ecosystem processes would be detrimentally impaired by the proposed activities. Key watershed functions such as water yield, sediment delivery and peak storm flows have been elevated from pre-fire conditions by the fire and were analyzed to be nearly immeasurably exacerbated by proposed activities implemented under recommended RHCA buffer widths and Best Management Practices (BMPs) included in the EIS. Harvest and yarding systems utilizing helicopter and skyline

operations are proposed on slopes exceeding 30% to reduce disturbance to the soil resource, while ground-based harvest systems would be implemented using designed layouts intended to limit the extent of multiple machine trips and associated detrimental compaction.

The Forest intends to implement the proposed activities in a manner in which the needs of soil, water, wildlife, fisheries and ecosystem resources are provided for within the context of the treatment proposals. Erosion losses, sediment delivery and water quality are addressed by proposing harvest activities outside the riparian areas sediment delivery boundaries in order to reduce disturbance of the soil and vegetation that has returned following the fire. Harvest prescriptions have been designed to provide enough snags for cavity nesting and foraging species and sufficient coarse woody debris to meet the needs of wildlife species dependent upon them.

The Eyerly EIS proposes no activities within the aquatic and riparian ecosystems. Portions of the riparian reserves were aerially seeded following the fire and had some diversity planting of native tree and shrub species. Large wood that was documented to have burned out of stream channels will be replaced naturally with currently standing dead and newly fallen trees that were killed by the fire. Although sediment delivery and runoff has the potential to increase during the immediate post-fire, low cover conditions, some vegetative cover has already returned within the riparian areas which will not be disturbed by proposed activities. These areas will be allowed to recover naturally and have been jumpstarted to some degree by the diversity planting implemented during the spring of 2003. There are also numerous upland acres within the fire perimeter that are not proposed for salvage and would also be left to recover naturally.

“No management activity should be undertaken which does not protect soil integrity.”

“Soil loss and compaction are associated with both substantial loss of site productivity and with off-site degradation (water quality).”

“Reduction of soil loss is associated with maintaining the litter layer.”

“Although post-burn soil conditions may vary depending upon fire severity, steepness of slope, inherent erodibility, etc., soils are particularly vulnerable in burned landscapes.”

“Post-burn activities that accelerate erosion or create soil compaction must be prohibited.”

The EIS includes analysis of soil conditions following the fire and those predicted as a result of the proposed activities. Post-fire burn severity was found to be predominately moderate and low within the fire perimeter with less than 2% having high burn severities capable of altering productivity or hydrologic functions. While the initial vulnerability of the soil and water resources to erosion mechanisms is elevated due to the loss of cover, the return of vegetation has and will continue to occur on these sites under uninhibited post-fire rates.

Proposals to salvage log within the fire perimeter are acknowledged to incur detrimental soil disturbance in the form of compaction, vegetative disturbance from crushing and uprooting, and some levels of organic litter disturbance, especially within units proposed for ground-based harvest and yarding operations. The proposed harvest and yarding systems are designed in order to limit these impacts to meet standards and guidelines for

the soil resource outlined in FSM-2500, R6 Supplement 2500-98-1. Hand-fell harvest and Helicopter and Skyline yarding systems are proposed for units with slopes exceeding 30% and ground-based logging systems would be implemented under BMP's intended to limit the amount of detrimental compaction incurred. Subsoiling rehabilitation would be utilized to relieve compaction within ground-based units where detrimental conditions exceeded 20% of the activity area following harvest and yarding activities.

Disturbance levels following operations within activity units are not predicted to be extensive enough to significantly reduce soil productivity or increase erosion losses from overland flows. Riparian protection buffers have been extended along the primary forks of Street and Spring Creeks to 320 feet in order to reduce the amount of soil disturbance within sediment delivery zones capable of sourcing sediment to intermittent or perennial stream channels. Areas in which harvest activities are proposed would also have increased amounts of debris and litter on the soil surface as a result of operations, reducing the energies of overland flows and limiting sediment movement as a result of sheet erosion. Additional sediment delivery as a result of proposed activities is predicted to be a fraction of that exposed and potentially delivered under post-fire conditions alone.

“Preserve species’ capability to naturally regenerate.”

“If warranted, artificial regeneration should use only species and seed sources native to the site, and should be done in such a way that recovery of native plants or animals is unhampered.”

Aerial seeding of non-native, non-persistent species mix comprised of soft, white winter wheat (“Madsen”) and annual ryegrass (“Gulf”) was implemented over approximately 2,500 acres by the BAER team for slopes considered to have an elevated risk of erosion due to the loss of surface cover. Photo monitoring of the 1994 Entiat fires on the Wenatchee National Forest show that these species do not persist at levels capable of inhibiting the return and growth of native species beyond three years.

Planting of native conifer seedlings has occurred on 500 acres and is proposed to occur on about 3,900 acres following proposed harvest activities. Natural regeneration of conifers throughout the Stand Replacement mortality areas is unlikely to occur at significant rates since last year's seed sources were burned before full maturation. The return of native annuals and shrubs has occurred to significant cover levels within other fire salvage areas on the Forest and has already become well established during the first growing season following the fire.

“Do not impede the natural recovery of disturbed systems.”

Much of the watershed would be left for natural recovery processes. Exotic noxious weed populations would be combated to limit their influence on delaying the recovery of native species. Extensive surveys, manual treatment, and monitoring of noxious weeds began in the fall of 2002 and will continue indefinitely. Decommissioning of roads would remove some roadbeds from and adjacent to stream channels that currently contribute sediment and runoff directly to the aquatic system. Additional roadbeds located in upland areas are also proposed for decommissioning, returning areas capable of supporting vegetation to a less disturbed condition.

❖ Recommendations on Post-fire Practices

“Salvage logging should be prohibited in sensitive areas.”

“Logging on sensitive areas is often associated with accelerated erosion and soil compaction.”

“Salvage logging by any method must be prohibited on sensitive sites, including: severely burned areas (no duff layer), on erosive soils, on fragile soils, in roadless areas, in riparian areas, on steep slopes, or any site where accelerated erosion is possible.”

The Eyerly ID team considered sensitive areas when designing alternatives for the project. Best Management Practices (BMPs) and the Deschutes National Forest Plan mandate specific protection for soil and water resources during proposed harvest activities. Recommendations for the use of hand felling along with helicopter and skyline yarding are to be implemented on units where slopes exceed 30%. No activities are proposed within roadless areas or Riparian Habitat Conservation Areas or Riparian Reserves. Additional protection for primary intermittent and perennial stream reaches have been extended to 320 feet in order to minimize disturbance within distances capable of delivering sediment to existing channels during sheet erosion events.

Soils within the Eyerly fire perimeter were exposed to wind and water erosion mechanisms as a result of the consumption of surface litter, duff and live vegetative components. Most of the soils located within proposed activity units with Sand Replacement harvest prescriptions had their duff layer entirely consumed during the fire and would meet the Beschta criteria for classification as sensitive. Some of these areas have had significant needle fall following the fire and most have had vegetative re-growth of annuals, shrubs and seeded grass that is providing litter cover capable of reducing raindrop impacts, overland flow energies and post-fire susceptibility to erosion.

“Fragile” soils were considered to be those identified as sensitive soils in the Deschutes Land Resource Management Plan, including soils with slopes exceeding 30% having elevated erosion risks and those located in bottomland landscape positions likely to have seasonal water tables. No activities are proposed within bottomland soil types while hand-fell harvest and helicopter or skyline yarding systems have been recommended for slopes exceeding 30%. These systems would lop tops off of merchantable material before yarding occurred and variably pile them to break up the continuity and reduce the overall levels of activity fuels on these sites.

“On portions of the post-fire landscape determined to be suitable for salvage logging, limitations aimed at maintaining species and natural recovery processes should apply.”

“Dead trees (particularly large dead trees) have multiple ecological roles in the recovering landscape including providing habitat for a variety of species, and functioning as an important element in biological and physical processes. In view of these roles, salvage logging must leave at least 50% of the standing dead trees in each diameter class; leave all trees greater than 20 inches dbh or older than 150 years; generally, leave all live trees.”

“Because of soil compaction and erosion concerns, conventional types of ground-based yarding systems should be generally prohibited.”

“Helicopter and cable systems using existing roads and landings may be appropriate, however, even these... methods could locally increase runoff and sediment.”

The value of dead trees in biological and physical processes is recognized by the team and addressed in the snag and downed wood habitat and soils sections of Chapter 3. Current snag and downed wood guidelines on the Forest are a result of Northwest Forest Plan and Deschutes LRMP direction for retention, recruitment and cycling of snags and coarse woody material at levels that maintain ecological processes across the landscape. Harvest prescriptions would leave approximately 1/3 to 1/2 of merchantable material over 10” in order to meet guidelines for snags for each Plant Association Group. No upper diameter limit has been set for the harvest prescriptions which could result in the harvest of trees over 20” within proposed activity units.

Silviculture prescriptions for salvage call for the removal of trees that are already dead or not expected to survive using criteria considering post-fire crown and bole scorch. Proposed activity area acreage within the Stand Replacement mortality class (>80% mortality from the fire) is about 35% of the total amount within the fire perimeter, leaving nearly 7,500 acres of untreated stands that would have 100% of the stand volume left on site to provide snag and coarse woody material.

All harvest and road related activities proposed in the salvage are consistent with the goal of minimizing soil erosion and negative impacts to both terrestrial and aquatic environments. Ground-based harvest and yarding systems are proposed within activity units with slopes <30% and would utilize BMPs to limit the extent of detrimental disturbance. The team has recommended additional protection for primary intermittent and perennial reaches of stream channels to address concerns for increased erosion and sediment delivery as a result of proposed activities.

“Building new roads in the burned landscape should be prohibited.”

The action alternatives of the Eyerly EIS do not include any permanent road construction although they do propose to construct approximately 2.1 and 1.4 miles of temporary road, respectively, to access ridgetop locations above units identified for skyline yarding systems. Approximately 2.1 miles of currently closed roads will also be temporarily opened for harvest removal. All temporary roads constructed under this EIS would be fully decommissioned and allowed to revegetate following proposed activities requiring their use.

Current road densities within the primary subwatersheds of the analysis exceed Forest Plan Standards and Guidelines and may be contributing to elevated storm flows and sediment delivery to stream channels. The Eyerly ID team acknowledges that high road densities can be linked to a series of negative effects to the aquatic environment, including increased drainage miles and run-off, and potentially altered water chemistry. Wemple et al. (1996) demonstrates how road systems can increase peak flows and that drainage ditches can form gullies that can lead to direct input of flows and sediment to streams.

The Eyerly ID team identified approximately 32 miles of roads for obliteration or closure in the roads analysis in order to address density, run-off and sediment delivery problems. Some roads and culverts within the fire perimeter have been re-designed and improved as a part of the Burned Area Emergency Restoration package implemented in the fall of 2002

and the spring of 2003. Although road management is not a part of the EIS decision notice, it will be proposed in a separate environmental analysis.

“Active reseeding and replanting should be conducted only under limited conditions.”

“Active planting and seeding has not been shown to advance regeneration and most often creates exotic flora. Therefore, such practices should be employed only where there are several years of evidence that natural regeneration is not occurring.”

“Native species from regional stocks that may enhance fire resistance of site may be planted if the effect is to not homogenize the landscape.”

“Seeding grasses into burned forests has been shown to disrupt recovery of native plants and is likely to create more problems than it solves.”

“The use of pesticides, herbicides, and fertilizers should generally be prohibited.”

Planting of conifer seedlings in salvage units would occur following proposed harvest activities to re-establish live conifers within the fire perimeter in a time frame where competition from shrubs and grasses would not inhibit their establishment. Natural regeneration of conifers throughout the Stand Replacement mortality areas is unlikely to occur at significant rates since there is no longer any seed sources. The return of native annuals and shrubs has occurred within other fire salvage areas on the Forest and has already become well established during the first growing season following the fire.

Because a sufficient supply of native, local-source seeds was not available, a non-native, non-persistent species mix comprised of soft, white winter wheat (“Madsen”) and annual ryegrass (“Gulf”), was selected during the BAER response to the Eyerly fire to help provide cover on slopes considered to have an elevated risk for post-fire, rill erosion above intermittent and fish-bearing perennial stream reaches. Aerial seeding occurred over approximately 2500 acres considered at risk due to the loss of surface cover, location within a dry forest type, slopes over 20%, and/or the presence of volcanic ash soils. Photo monitoring of the 1994 Entiat fires on the Wenatchee National Forest have shown that these species do not persist at levels capable of inhibiting the return and growth of native species beyond three years.

No herbicide use within the burned area perimeter is planned. Control measures for noxious and invasive weeds have included grazing by goats, but the principal control measure has been, and continues to be manual pulling or cutting.

“Structural post fire restoration is generally to be discouraged”

None of the alternatives considered in the EIS propose the installation of additional “hard” structures to function as sediment traps, fish habitat or slope and bank stabilization. BAER response efforts following the fire implemented contour felling and log erosion barriers on numerous slopes within the fire perimeter to capture sediment carried by potential overland flows, especially during first year, post-fire conditions of low vegetative and organic cover. These structures have not been seriously tested by precipitation events and still have the capacity to capture sediment as vegetative growth returns on the soil surface.

Restoration, rehabilitation and enhancement within the aquatic ecosystem in this project area are limited at the current time. In channel stream work has been limited to the

redesign and installation of culverts to ensure passage of post-fire storm runoff, smaller woody debris, and fish movements. No plans are being considered to increase wood concentrations manually or to build sediment traps or other types of channel restoration/rehabilitation or fish habitat enhancement projects as a result of the fire or as a result of the salvage operations.

The ID team completed a roads analysis during the EIS process and has made recommendations for the closure and/or decommissioning of approximately 32 miles of roads within subwatersheds burned by the fire. Priority conditions for closure were identified as those roads considered to be direct conduits to stream channels for storm flows and sediment that are located within or immediately adjacent to intermittent or perennial stream channels. Although road management for the fire area is not a part of the decision notice for the Eyerly EIS, the implementation of a separate road management Environmental Analysis is intended in the near future and would likely be a significant improvement to the current health of the aquatic environment in the watershed in terms of sediment delivery and storm flows. The EIS does include proposals to implement temporary roads for the action alternatives in order to access the ridge tops above a few units for skyline yarding. These roads would be fully decommissioned following proposed harvest activities and should not contribute to runoff or sediment production after subsoiling and obliteration activities occurred.

“Post-fire management will generally require reassessment of existing management.”

a. By increasing runoff, erosion, and sedimentation, fire may increase the risks posed by existing roads.

b. Therefore, post-fire analysis is recommended to determine the need for undertaking road maintenance, improvement, or obliteration.

The Eyerly IDT conducted a road analysis containing recommendations for road obliteration (decommissioning) and road closures (inactivation). These recommendations are being carried forward to a road management proposed action. The road management proposed action has completed the scoping process and will be documented in a separate environmental document. The road management proposal is considered in the Eyerly Fire salvage FEIS as a reasonably foreseeable future action.

Immediately following the Eyerly Fire resource conditions were assessed as part of the Burned Area Emergency Rehabilitation (BAER) process. Additional assessment was completed in a rapid assessment effort conducted by the district and forest specialists. These assessments considered existing management and the risks inherent in the condition of the watershed, from which numerous fire recovery and rehabilitation projects have been proposed or completed.

“Continued research efforts are needed to help address ecological and operational issues.”

The ID team acknowledges the value of continued research in these areas although the EIS does not propose, authorize or fund any research activities. The BAER response team provided funding for the implementation and monitoring of post-fire slope stabilization treatments such as aerial seeding and log erosion barriers and the Forest is coordinating research with a Portland State Masters thesis project tracking sediment traps installed

within the fire perimeter. Oregon State University is also conducting research within the fire perimeter under Professor Kathy Hibbard, who is examining seedling physiologic responses to post-fire environments. Considerable research has begun regarding fire ecology, fire effects, fire risks, fire recovery and restoration as part of the Joint Fire Science Program and the National Fire Plan throughout the western regions over the past number of years.

Reburn issues in post-fire environments are discussed within the effects analysis of the EIS. The team recognizes that the likelihood of ignition does not change significantly as a result of salvage or increased down wood levels. What can change, however, are fire behaviors, intensities and associated effects to resources should a reburn occur. Ice (1996) references the reburn of the Tillamook fire in the Oregon coast range within six years following that event. Anecdotal references document the reburn of thousands of snags and deadfall down wood throughout the fire area, although no evidence of the severity of this event was included. Proposed salvage is intended to reduce the amount of dead vegetation accumulated on these sites and provide breaks in the continuity of fuel loads across this landscape. Large continuous areas of high fuel loads are more likely to result in larger fires than where the spatial arrangement of high fuel loads is discontinuous.

The role of down and dead wood in providing for the full range of ecosystem processes and the needs of species is an ongoing debate. The Eyerly EIS provides for snag and coarse wood levels mandated by the Deschutes LRMP standards and guidelines and the Northwest Forest Plan. The introduction of the Decayed Wood Advisor (DecAID) tool developed by Marcot et al. (2002) into the wildlife analysis of this project is an ongoing endeavor used as an advisory analysis tool to help land managers evaluate effects of forest conditions and proposed management activities on organisms that use snags, down wood, and other wood decay elements. A large number of acres within the fire perimeter would not have any wood removed as a result of proposed activities and would carry significant loads of this material into the future. Treated acres would have snags and down wood at levels that would provide for some of the needs of species associated with this component.

The environmental effects of post-fire salvage and site preparation are described within the EIS in context to existing watershed and resource conditions under a no action scenario following the fire. Effects analysis includes documentation of the results of available research to describe predicted effects from the proposed activities.

“Additional information must be provided to the public regarding natural fires and post-burn landscapes to provide balance to a ‘Smokey Bear’ perspective of fires and forests. “

Although post-fire landscapes are often portrayed as “disasters” in human terms, from an ecological perspective, fire is part of the normal disturbance regime and renewal of natural forest ecosystems.

An increased appreciation and understanding of natural disturbance regimes in the ecology of forest ecosystems is needed by the public, and the public’s land managers.

Changes in federal wildland fire management are evident in: The Federal Wildland Fire Management, Policy and Program Review (1995), Managing the Impact of Wildfires on Communities and the Environment – A Report to the President In Response to the Wildfires of 2000, and A Collaborative Approach for Reducing Wildland Fire Risks to

Communities and the Environment: 10-Year Comprehensive Strategy (2001). The National Fire Plan goals are:

- Ensuring sufficient firefighting resources for the future;
- Rehabilitating and restoring fire-damaged ecosystem;
- Reducing fuels (combustible forest materials) in forests and rangelands at risk, especially near communities; and
- Working with local residents to reduce fire risk and improve fire protection.

Specific to the Eyerly Fire, fire regimes are addressed in both a historic and existing context as well as vegetation conditions. Vegetation and fuels conditions that are sustainable considering the role of fire in this landscape are described in the Metolius LSR Assessment. Though fire occurrence is natural considering the lightning ignition source, the fire behavior observed (rate of spread, spotting, intensity, etc.) was not. Fire behavior is largely dependent on the amount, arrangement and condition of fuels and vegetation. The conditions of fuels and vegetation for much of the Eyerly Fire area was outside the range of historic variability, the fire burned at higher intensities over a larger portion of the area than would have been expected if conditions were closer to HRV's.

The effects, then, of the Eyerly Fire are also more severe than would be expected historically. Following fires these same sites are outside the historical range of variability in amounts of snags and logs (Everett, 1995). Unless dead material is removed and stands are subsequently managed for historical tree densities, future fuel loading will be outside the historical range of variability for both live trees and dead and down, creating the potential for intense reburn situations. The "intense reburn" assumption is based on the physics of fire behavior, the greater the amount of available fuel the greater the fireline intensity in BTU's and the difficulty of fire suppression (Rothermel, 1983).

❖ Recommendations Concerning Fire Management _____

“Fire suppression activities should be conducted only when absolutely necessary and with utmost care for the long-term integrity of the ecosystem and the protection of natural recovery processes.”

This recommendation is outside the scope of the Eyerly Fire Salvage EIS. Minimum impact suppression techniques were used on the Eyerly fire whenever possible. Specific environmental effects of fire suppression activities on the Eyerly fire are discussed within the Cumulative Effects Analysis portions of Chapter 3 in the EIS.

“When land ownerships are mixed, the federal land management agencies should establish policies to prevent conflicts between re-establishment of natural disturbance regimes on federal land and the protection of private property.”

This proposal for policy change is outside the scope of the Eyerly Fire Salvage EIS.

As noted above, the National Fire Plan goals include identification of natural fire regimes, and condition class, and working collaboratively with local land owners and residents to identify fire risk and reduce fuel hazards especially near communities.

❖ Jerry Franklin's Comments on the Biscuit Fire DEIS_____

Jerry Franklin is professor of Ecosystem analysis, College of Forest Resources from the University of Washington in Seattle. Professor Franklin was part of the Forest Ecosystem Management Assessment Team (FEMAT) in 1993 that ultimately contributed to the drafting of the Northwest Forest Plan Record of Decision in 1994. Professor Franklin provided comments to the Biscuit Fire EIS on the Siskiyou and Rogue River National Forests.

Jerry Franklin, in his comment on the Biscuit Recovery EIS, mentioned that “establishment of dense, uniform stands is completely inappropriate in the LSRs and on any PAG identified as fire regime types I and II” (Franklin 2004).

Reforestation at rates of 200 trees per acre is not considered dense because regenerated stands which are not treated will not be developing an intermediate tree component until the average stand diameter is more than 8” dbh (Cochran 1994). Reforestation in this context will have variability following prescribed fire because fuels treatments, unlike customary thinning treatments, will not leave a uniform level of fuels. Franklin proposes variability in planting where the plan here is to introduce variability in the survival or established tree.

The Biscuit Fire, located in southern Oregon and northern California, began on July 13, 2002 and reached 499,965 acres. Estimated to be one of Oregon's largest in recorded history, the Biscuit Fire encompassed most of the Kalmiopsis Wilderness. The boundary of the Biscuit Fire stretches from 10 miles east of the coastal community of Brookings, Oregon; south into northern California; east to the Illinois Valley; and north to within a few miles of the Rogue River.

In his comments specific to the Biscuit Fire, Professor Franklin asserts salvage logging in Late Successional Reserves does not contribute to the revival of forest habitat and that it is antithetical to the recovery process. He also states that the Late Successional network was designed to accommodate large, intense natural disturbances and allow for natural recovery processes. Further in his comments on page 5, he states “one might question the appropriateness of allowing natural recovery processes to proceed if stand-replacement fire behavior with the resulting high levels of fuels were not characteristic of the LSRs”.

It should be noted that the 1994 Final Supplemental Environmental Impact Statement which resulted in the Northwest Forest Plan relied heavily on the Forest Ecosystem Management Assessment Team report (FSEIS, 1994, page 3 & 4-3). In the Record of Decision for the Northwest Forest Plan, additional analysis was used to design the Late Successional Reserve system to “achieve the biological results required by law, while minimizing adverse impact on timber harvest and jobs (ROD, 1994, page 26).” The FEMAT report acknowledged that the approach for adaptive management should be an objective in forest management as new or more complete science becomes available as we learn how the forest stands respond to environmental conditions that were impossible to forecast. Also, on page ii, the report acknowledges that the social and economic needs of humans should be considered.

The path chosen for the Biscuit Fire project may or may not be the best course of action for the Eyerly Fire. To let natural processes proceed may not be as appropriate. Agee recognized this point in his article in “Conservation Biology In Practice,” winter 2002, that passive management on the eastside forest LSRs over a century could potentially lead to losses of over half of the reserves in that time frame due to stand replacement fires and insect attacks, leaving no old growth characteristics.

Franklin also acknowledges eastside systems may function differently from westside forest ecosystems. In the fall edition of “Issues in Science and Technology Online,” Agee and Franklin coauthored an article that quotes: “Uncharacteristic stand-replacement fires in dry forests can produce uncharacteristic levels of post-fire fuels, including standing dead and down trees. Removing portions of that particular biological legacy may be appropriate as part of an intelligent ecological restoration program, and not simply as salvage.” They recommend that any management for fuels and ecosystems should be science based, which this analysis is.

Also recently, the rate of loss of habitat including connectivity to the Late Successional Reserve system on the Deschutes National Forest and adjacent Forests may indicate a need for more active management. Especially for protection for remaining Nesting, Roosting, and Foraging (NRF) habitat for the northern spotted owl.

Two important points made in Agee’s comments on passive management are “The hard lesson that we should take away from the last decade of fire management in drier forests, particularly in the North American West, is that a choice to do nothing is a choice of action, not always one with a desirable outcome.” He also recommends “In order of priority treatment should focus on surface fuel, ladder fuel, and then crown fuel.” (Agee 2002a).

APPENDIX G: REFERENCES CITED

- Agee, J.K. 1993. Fire Ecology of Pacific Northwest Forests. Washington D.C.: Island Press.
- Agee, J. K. 1994. Fire and weather disturbances in terrestrial ecosystems of the eastern Cascades. Gen. Tech. Rep. PNW-GTR-320. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station.
- Agee, J.K. 2002. Fire Behavior and Fire-Resilient Forests. In: Fire in Oregon's Forests: Risks, Effects, and Treatment Options, A Synthesis of Current Issues and Scientific Literature. Fitzgerald, S.A. ed. The Oregon Forest Resources Institute, Extension Forestry Program, Oregon State University.
- Amaranthus, M., Jubas, H. & Arthur, D. 1989. Stream shading, summer streamflow and maximum water temperature following intense wildfire in headwater streams. U.S. Forest Service Gen. Tech. Rep. PSW-GTR-109: Berkely, CA: U.S. Department of Agriculture, Forest Service, Pacific Southwest Research Station.: 75-108.
- Anderson, D.A.. 1989. Guidelines for Computing Quantified Soil Erosion Hazard and On-Site Soil Erosion. Berkeley, CA: U.S. Department of Agriculture, Forest Service, Pacific Southwest Research Station.
- Andrews, P.L. 1986. Behave:Fire Behavior Prediction and Fuel Modeling System-BURN Subsystem, Part 1. Gen. Tech. Rep. INT-GTR-94. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station. 130p.
- Anthony, R.G.; Steidl, R.J.; & McGarigal, K. 1995. Recreation and bald eagles in the Pacific Northwest. IN: R.L. Knight and K.J. Gutzwiller, eds. Wildlife and recreationists: coexistence through management and research. Washington D.C.: Island Press. Island Press. 372 pp.
- Barber, S.A. 1984. Soil nutrient bioavailability- a mechanistic approach. New York: John Wiley and Sons.
- Baxter, C.V., Frissell, C.A., & Hauer, F.R. 1999. Geomorphology, logging roads, and the distribution of bull trout spawning in a forested river basin: implications for management and conservation. Transactions of the American Fisheries Society 128: 854-867.
- Bayley, S.E.; Schindler, D.W.; Beatty, D.W. [et al]. 1992. Effects of multiple fires on nutrient yields from streams draining boreal forests and fen watersheds: nitrogen and phosphorus. Canadian Journal of Fisheries and Aquatic Sciences 49: 584-596.
- Bayley, S.E.; Schindler, D.W.; Beaty, K.G. [et al]. 1992. Effects of multiple fires on nutrient yields from streams draining boreal forest and fen watersheds: nitrogen and phosphorus. Canadian Journal of Fisheries and Aquatic Sciences. 51: 2723-2733.
- Becker, G. W. 1983. Fishes of Wisconsin. Madison, WI: University of Wisconsin Press.
- Benda, L.D.; Bigelow, M.P.; & Andras, K. 2003a. Effects of post-wildfire erosion on channel environments. Forest Ecology and Management 178:105-1149.

- Benda, L.; Miller, D.; Sias, J. [et al]. 2003b. Wood recruitment processes and wood budgeting. Pages 49-74 in S. Gregory, K. Boyer and A. Gurnel, editors. The ecology and management of wood in rivers. American Fisheries Society Symposium 37, Bethesda, Maryland.
- Berris, S. N., Harr, R.D. 1987. Comparative snow accumulation and melt during rainfall in forested and clear-cut plots in western cascades of Oregon. *Water Resources Research*. 23: 135-142.
- Beschta, R.L.; Frissell, C.A.; Gresswell, R. [et al]. 1995. Wildfire and Salvage Logging, Recommendations for Ecologically sound Post-Fire Salvage Logging and Other Post-Fire Treatments On Federal lands in the West. Unpublished report. On file with: College of Forestry, Oregon State University, Corvallis, OR 97331. 16p.
- Beukema, S.J.; Reinhardt, E.; Kurz, W.; & Crookston, N. 2000. An overview of the Fire and Fuels Extension to the Forest Vegetation Simulator. In: Proceedings: The Joint Fire Sciences Conference and Workshop-Crossing the Millennium: Integrating spatial technologies and ecological principles for a new age in fire management. Volume II; 1999 June 15-17. Boise, ID: University of Idaho and International Association of Wildland Fire: 80-85.
- Bilby, R.E., Bisson, P.A. 1998. Function and distribution of large woody debris: 324- 346 In: Naiman, R.J., Bilby, R.E. eds. *River ecology and management: Lessons from the pacific coastal ecoregion*. New York, NY: Springer-Verlog.
- Bisson, P. A.; Rieman, B.E.; Luce, C. [et al]. Fire and aquatic ecosystems current knowledge and key questions. *Forest Ecology and Management*. Portland, OR: US Department of Agriculture, Forest Service, Pacific Northwest Research Station.
- Blank, R., Zamudio, D. 1998. The Influence of Wildfire on Aqueous_extractable Soil Solutes in Forested and Wet Meadow Ecosystems Along the Eastern Front of the Sierra-Nevada Range, California. *Int. J Wildland Fire* 8(2): 79-85.
- Boivin, C., Bailor, C. 1996. Human health and ecological risk assessments: Wildland fire suppression chemicals. Proceedings: International wildland fire foam symposium and workshop. Thunder Bay, Ontario. 3-5 May 1994. Ramsey, G.S., ed. Natural Resources Canada. Information Report PI-X-123. Chalk River, ON, Canada: Canadian Forestry Service. Petawa National Forestry Institute. 170p.
- Boyer, D., Dell, J. 1980. Fire effects of Pacific Northwest forest soils. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Region, Watershed Management, Aviation and Fire Management.
- Brown, J. K. 1974. Handbook for inventorying downed woody material. Gen. Tech. Rep. INT -GTR-16. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station.
- Brown, J.K.; Reinhardt, E. & Fischer, W. 1991. Predicting duff and woody fuel consumption in northern Idaho prescribed fires. *Forest Science*. 37(6):1550-1566.
- Brown, J.K.; Reinhardt, E.D.; & Kramer, K.A. 2003. Coarse Woody Debris: Managing Benefits and Fire Hazard in the Recovering Forest. Gen. Tech. Rep. RMRS-GTR-105. Missoula, MT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.

- Brown, R. 2000. Thinning, Fire and Forest Restoration: A Science-Based Approach for National Forests in the Interior Northwest. Washington D.C.: Defenders of Wildlife, National Headquarters. 25p.
- Buchanan, D.V.; Hanson, M.L.; & Hooton, R.M. 1997. Status of Oregon's bull trout. Portland, OR: Oregon Department of Fish and Wildlife.
- Bunte, K., MacDonald, L.H. 1998. Scale Considerations and the Detectability of Sedimentary Cumulative Watershed Effects. [Research Triangle Park, NC]: National Council for Air and Stream Improvement, Inc. Technical Bulletin 776: 229-231.
- Busse, M.D. 1994. Downed bole-wood decomposition in lodgepole pine forests of Central Oregon. *Soil Science Society of America Journal*. 58:221-227.
- Cairns, J. Jr. 1982. Restoration of damaged ecosystems. In: Mason, W.T., Iker, S. eds. *Research of fish and wildlife habitat*. Res. Rep. EPA-600/8-82-022. Washington D.C.: U.S. Environmental Protection Agency, Office of Research and Development: 220-23
- Carlton, D. 2001. FMAPlus Ver.1.2.20. Fire Management Analysis Plus software for representative photos and tables of fuel loading, 1999 [CD-Rom]. Estacada, OR. Fire Program Solutions, LLC
- Cassirer, E.F., Groves, C.R. 1989. Breeding ecology of harlequin ducks (*Histrionicus histrionicus*). Boise, ID: Idaho Department of Fish and Game.
- Chitwood, L. 1997. An overview of liquid waste disposal and water quality in the Metolius basin, Bend, OR: U.S. Department of Agriculture, Forest Service, Deschutes National Forest, Supervisor's Office.
- Chou, Y.H.; Conard, S.G.; Wohlgemuth, P.M. 1994. Postfire salvage logging variables and basin characteristics related to sedimentation. Stanislaus NF, California. In: *Proceedings, GIS '94 symposium*, Palm Springs, CA. Vancouver, BC. [Unkown Publisher]: 873-878.
- Claar, J.S.; Gniadek, B.; Holt, S. [et al]. 2001. Lynx Biology Team response to: Management of Canada Lynx in the Cascades Geographic Areas of Oregon and Washington [White paper]. Portland, OR: U.S. Fish and Wildlife Service, Region 1. 4p.; 25p.
- Clark, B. 2001. Soils, Water and Watersheds. In: National Wildfire Coordinating Group *Fire Effects Guide*. Plan. Guide NFES 2394. Boise, ID: National Interagency Fire Center.
- Clifton, C., Ager, A. 1995. Methods for calculating equivalent clearcut acres (ECAs) to meet requirements of NFMS Biological Opinion on the Forest Plan. Pendleton, OR: U.S. Department of Agriculture, Forest Service, Umatilla National Forest, Supervisor's Office. 17 p.
- Clowers, G. 1997. PGE 1997 Bald eagle fall communal roost study. Portland, OR: Portland General Electric.
- Clowers, G. 2003. Personal Communication. Environmental Consultant. Raven Research, 874 N. 3rd St., Madras, OR 97741.
- Cole, G.A. 1994. *Textbook of Limnology*, 4th ed. Prospect Heights, IL: Waveland Press.
- Concannon, G. 1998. 1998 Harlequin duck surveys, Pelton Round Butte Hydroelectric Project. Study Plan FERC No. 2030. Portland, OR: Portland General Electric.

Confederate Tribes of the Warm Springs Reservation, Portland General Electric (CTWSR, PGE). 2002. Pelton Round Butte Project Water Quality Management and Monitoring Plan, 4th draft proposal. Warm Springs, OR. Unpublished report. On file with: USDA Forest Service, Deschutes National Forest, Sisters Ranger District, Pine Street and Highway 20, PO Box 249, Sisters, Oregon, 97759.

Corkran, C.C., Thoms C. 1996. Amphibians of Oregon, Washington, and British Columbia: a field identification guide. Edmonton, AL, Canada: Lone Pine Publishing. 175 p.

Cotter, S., Riehle, M. 2001. Water quality monitoring of the Upper Metolius River Basin for years 2000 and 2001. Unpublished report. On file with: USDA Forest Service, Deschutes National Forest, Sisters Ranger District, Pine Street and Highway 20, PO Box 249, Sisters, Oregon, 97759.

Cotter, S., Riehle, M. 2002. Water chemistry monitoring of the upper Metolius River Basin for years 2000 and 2001. Unpublished report. On file with: USDA Forest Service, Deschutes National Forest, Sisters Ranger District, Pine Street and Highway 20, PO Box 249, Sisters, Oregon, 97759.

Cotter, S., Wise, T. 2004. Metolius river redband trout redd survey 2002-2003. Bend, OR: U.S. Department of Agriculture, Forest Service, Deschutes National Forest, Supervisor's Office.

Craigg, T. 2000. Subsoiling to Restore Compacted Soils. Proceedings, Presented at the 21st annual Forest Vegetation Management Conference. Unpublished report. On file with: USDA Forest Service, Deschutes National Forest, 1645 Hwy. 20 E., Bend, OR 97701

CSIRO Forestry and Forest Products. 2000. Assessment of the Effectiveness and Environmental Risk of the use of Retardants to Assist in Wildfire Control in Victoria. Res. Rep. No. 50 prepared for the Department of Natural Resources and Environment. Kingston, ACT, Australia.

Csuti, B.A.; Kimerling, A.J.; O'Neil, T.A. [et al]. 1997. Atlas of Oregon Wildlife: Distribution, Habitat, and Natural History. Corvallis, OR: Oregon State University Press. 492 pp.

Dachtler, N. 1998. Street Creek level II stream inventory report. Bend, OR: U.S. Department of Agriculture, Forest Service, Deschutes National Forest, Supervisor's Office.

Dachtler, N. 1999. Street Creek level II stream inventory report. Bend, OR: U.S. Department of Agriculture, Forest Service, Deschutes National Forest, Supervisor's Office.

Dachtler, N. 2003. Street Creek post-fire Eyerly Fire channel condition survey. Bend, OR: U.S. Department of Agriculture, Forest Service, Deschutes National Forest, Supervisor's Office.

Dahms, W.G. 1949. How long to ponderosa pine snags stand?. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific, Pacific Northwest Forest and Range Experiment Station, Deschutes Branch. Research Note No. 57.

David, J. 2002. Eyerly Fire Soils Report. Bend, OR: U.S. Department of Agriculture, Forest Service, Deschutes National Forest, Supervisor's Office.

- DeBano, L.F.; Neary, D.G.; & Ffolliot, P.F. 1998. Fire's effects on Ecosystems. New York, NY: John Wiley and Sons, Inc: 332 p.
- DeByle, N. 1981. Clearcutting and fire in larch/douglas-fir forests of Western Montana – A multifaceted research summary. Gen. Tech. Rep. INT-99. Missoula, MT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.
- DeLuca, T.H., Zouhar, K.L. 2000. Effects of selection harvest and prescribed fire on the soil nitrogen status of ponderosa pine forests. *Forest Ecology and Management*. 138:263-271.
- Dewey, R. 2003. Eyerly Fire Salvage Project Biological Evaluation for Survey and Manage and Sensitive Plant Species, and Noxious Weeds. Unpublished report. On file with: USDA Forest Service, Deschutes National Forest, Sisters Ranger District, Pine Street and Highway 20, PO Box 249, Sisters, Oregon, 97759.
- Dunaway, Vicki. May, 2003. Personal Communication. Deschutes National Forest Timber Appraiser. Deschutes National Forest, Sisters Ranger District, Pine Street and Highway 20, PO Box 249, Sisters, Oregon, 97759.
- Dunn, T., Leopold, B. 1978. Water in Environmental Planning. New York, NY: W.H. Freeman & Company:12-16.
- Dyer, E.E. 1981. Big Bear, Potatoe, and Nine Timber Sale Cultural Resource Report. Unpublished report. On file with: USDA Forest Service, Deschutes National Forest, Sisters Ranger District, Pine Street and Highway 20, PO Box 249, Sisters, Oregon, 97759.
- Eaglin, G. S., Hubert, W.A. 1993. Effects of logging and roads on substrate and trout in streams of the Medicine Bow National Forest. *North American Journal of Fisheries Management* 13: 844-846.
- Eilers, J.M.; Raymond, R.B. Vaché, KB. 2000. Water quality of the lower Deschutes River, Oregon. Pelton Round Butte Hydroelectric Project Report FERC No. 2030. Fin. Rep. to Portland General Electric Company. Portland, OR: EDAW, Inc.
- Engstrom, Paul. 2003. Eyerly Salvage EIS Recreation Affected Environment Report. Unpublished report. On file with: USDA Forest Service, Deschutes National Forest, Sisters Ranger District, Pine Street and Highway 20, PO Box 249, Sisters, Oregon, 97759.
- Engstrom, Paul. 2003. Eyerly Salvage EIS Recreation Existing Condition Report. Unpublished report. On file with: USDA Forest Service, Deschutes National Forest, Sisters Ranger District, Pine Street and Highway 20, PO Box 249, Sisters, Oregon, 97759.
- Environmental Protection Agency. 1999. Update of ambient water quality criteria for ammonia. EPA Rep. EPA-822-R-99-014. Washington D.C.
- Everett, R.L.; Schellhaas, R.; Keenum, D. [et al]. 2000. Fire History in the Ponderosa Pine/Douglas-fir forests on the East Slope of the Washington Cascades. *Forest Ecology and Management* 129:207-225. Wenatchee, WA: U.S. Department of Agriculture, Forest Service, USDA Forestry Science Laboratory. 19 p.
- Everett, R. 1995. Memorandum to John Lowe, Regional Forester, Region 6. Review of Beschta Document. On file with: Deschutes National Forest, 1645 Hwy. 20 E., Bend, OR 97701. 16 August.

- Ewing, R. 1996. Postfire Suspended Sediment From Yellowstone National Park, Wyoming. Water Resources Bulletin. Middleburg, VA: American Water Resources Association. 32(3): 605-627
- Farnes, P. 2000. Effects of the 1988 Yellowstone Fires on the 1997 Yellowstone River Peak Flow. Bozeman, MT: Snowcap Hydrology.
- Fies, T.; Fortune, J.; Marx, S. [et al]. 1996. The Upper Deschutes River Subbasin Fish Management Plan. Portland, OR: Oregon Department of Fish and Wildlife.
- Flanagan, P. 2001. Survival of Fire-Injured Conifers in Eastern Washington. 2nd ed. originally published in Fire Management Notes. Wenatchee, WA: U.S. Department of Agriculture, Forest Service, USDA Forestry Science Laboratory. 56(2): 13-16).
- Fowler, W.B.; Anderson, T.D. & Helvey, J.D. 1988. Changes in water quality and climate after forest harvest in central Washington State. Res. Pap. PNW-RP-388. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station.
- Fowler, W.B.; Helvey, J.D. & Felix, E.N. 1987. Hydrologic and climatic changes in three small watersheds after timber harvest. Res. Pap. PNW-RP-379. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 13 p.
- Fraley, J.J., Shepard, B.B. 1989. Life history ecology and population status of migratory bull trout (*Salvelinus confluentus*) in the Flathead Lake and river system, Montana. Northwest Science 63(4): 133:143.
- Franklin, J.F., Dyrness, C.T. 1973. Natural vegetation of Oregon and Washington. Gen. Tech. Rep. GTR-PNW-8. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Forest and Range Experiment Station.
- Franklin, J.F., Agee, J.K. 2003. Forging a Science-Based National Forest Fire Policy. Issues in Science and Technology, Fall 2003. 13pp.
www.issues.org/issues/20.1/franklin.html
- Fitzgerald, S.A. 2002. Post-Fire Salvage Cutting and Rehabilitation Treatments. In: Fire in Oregon's Forests: Risks, Effects, and Treatment Options, A Synthesis of Current Issues and Scientific Literature. Prepared for The Oregon Forest Resources Institute, Fitzgerald, S.A., ed. Corvallis, OR: Oregon State University, Extension Forestry Program.
- Froehlich, H.A.; Robbins, R.W.; Miles, D.W.R.; & Lyons, J.K. 1983. Monitoring Recovery of Compacted Skidtrails in Central Idaho. Unpublished report. On file with: USDA Forest Service, Payette National Forest, P.O. Box 1026, McCall, Idaho 83638.
- Furniss, M.M. 1965. Susceptibility of fire-injured Douglas-firs to bark beetle attack in southern Idaho. Journal of Forestry. 63:8-11.
- Goetz, F.A. 1989. Biology of the bull trout, *Salvelinus confluentus*: a literature review. Eugene, OR: U.S. Department of Agriculture, Forest Service, Willamette National Forest.
- Golladay, S.W., Webster, J.R. & Benfield, E.F. 1987. Changes in stream morphology and storm transport of seston following watershed disturbance. Journal of the North American Benthological Society. 6: 1-11.
- Gomez, A.; Powers, R.F.; Singer, M.J.; & Horwath, W.R. 2002. Soil Compaction Effects on Growth of Young Ponderosa Pine Following Litter Removal in California's Sierra Nevada. Soil Sci. Soc. Am. J. 66:1334-1343.

- Gore, J.A. 1994. Hydrological change. In Calow, P., Petts, G.E. eds. The rivers handbook. Boston, MA: Blackwell Science: 33-54.
- Graham, R.T.; Harvey, A.E.; Jain, T.B.; & Tonn, J.R. 1999. The Effects of Thinning and Similar Stand Treatments on Fire Behavior in Western Forests. Gen. Tech. Rep. PNW-GTR-463. Portland, OR: U.S. Department of Agriculture, Forest Service; U.S. Department of the Interior, Bureau of Land Management, Pacific Northwest Research Station. 28p.
- Graham, R.T.; Harvey, A.E.; Jurgensen, M.F. [et al]. 1994. Managing coarse woody debris in forests of the rocky mountains. Res. Pap.INT-RP-477. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station. 12p.
- Graham, R.T.; McCaffrey, S.; & Jain, T.B. 2004. Science Basis for Changing Forest Structure to Modify Wildfire Behavior and Severity. Gen. Tech. Rep. RMRS-GTR-120. Missoula, MT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.
- Gresswell, R.E. 1999. Fire and aquatic ecosystems in forested biomes of North America. Transactions of the American Fisheries Society. 128:193-221.
- Grier, C.C. 1975. Wildfire Effects on Nutrient Distribution and Leaching in a Coniferous Ecosystem. Canadian Journal of Forest Research. 5: 599-607.
- Groves, K; Shields, B.; & Gonyaw, A. 1999. Lake Billy Chinook rainbow (redband) trout life history study- final report. Pelton Round Butte Hydroelectric Project Report FERC No. 2030. Corvallis, OR: Oregon State University.
- Haggard, M. and Gaines, W.L. 2001. Effects of stand-replacement fire and salvage logging on a cavity-nesting bird community in eastern Cascades, Washington. Northwest Science 57(4):387-396.
- Hall, J.D., Lantz, R.L. 1969. Effects of logging on the habitat of coho salmon cutthroat trout in coastal streams. In: Northcote, T.G. ed. Symposium on salmon and trout in streams. Vancouver, BC, Canada: University of British Columbia, H. R. Macmillan Lectures in Fisheries: 355- 375
- Harris, D.D., Hubbard, L.E. 1983. Magnitude and Frequency of Floods in Eastern Oregon. WRIR 82-4078. Portland, OR: U.S. Geological Survey. 39 p.
- Harvey, R.D., Jr. & Hessburg, P.F., Sr. 1992. Long-Range Planning for Developed Sites in the Pacific Northwest: The Context of Hazard Tree Management. Tech. Pub. FPM-TP039-92. Washington, D.C.: U.S. Department of Agriculture, Forest Service,
- Hauer R., Spenser, C. 1998. Phosphorus and Nitrogen dynamics in streams associated with wildfire: A study of immediate and longterm effects. International Journal of Wildland Fire. 8(4): 183-198.
- Helliwell, R. 2003. Personal communication. Forest Botanist, Umpqua National Forest, 2900 NW Stewart Pkwy, Roseburg, OR, 97470.
- Helvey, D. Fowler, W. 1979. Grass seeding and soil erosion in a steep, logged area in northeastern Oregon. Tech. Rep. PNW-RN-343. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 11 p.

- Helvey, D., Fowler, W. 1995. Effects of timber harvest on the hydrology and climate of four small watersheds. Pendleton, OR: U.S. Department of Agriculture, Forest Service, Umatilla National Forest Barometer Watershed Program. 128 p.
- Helvey, J. 1980. Effects of a North Central Washington Wildfire on Runoff and Sediment Production. *Water Resources Bulletin*. American Water Resources Association. 16(4): 627-634.
- Helvey, J. D. 1972. First-year effects of wildfire on water yield and stream temperature in north-central Washington. In Callany, S.C.; McLaughlin, T.G.; & Striffler, W.G. eds. *Watersheds in transition*. Urbana, IL: American Water Resources Association Proceedings Series 14: 308-312
- Helvey, J.D., Fowler, W.B. 1995. Effects of Timber Harvest on the Hydrology and Climate of Four Small Watersheds. Pendleton, OR: U.S. Department of Agriculture, Forest Service, Umatilla National Forest Barometer Watershed Program.
- Hennings, K. 2003a. Eyerly Fire Salvage Project: Wildlife Report for Non-TES Species. Spec. Rep. Unpublished report. On file with: USDA Forest Service, Deschutes National Forest, Sisters Ranger District, Pine Street and Highway 20, PO Box 249, Sisters, Oregon, 97759.
- Hennings, K. 2003b. Biological Evaluation of Threatened, Endangered, and Sensitive Wildlife – Eyerly Fire Salvage Project. Spec. Report. Unpublished report. On file with: USDA Forest Service, Deschutes National Forest, Sisters Ranger District, Pine Street and Highway 20, PO Box 249, Sisters, Oregon, 97759.
- Herrick, J. 1996. 96-01 Final Forest Plan Interpretation: Standards and Guidelines – Forest-wide SL-3 and SL-4. Forest Interdisciplinary Team Report. Bend, OR: U.S. Department of Agriculture, Forest Service, Deschutes National Forest.
- Hibbard, K. Personal Communication. Terrestrial Ecosystem Modeler. Oregon State University, Forest Science, 304 Richardson Hall, Corvallis, OR 97331.
- Hollis, H.; Knecht, D.; Lowery, M. [et al]. 2002. Management Recommendations for Clustered Lady Slipper Orchid (*Cypripedium fasciculatum* Kellogg ex Watson, S.). Portland, OR: U.S. Department of Agriculture, Forest Service; U.S. Department of the Interior, Bureau of Land Management, Pacific Northwest Research Station.
- Horgen, R. 2003. Eyerly Fire Salvage Project EIS Transportation Report. Spec. Rep. Unpublished report. On file with: USDA Forest Service, Deschutes National Forest, Sisters Ranger District, Pine Street and Highway 20, PO Box 249, Sisters, Oregon, 97759.
- Horner, N.J. 1978. Survival, densities and behavior of salmonid fry in streams in relation to fish predation. Moscow, ID: University of Idaho Moscow. M.S. Thesis.
- Hornocker, M.G., Hash, H.S. 1981. Ecology of the wolverine in northwestern Montana. *Canadian Journal of Zoology*. 59:1286-1301.
- Houser, M. 1996. Deschutes County Prehistoric Context Statement. Bend, OR: Deschutes County Community Development Department.
- Houslet, B.S. 1997. Inland redband trout spawning survey of the upper Metolius River Subbansin. Unpublished report. On file with: USDA Forest Service, Deschutes National Forest, Sisters Ranger District, Pine Street and Highway 20, PO Box 249, Sisters, Oregon, 97759.

- Houslet, B.S. 2000. Fine sediment accumulation rates for selected streams in the Metolius River Basin, Oregon. Unpublished report. On file with: USDA Forest Service, Deschutes National Forest, Sisters Ranger District, Pine Street and Highway 20, PO Box 249, Sisters, Oregon, 97759.
- Houslet, B.S. 2004. Recruitment of large wood to the Metolius River, Oregon. Unpublished report. On file with: USDA Forest Service, Deschutes National Forest, Supervisor's Office, 1645 Hwy. 20 E., Bend, OR 97701
- Houslet, B.S., Riehle, M.R. 1998. Trends in juvenile bull trout abundance and thermal habitat use in tributaries to the Metolius River, Oregon. Unpublished report. On file with: USDA Forest Service, Deschutes National Forest, Sisters Ranger District, Pine Street and Highway 20, PO Box 249, Sisters, Oregon, 97759.
- Houslet, B.S.; Riehle, M.R.; & Harvey, J. 1999. Jefferson fire monitoring final Report-1999. Unpublished report. On file with: USDA Forest Service, Deschutes National Forest, Sisters Ranger District, Pine Street and Highway 20, PO Box 249, Sisters, Oregon, 97759.
- Howell, P.J. 2001. Effects of disturbance and management of forest health on fish and fish habitat in eastern Oregon and Washington. Northwest Science. 75 Special Issue: 157-165.
- Ingram, R. 1973. Wolverine, fisher, and marten in central Oregon. Oregon State Game Commission Report No. 73-2. Salem, OR: Oregon Department of Fish & Wildlife.
- Interagency Scientific Committee. 1990. Conservation strategy for the northern spotted owl: a report of the Interagency Scientific Committee to address the conservation of the northern spotted owl. Oregon Natural Heritage Data Base. Portland, OR: The Nature Conservancy.
- Johnson, D.; Petersen, R.; Lycan, R. [et al]. eds. 1985. Atlas of Oregon lakes. Corvallis, OR: Oregon State University Press.
- Jones, J.A., Grant, G.E. 1996. Peak flow responses to clear-cutting and roads in small and large basins, western Oregon. Water Resources Research 32: 959-974.
- Keen, F.P. 1950. The rate of natural falling of beetle-killed ponderosa pine snags. Journal of Forestry 53:720-723.
- Keyser, J. D.; Burge, T.L.; & Fleming, D.M. eds. 1988. Management Strategy for the Treatment of Lithic Scatter Sites. Portland, OR: U.S. Department of Agriculture, Forest Service; U.S. Department of the Interior, Bureau of Land Management, Pacific Northwest Research Station.
- King, J. 1989. Streamflow responses to road building and harvesting. A comparison with equivalent clearcut area procedure. Gen. Tech. Rep. INT-401. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station.
- King, J.G. 1996. Streamflow responses to road building and harvesting: a comparison with equivalent clearcut area procedure. Gen. Tech. Rep. INT-401. Ogden, UT; U.S. Department of Agriculture, Forest Service, Intermountain Research Station.
- Koehler, G.M.; Krebs, C.J.; McKelvey, K.S.; & Squires, J.R., eds. Ecology and conservation of lynx in the United States. Boulder, CO: Univ. Press of Colorado. 480 p.

- Koehler, G.M. 1990. Population and habitat characteristics of lynx and snowshoe hares in north central Washington. *Canadian Journal of Zoology*. 68:845-851. In: Ruediger, B.; Claar, J.; Gniadek, S. [et al]. 2000. Canada lynx conservation assessment and strategy. Forest Service Publication #R1-00-53. U.S. Department of Agriculture, Forest Service; U.S. Department of the Interior, Fish and Wildlife Service, Bureau of Land Management, National Park Service. Missoula, MT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. U.S. Department of Agriculture, Forest Service 142 p.
- Kovalchik, B.L. 1988. Riparian zone associations: Deschutes, Ochoco, Fremont and Winema National Forests. *Ecol. Tech. Pap. ECOL TP-279087*. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station.
- Larsen, D., Klink, R. 1976. Soil Resource Inventory. Bend, OR: U.S. Department of Agriculture, Forest Service, Deschutes National Forest, Supervisor's Office.
- Layne, J.N. 1954. The biology of the red squirrel, *Tamiasciurus hudsonicus loquax* (Bangs), in central New York. *Ecol. Monogr.* 24:227-267. In: Ruediger, B.; Claar, J.; Gniadek, S. [et al]. 2000. Canada lynx conservation assessment and strategy. Forest Service Publication #R1-00-53. U.S. Department of Agriculture, Forest Service; U.S. Department of the Interior, Fish and Wildlife Service, Bureau of Land Management, National Park Service. Missoula, MT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. U.S. Department of Agriculture, Forest Service 142 p.
- Leary, R.F.; Allendorf, F.W.; & Forbes, S.H. 1993. Conservation genetics of bull trout in the Columbia and Klamath River drainages. *Conservation Biology*. 7:856-865.
- Leonard, W.P.; Brown, H.A.; Jones, L.C.; McAllister, K.R.; & Storm, R.M. 1993. *Amphibians of Washington and Oregon*. Seattle, WA: Seattle Audubon Society. 168 p.
- Leven, A.A. 1971. A procedure for estimating delivery coefficients of surface erosion from source area to channel. *Q/D Note #1*. Vallejo, CA: U.S. Department of Agriculture, Forest Service, Pacific Southwest Regional Headquarters.
- Little, E., Calfee, R. 2002. Environmental Implications of Fire-Retardant Chemicals. Columbia, MO: U.S. Department of the Interior, U.S. Geological Survey, Columbia Environmental Research Center. 9 p.
- Little, E., Calfee, R. 2002. Environmental Implications of Fire-Retardant Chemicals. Columbia, MO: U.S. Department of the Interior, U.S. Geological Survey, Columbia Environmental Research Center, Biological Resources Division.
- Little, E.E., Calfee, R.D. 2000. The effects of UVB radiation on the toxicity of fire – fighting chemicals final report. Columbia, MO: U.S. Department of the Interior, U.S. Geological Survey, Columbia Environmental Research Center.
- Little, S.N., Schainsky, L.J. 1995. Biomass and nutrient distributions in central Oregon second-growth ponderosa pine ecosystems. *Res. Pap. RP-481* 94-048. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station.
- Longbom, K. 2003. Personal Communication. Ochoco National Forest Timber Appraiser, Ochoco National Forest Supervisor's Office, 3160 N.E. 3rd Street, Prineville, OR, 97754.
- Lotspeich, F.B., Everest, F.H. 1981. A new method for reporting and interpreting textural composition of spawning gravel. *Res. Note PNW-369*. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station.

- Luce, C.H. 1997. Effectiveness of road ripping in restoring infiltration capacity of forest roads. *Restoration Ecology*. 5(3): 265-270.
- M. Parenti & Associates. 2003. Modified Rational GIS Flow Model Users Guide 1.0. Based on URS Greiner Woodward Clyde.1999. [Draft]: Appendix B Hydraulic and Hydrologic Calculations. Oakland, CA: URS Greiner Woodward Clyde.
- MacDonald, L.H.; Smart, A.W. & Wissmar, R.C. 1991. Monitoring guidelines to evaluate effects of forestry activities on streams in the Pacific Northwest and Alaska. Mon. Rep. EPA/910/9-91-001. Seattle, WA: U.S. Environmental Protection Agency.
- MacLulich, D.A. 1937. Fluctuations in the numbers of the varying hare (*Lepus Americanus*). University of Toronto Studies, Biological Series, No. 43. Toronto, ON, Canada: University of Toronto Press.
- Maffei, H. 2003. Personal Communication. Plant Pathologist-Pacific Northwest Region, Deschutes National Forest Supervisor's Office, 1645 Hwy. 20 E., Bend, OR 97701
- Malaby, S. 2002. Summary of the 1999 results from the Lone Pine Fire study area, Winema National Forest. Unpublished report. On file with: USDA Forest Service, Winema National Forest, Chiloquin Ranger District, 38500 Highway 97 North , Chiloquin, OR, 97624.
- Manga, M., 1997. A model for discharge in spring-dominated streams and the implications for the transmissivity and recharge of quaternary volcanics in the Oregon Cascades. *Water Res. Res.* 33:1813-1822. Eugene, OR: University of Oregon, Department of Geological Sciences.
- Maxwell, W.G., Ward, F.T. 1980. Photo Series For Quantifying Natural Forest Residues in common Vegetation of the Pacific Northwest. Gen. Tech. Rep.PNW-105. U.S. Department of Agriculture, Forest Service, http://www.srs.fs.usda.gov/pubs/gtr/gtr_pnw105.pdf. Jun 2003.
- McAllister, K.; Anderson, D.; Anthony, B. [et al]. 1990. Working Implementation Plan for Bald Eagle Recovery in Oregon and Washington. Olympia, WA: Washington Department of Wildlife.
- McCaughey, W., Farne, P. 2001. Snowpack Comparison Between an Opening and a Lodgepole Stand. Proceedings, 69th Annual Meeting of the Western Snow Conference. Sun Valley, ID: U.S. Department of Agriculture, Forest Service, Sawtooth National Forest, Supervisor's Office.
- McCown, C. 2003. Eyerly Fire Salvage Project Hydrology Report. Spec. Rep. Unpublished report. On file with: USDA Forest Service, Deschutes National Forest, Sisters Ranger District, Pine Street and Highway 20, PO Box 249, Sisters, Oregon, 97759.
- McIver, J.D., Starr, L., eds. 2000. Environmental effects of postfire logging: literature review and annotated bibliography. Gen. Tech. Rep. PNW-GTR-486. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 72 p.
- McKelvey, K.S., Aubry, K.B. 2001. Response to Management of Canada Lynx in the Cascades Geographic Areas of Oregon and Washington [White Paper]. Portland, OR: U.S. Fish and Wildlife Service, Region 1. 12pp.
- McKelvey, K.S.; Claar, J.J.; McDaniel, G.W.; & Hanvey, G. 1999. National Lynx Detection Protocol. Missoula, MT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.

- McKelvey, K.S., K.B. Aubry, and Y.K. Ortega. 2000. History and distribution of lynx in the contiguous United States: 207-264. In: Ruggiero, L.F.; Aubry, K.B.; Buskirk, S.W. [et al], eds. Ecology and conservation of lynx in the United States. Boulder, CO: University Press of Colorado. 480 p.
- Megahan, W.F. 1983. Hydrologic effects of clearcutting and wildfire on in steep granitic slopes in Idaho. *Water Resources Research*. 19(3): 811-819.
- Mellen, K.; Marcot, B.G.; Ohmann, J.L.; [et al]. 2002. DecAID, the Decayed Wood Advisor for Managing Snags, Partially Dead Trees, and Down Wood for Biodiversity in Forests of Washington and Oregon. Vers. 1.10. Berkeley, CA: U.S. Department of Agriculture, Forest Service, Pacific Southwest Research Station.
- Metzger, K. 2003. Eyerly Fire Salvage Project-Fire and Fuels Report. Spec. Rep. Unpublished report. On file with: USDA Forest Service, Deschutes National Forest, Sisters Ranger District, Pine Street and Highway 20, PO Box 249, Sisters, Oregon, 97759.
- Metzler, J. 1988. Post-harvest water quality monitoring report, Skates SW Timber Sale. Mon. Rep. Packwood, WA: U.S. Department of Agriculture, Forest Service, Gifford Pinchot National Forest, Packwood Ranger District.
- Miller, G.S.; Small, R.J.; Meslow, E.C. 1997. Habitat selection by spotted owls during natal dispersal in western Oregon. *Journal of Wildlife Management*. 61(1):140-150.
- Miller, J.F.; Frederick, R.H.; & Tracey, R.J. 1973. NOAA Atlas 2, Precipitation-Frequency Atlas of the Western United States, Volume X-Oregon. Washington, D.C.: U.S. Department of Agriculture, Forest Service, Soil Conservation Service, Engineering Division.
- Miller, J. M., Keen, F. P. 1960. Biology and control of the western pine beetle. Misc. Pub. 800. Albany, CA: U.S. Department of Agriculture, Forest Service, Pacific Southwest Forest and Range Experiment Station. 381 p.
- Miller, J. M., Patterson, J. E. 1927. Preliminary studies on the relation of fire injury to bark beetle attack in western yellow pine. *Journal of Agricultural Research* 34:598-613, illus.
- Minckley, W. L., Mefee, G.K. 1987. Differential selection by flooding in stream-fish communities of the arid American southwest: 93-104. In: Mathews, W.J., Heins, D.C., eds. Community and evolutionary ecology of North American stream fishes. Norman, OK: University of Oklahoma Press.
- Minshall, G. W. 1988. Stream ecosystem theory: a global perspective. *Journal of the North American Benthological Society*. 7: 263-288.
- Mochan, D.G. 1998. 1997-98 Upper Deschutes R-emap temperature summary. Technical Report No. BIO98-02. Portland, OR: Oregon Department of Environmental Quality
- Moldenke, A., et al. The Functional Role of Forest Soil Arthropods: The Soil is a Lively Place. In: Proceedings, 51st Annual Meeting of the Western Forest Insect Work Conference, Portland, OR, Feb. 7-10, 2000. Corvallis, OR: Oregon State University, Department of Forest Science.
- Mullan, J.W.; Williams, K.; Rhodus, G. [et al]. 1992. Production and habitat of salmonids in mid-Columbia River tributary streams. Monograph 1. Portland, OR: U.S. Department of the Interior, Fish and Wildlife Service.

- National Council for Air and Stream Improvement, Inc. [Unknown year]. Cumulative Watershed Effects. Technical Bulletin 776. pp 229-231.
- National Oceanic and Atmospheric Administration, National Marine Fisheries Service (NMFS). 1995. Biological Opinion on the Umatilla National Forest Land and Resource Management Plan. Portland, OR.
- Noble, E.L., Lundeen, E. 1971. Analysis of rehabilitation Treatment Alternatives for Sediment Control. In: Symposium on Forest Land uses and Stream Environment. Corvallis, OR: Oregon State University: 86-96.
- Noss, R.F., Cooperrider, A.Y. 1994. Saving Nature's Legacy: Protecting and Restoring Biodiversity. Washington D.C.: Island Press. 416 p.
- National Wildfire Coordinating Group (NWCG). 1994, Intermediate Wildland Fire Behavior (S-290), Student Workbook, NFES 2378. Boise, ID: National Interagency Fire Center.
- National Wildfire Coordinating Group (NWCG). 1998, Fireline Handbook. PMS 410-1, NFES 0065. Boise, ID: National Interagency Fire Center.
- National Wildlife Coordinating Group (NWCG). 2001. National Wildfire Coordinating Group Fire Effects Guide. NFES 2394. Boise, ID: National Interagency Fire Center.
- Northwest Coalition for Alternatives to Pesticides V. U.S. Department of Agriculture, Forest Service. 1999. Mediated Agreement, resolution of injunction relating to 1998 ROD for the U.S. Department of Agriculture, Forest Service, Region 6 FEIS: Managing Competing and Unwanted Vegetation. Portland, OR.
- O'Connor, J.E.; Grant, G.E.; & Haluska, T.L. 2003. Overview of geology, hydrology, geomorphology, and sediment budget of the Deschutes River Basin, Oregon. In A Peculiar River: Geology, Geomorphology, and Hydrology of the Deschutes River, Oregon. 2003. O'Connor, J.E., Grant, G.E., eds. American Geophysical Union, Washington, DC.
- O'Neil, C. 1992. Species Conservation Strategy, Peck's Penstemon (*Penstemon peckii*), Deschutes National Forest Sensitive Plant Program. Bend, OR: U.S. Department of Agriculture, Forest Service, Deschutes National Forest, Supervisor's Office.
- Obbard, M.E. 1987. Red squirrel. In: Ruediger, B.; Claar, J.; Gniadek, S. [et al]. 2000. Canada lynx conservation assessment and strategy. Forest Service Publication #R1-00-53. U.S. Department of Agriculture, Forest Service; U.S. Department of the Interior, Fish and Wildlife Service, Bureau of Land Management, National Park Service. Missoula, MT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. U.S. Department of Agriculture, Forest Service 142 p.
- Oregon Department of Environmental Quality (ODEQ). 2002a. Final evaluation and findings report on the Application for Certification pursuant to Section 401 of the Federal Clean Water Act, Submitted by Portland General Electric Company and the Confederated Tribes of the Warm Springs Reservation of Oregon for the relicensing of the Pelton Round Butte Hydroelectric Project on the Deschutes River, Jefferson County, Oregon (FERC No. 2030). Portland, OR.
- Oregon Department of Environmental Quality (ODEQ). 2002b. Listing criteria for Oregon's 2002 303(d) list of water quality limited waterbodies. Portland, OR.

- Oetting, A.C.; Beckham, S.D.; & Chappel, J.A. 1991. Cultural Resource Overview and Sample Survey for the Metolius River Wild and Scenic Area, Central Oregon. Report on file with: USDA Forest Service, Deschutes National Forest, Sisters Ranger District, Pine Street and Highway 20, PO Box 249, Sisters, Oregon, 97759.
- Oregon Department of Environmental Quality (ODEQ). 2002a. Consolidated assessment and listing methodology for Oregon's 2002 303(d) list of water quality limited water bodies and integrated 305(b) report.
<http://www.deq.state.or.us/wq/303dlist/303dpage.htm>.
- Oregon Department of Environmental Quality (ODEQ). 2002b. Final 2002 303(d) database. <http://www.odeq.state.or.us/wq/wqldata/searchchoice02.htm>.
- Oregon Department of Environmental Quality (ODEQ). 2003. Oregon Administrative Rules, Chapter 340, Division 41-Department of Environmental Quality, State-Wide Water Quality Management Plan; Beneficial Uses, Policies, Standards, and Treatment Criteria for Oregon.
- Packer, P., Williams, B. 1976. Logging and prescribed fire effects on the hydrologic and soil stability behavior of larch/douglas-fir forests in the Northern Rocky Mountains. Proceedings, Montana Tall Timbers Fire Ecology Conference and Fire and Land Management. 1974. Report No. 14: 465-479.
- Pajutee, M., 2002. BAER initial implementation monitoring report – seeding for erosion control. Unpublished report. On file with: USDA Forest Service, Deschutes National Forest, Sisters Ranger District, Pine Street and Highway 20, PO Box 249, Sisters, Oregon, 97759.
- Patton-Mallory, M.; Franzreb, K.; Carll, C.; & Cline, R. 2000. Ethical Conduct for Research: A Code of Scientific Ethics. Journal of Forestry, Volume 98, Number 7, July 2000. http://www.srs.fs.usda.gov/pubs/ja/ja_patton-mallory001.pdf.
- Pearsons, T.N.; Li, H.W.; & Lamberti, G.A. 1992. Influence of habitat complexity on resistance to flooding and resilience of stream fish assemblages. Transactions of the American Fisheries Society 121: 427-436.
- Pettigrew, R.M., ed. 1998. Final Technical Report of Cultural Resources Studies, Pelton-Round Butte Hydroelectric Project, Ferc Rep. No. 2030. Unpublished report. On file with: USDA Forest Service, Deschutes National Forest, Sisters Ranger District, Pine Street and Highway 20, PO Box 249, Sisters, Oregon, 97759.
- Pollet, J., Omi, P.N. 1999. Effect of Thinning and Prescribed Burning on Wildfire Severity in Ponderosa Pine Forests. Boise, ID: National Interagency Fire Center. www.nifc.gov/joint_fire_sci/conferenceproc/T-03Polletetal.pdf. 5p.
- Potts, D.F; Peterson, D.L; & Zuuring, R. 1985. Watershed modeling for fire management planning in the northern Rocky Mountains. Res. Pap. PSW-177. Berkeley, CA: USDA Forest Service. Pacific Southwest Forest Range and Experiment Station. 11 p.
- Pratt, K.L. 1984. Habitat selection and species interactions of juvenile west slope cutthroat trout, *Salmo clarki* Lewisi, and bull trout, *Salvelinus confluentus*, in the upper Flathead River Basin. University of Idaho, Moscow. M.S. Thesis.
- Pratt, K.L. 1991. Bull trout scale analysis for the Metolius River Basin. Res. Rep. Bend, OR: U.S. Department of Agriculture, Forest Service, Deschutes National Forest, Supervisor's Office.

- Prescott, C., Laiho, R. 2002. The Nutritional Significance of Coarse Woody Debris in Three Rocky Mountain Coniferous Forests. Gen. Tech. Rep. PSW-GTR-181. Bekeley, CA: U.S. Department of Agriculture, Forest Service, Pacific Southwest Research Station.
- Quinn, N.W.S., Parker, G. 1987. Lynx: 683-694. In: Novak, M.; Baker, J.A.; Obbard, M.E.; & Malloch, B., eds. Wild furbearer management and conservation in North America. North Bay, ON, Canada: Ontario Trappers Association.
- Radek, K.J. 2001. Monitoring soil erosion following wildfires in North Central Washington State. Wenatchee National Forest, Wenatchee, WA.
- Ratliff, D.E. 1992. Bull trout investigations in the Metolius River-Lake Billy Chinook system: 37-44. In: Howell, P.J., Buchanan, D.V., eds. Proceedings of the Gearhart Mountain bull trout workshop. Corvallis, OR: Oregon Chapter of the American Fisheries Society.
- Ratliff, D.E., Howell, P.J. 1992. The status of bull trout population in Oregon: 10-17 In: Howell, P.J., Buchanan, D.V., eds. Proceedings, of the Gearhart Mountain bull trout workshop. Corvallis, OR: Oregon Chapter of the American Fisheries Society.
- Ratliff, D.E.; Thiesfeld, S.L.; Weber, W.G. [et al]. 1996. Distribution, life history, abundance, harvest, habitat and limiting factors of bull trout in the Metolius River and Lake Billy Chinook, Oregon, 1934-1994. Info. Rep. Portland, OR: Oregon Department of Fish and Wildlife.
- Raymond, K.B.; Eilens, J.M.; Vache, K.B.; & Sweet, J.W. 1997. Limnology of Lake Billy Chinook and Lake Simtustus, Oregon. Pelton Round Butte Limnology Study Final Report, Project #2030. Corvallis, OR: E & S Environmental Chemistry, Inc. 77 p.
- Reeves, G. H.; Bends, L.E.; Burnett, K.M. [et al]. 1995. A disturbance-based ecosystem approach to maintaining and restoring freshwater habitats of the evolutionary significant units of anadromous salmonids in the Pacific Northwest: 334-349 In: Neilsen, J.L., ed. Evolution and the aquatic ecosystem: Defining unique units in population conservation. American Fisheries Symposium 17. Bethesda, MD: American Fisheries Society.
- Reid, L.M. 1993. Research and cumulative watershed effects. Gen. Tech. Rep. PSW-GTR-141. Albany, CA: U.S. Department of Agriculture, Forest Service, Pacific Southwest Research Station. 118 p.
- Reiser, White. 1988. Effects of two sediment sizes on survival of steelhead and Chinook salmon eggs. North American Journal of Fisheries Management 8: 432-437.
- Resh, V. H.; Brown, A.V.; Covich, A.P. [et al]. 1988. The role of disturbance in stream ecology. Journal of the North American Benthological Society. 7: 433-455.
- Riehle, M. 2003. Personal Communication. District Fisheries Biologist, Deschutes National Forest, Sisters Ranger District, Pine Street and Highway 20, PO Box 249, Sisters, Oregon, 97759.
- Riehle, M.; Weber, W; Stuart, A.M.; Thiesfeld, S.L., & Ratliff, D.E. 1997. Progress report of the multi-agency study of bull trout in the Metolius River System, Oregon: 137-144. In: Makay, W.D.; Brewin, M.K.; & Monita, M., eds. Friends of the bull trout conference proceedings. Calgary, AB, Canada: Bull Trout Task Force (Alberta), c/o Trout Unlimited Canada.

- Riehle, M.D. 1993. Metolius basin water quality monitoring, 1988-1992. Prog. Rep. Unpublished report. On file with: USDA Forest Service, Deschutes National Forest, Sisters Ranger District, Pine Street and Highway 20, PO Box 249, Sisters, Oregon, 97759.
- Riehle, M.D., Nolte D.A. 1993. Bull trout monitoring plan Deschutes National Forest 1985-1992. Unpublished report. Sisters, OR: U.S. Department of Agriculture, Forest Service, Deschutes National Forest, Sisters Ranger District.
- Rieman, B., Clayton, J. 1997. Wildfire and native fish: Issues of forest health of sensitive species. *Fisheries* 22(11): 6-15.
- Rieman, B., McIntyre, J.D. 1993. Demographic and habitat requirements for conservation of bull trout. Gen. Tech. Rep. INT-302. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station. 38p.
- Riley, S. 2002. Eyerly Fire BAER Team Botanical Report. Unpublished report. On file with: USDA Forest Service, Deschutes National Forest, Sisters Ranger District, Pine Street and Highway 20, PO Box 249, Sisters, Oregon, 97759.
- Riley, S. 2003. Personal communication. Botanist for the Eyerly Fire, Umatilla National Forest, Supervisors Office, 2517 S.W. Hailey Ave., Pendleton, Oregon 97801.
- Rinne, J. N. 1996. Short-term effects of wildfire on fishes and aquatic macroinvertebrates in the southwestern United States. *North American Journal of Fisheries Management* 16: 653-658.
- Robichaud, P., Wagenbrenner, J. 2004. Progress report. Sediment yield from six paired watersheds during the first year after the Hayman Fire. Moscow, ID: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Forestry Sciences Laboratory.
- Robichaud, P.R. 2000. Fire and Erosion: Evaluating the effectiveness of a post-fire rehabilitation treatment, contour-felled logs. In: Flug, M., Frevert, D., eds. *Proceedings, Watershed Management & Operations Management 2000*, Fort Collins, CO, 20-24 June. Reston, VA:ASCE. 9p.
- Robichaud, P.R., Brown, R.E. 1999. What Happened After the Smoke Cleared: Onsite Erosion Rates After A Wildfire In Eastern Oregon [Rev. Nov., 2000]. Middleburg, VA: American Water Resources Association, Wildland Hydrology.
- Rosenberg, D.K.; Noon, B.R.; & Meslow, E.C. 1997. Biological Corridors: form, function, and efficacy. *BioScience* 47:677-687.
- Rosgen, D. 1996. *Applied River Morphology*. Wildland Hydrology, Pagosa Springs, Colorado. 380 p.
- Rothermel, R.C. 1983. How to Predict the Spread and Intensity of Forest and Range Fires. Gen. Tech. Rep. INT-143. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station. 161 p.
- Rothermel, R.C., 1991. Predicting Behavior and Size of Crown Fires in the Northern Rocky Mountains. Res. Pap. INT-438, Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station. 46 p.

- Ruediger, B.; Claar, J.; Gniadek, S. [et al]. 2000. Canada lynx conservation assessment and strategy. Forest Service Publication #R1-00-53. U.S. Department of Agriculture, Forest Service; U.S. Department of the Interior, Fish and Wildlife Service, Bureau of Land Management, National Park Service. Missoula, MT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. U.S. Department of Agriculture, Forest Service 142 p.
- Ruggerio, L.F.; Aubry, K.B.; Buskirk, S.W. [et al], tech. eds. 1994. The Scientific Basis for Conserving Carnivores: American Marten, Fisher, Lynx and Wolverine in the Western United States. Gen. Tech. Rep. RM-254. Ft. Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station. 184p.
- Ruggiero, L.F.; Aubry, K.B.; Buskirk, S.W. [et al], 2000. Ecology and conservation of lynx in the United States. Boulder, CO. University Press of Colorado. 480 pp.
- Ryan, K.C., Noste, N.V. 1985. Evaluating prescribed fires. In: Proceedings-the symposium and workshop on wilderness fire, November 15-18, 1983, Missoula, MT. Gen. Tech. Rep. INT-182 Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station.
- Schantz, R. 2003. Eyerly Fire Salvage Silviculture Report. Spec. Rep. Unpublished report. On file with: USDA Forest Service, Deschutes National Forest, Sisters Ranger District, Pine Street and Highway 20, PO Box 249, Sisters, Oregon, 97759.
- Scherer, R. 2000. Effects of changes in forest cover on streamflow: a literature review. Proceedings, Watershed Assessment for the Southern Interior of British Columbia: Workshop March 9-10, 2000. Penticton, B.C. Canada: Ministry of Forests Research Program.
- Schmidt, K.M.; Menakis, J.P.; Hardy, C.C. [et al]. 2002. Development of Coarse-Scale Spatial Data for Wildland Fire and Fuel Management. Gen. Tech. Rep. RMRS-87. Missoula, MT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.
- Scott, D.W.; Schmitt, C.L.; & Spiegel, L.H. 2002. Factors Affecting Survival of Fire Injured Trees: A Rating System for Determining Relative Probability of Conifers in the Blue and Wallowa Mountains. Tech. Rep. BMPMSC-03-01. La Grande, OR: U.S. Department of Agriculture, Forest Service, Wallowa-Whitman National Forest, Blue Mountains Pest Management Service Center.
- Scott, W.B., Crossman, E.J. 1979. Freshwater fishes of Canada. Bulletin 184. Ottawa, ON, Canada: Fisheries Research Board of Canada.
- Seevers, J., Lang, F. 1998. Management Recommendations for Mountain Lady's-slipper (*Cypripedium montanum* Douglas ex Lindley). Unpublished Manuscript, U.S. Department of Agriculture, Forest Service, Department of the Interior, Bureau of Land Management. <http://www.or.blm.gov/surveyandmanage/SP/VascularPlants/cypripediummontanum.htm>
- Seidel, K.W., Cochran, P.H. 1981. Silviculture of Mixed Conifer Forests in Eastern Oregon and Washington. Gen. Tech. Rep. PNW-121. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Forest and Range Experiment Station.
- Shakesby, R.A.; Boakes, D.J.; Coelho [et al]. 1996. Limiting the soil degradational impacts of wildfire in pine and eucalyptus forests in Portugal: a comparison of alternative post-fire management practices. *Applied Geography*. 16(4):337-355.

- Shank, D. 2002. Eyerly Fire Salvage and Recovery Project Soil and Water Report. Unpublished report. On file with: USDA Forest Service, Deschutes National Forest, Sisters Ranger District, Pine Street and Highway 20, PO Box 249, Sisters, Oregon, 97759.
- Shank, D.C. 2003. Personal Communication. Geologist, Willamette National Forest, Sweet Home District, 3225 Hwy. 20, Sweet Home, Oregon 97386
- Shank, D.C. 2004. Memorandum to Bill Anthony, District Ranger, Sisters Ranger District. Detrimentially Burnt Soils. April 16.
- Sheay, R.W. 1993. Effects of prescribed fire and silvicultural activities on fuel mass and nitrogen redistribution in *Pinus ponderosa* ecosystems of Central Oregon. Corvallis, OR: Oregon State University. Masters Thesis.
- Shepard, B.B.; Leathe, S.A.; Weaver, T.M.; Enk, M.D. 1984. Monitoring levels of fines sediment within tributaries to Flathead Lake, and impacts of fine sediment on bull trout recruitment. Proceedings, Wild Trout Symposium, Yellowstone National Park, Wyoming, September 24-25. Yellowstone National Park, WY: U.S. Department of the Interior, National Park Service.
- Shirazi, M. A., Siem, W.K. 1979. A stream systems evaluation: an emphasis of spawning habitat for salmonids. Tech. Rep. EPA-600/3-79-109. Washington D. C.: U.S. Environmental Protection Agency.
- Sirucek, Dean. 1987. The North Hills Fire-Erosion Event:197-202. Proceedings of Conference 18 – International Erosion Control Association. February 1987. Santa Barbara, CA: Erosion Control Magazine.
- Skidmore, P.; Hansen, K.; & Quimby, W. 1994. Snow Accumulation and Ablation Under Fire-Altered LodgepolePine Forest Canopies. Proceedings, 72nd Annual Meeting of the Western Snow Conference, Vancouver, B.C., Canada.
- Snyder, G.G.; Haupt, H.F., & Belt, G.H. Jr. 1975. Clearcutting and burning slash alter quality of stream water in northern Idaho. Res. Pap. INT-168. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station. 34p.
- Soil Monitoring Reports, Deschutes National Forest. 1994-2001. Bend, OR: U.S. Department of Agriculture, Forest Service, Deschutes National Forest, Supervisor's Office.
- Spenser, C., Hauer, R. 1991. Phosphorus and nitrogen dynamics in streams during a wildfire. *Journal of North American Benthological Society*. 10(1): 24-30.
- Spruell, P., Allendorf, F.W. 1997. Nuclear DNA analysis of Oregon bull trout. Fin. Rep. to Oregon Department of Fish and Wildlife. Missoula, MT: University of Montana, Division of Biological Sciences.
- Squires. 2000. Ecology and conservation of lynx in the United States. Boulder, CO: Univ. Press of Colorado.
- Stage, Albert R. 1973. Prognosis model for stand development. Research Paper INT-137. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station.
- Stalmaster, M. 1987. The Bald Eagle. New York, NY: Universe Books. 227 pp.

- State of Oregon. 2002. Oregon Administrative Rules, Chapter 340, Division 41- Department of Environmental Quality, State-Wide Water Quality Management Plan; Beneficial Uses, Policies, Standards, and Treatment Criteria for Oregon.
- Stednick, John D. 1995. Monitoring the effects of timber harvest on annual water yield. *Journal of Hydrology* 176 (1996): 79-95.
- Stewart, J. 2004. Personal communication. People Program Coordinator -Environmental Justice Program Coordinator, Deschutes National Forest, 1645 Hwy. 20 E., Bend, OR 97701.
- Suna, H. 2003. Effectiveness Monitoring for the Persistence of Aerial Seeded Non-Native Species on the Eyerly Fire. Unpublished report. On file with: USDA Forest Service, Deschutes National Forest, Sisters Ranger District, Pine Street and Highway 20, PO Box 249, Sisters, Oregon, 97759.
- Suna, H. 2003. Eyerly BAER Monitoring Report---Seeding for erosion control, Year 2 Monitoring for Seeding Persistence and Effectiveness. Unpublished report. On file with: USDA Forest Service, Deschutes National Forest, Sisters Ranger District, Pine Street and Highway 20, PO Box 249, Sisters, Oregon, 97759.
- Sussman, P. 2003. Eyerly EIS Soils Report: Alternative Effects Analysis. Spec. Rep. Unpublished report. On file with: USDA Forest Service, Deschutes National Forest, Sisters Ranger District, Pine Street and Highway 20, PO Box 249, Sisters, Oregon, 97759.
- Swanston, D.N. 1991. Natural processes. *American Fisheries Society Special Publication* 19: 139-179.
- Swift, M. 1987a. Ridgetop Timber Sale Cultural Resource Report. Unpublished report. On file with: USDA Forest Service, Deschutes National Forest, Sisters Ranger District, Pine Street and Highway 20, PO Box 249, Sisters, Oregon, 97759.
- Swift, M. 1987b. Monty Timber Sale Cultural Resource Report. Unpublished report. On file with: USDA Forest Service, Deschutes National Forest, Sisters Ranger District, Pine Street and Highway 20, PO Box 249, Sisters, Oregon, 97759.
- Swift, M. 1987c. Street Creek Cedar Timber Sale Cultural Resource Report. Unpublished report. On file with: USDA Forest Service, Deschutes National Forest, Sisters Ranger District, Pine Street and Highway 20, PO Box 249, Sisters, Oregon, 97759.
- Swift, M., De Klyen, M. 1988. Route 1 Road Hazard Salvage 1989 Cultural Resource Report. Unpublished report. On file with: USDA Forest Service, Deschutes National Forest, Sisters Ranger District, Pine Street and Highway 20, PO Box 249, Sisters, Oregon, 97759.
- Swift, M., De Klyen, M. 1990a. Third Base Overstory Removal Project Cultural Resource Report. Unpublished report. On file with: USDA Forest Service, Deschutes National Forest, Sisters Ranger District, Pine Street and Highway 20, PO Box 249, Sisters, Oregon, 97759.
- Swift, M., De Klyen, M. 1990b. National Guard Projects 1990 Cultural Resource Report. Unpublished report. On file with: USDA Forest Service, Deschutes National Forest, Sisters Ranger District, Pine Street and Highway 20, PO Box 249, Sisters, Oregon, 97759.
- Swift, M., De Klyen, M. 1990c. Slash Crushing Contract 1990 Cultural Resource Report. Unpublished report. On file with: USDA Forest Service, Deschutes National Forest, Sisters Ranger District, Pine Street and Highway 20, PO Box 249, Sisters, Oregon, 97759.

- Swift, M., De Klyen, M. 1991. Green Ridge Wildlife Road Closure Project Cultural Resource Report. Unpublished report. On file with: USDA Forest Service, Deschutes National Forest, Sisters Ranger District, Pine Street and Highway 20, PO Box 249, Sisters, Oregon, 97759.
- Tarapchak, S.J., Wright, H.E., Jr. 1986. Effects of forest fire and other disturbances on wilderness lakes in northeastern Minnesota. I. Limnology. *Archive for Hydrobiology*. 106:177-202.
- Thomas, J., ed. 1979. Wildlife Habitats in Managed Forests: the Blue Mountains of Oregon and Washington. USDA Forest Service Agriculture Handbook 553: 512 p.
- Thomas, J.W.; Forsman, E.D.; Lint, J.B. [et al]. A conservation strategy for the northern spotted owl: a report to the Interagency Scientific Committee to address the conservation of the northern spotted owl. Washington, D.C. : U.S. Department of Agriculture, Forest Service; U.S. Department of the Interior, Fish and Wildlife Service, National Park Service. 427 pp.
- Tiedemann, A.R.; Conrad, C.E.; Dieterich, J.H. [et al]. 1979. Effects of Fire on Water, A State-of-Knowledge Review. Gen. Tech. Rep. GTR-WO-10. Washington D.C.: U.S. Department of Agriculture, Forest Service, Washington Office.
- Toupin, R. 2003. Personal Communication. Region 6 Logging Systems Specialist, USDA Forest Service, R6 Regional Office, PO Box 3623, 333 SW First Avenue Portland, Oregon 97208.
- Townsend, C. R. 1989. The patch dynamics concept of stream community ecology. *Journal of the North American Benthological Society* 8:36-50.
- Tressler, R., S. Bondi, and C. McShane. 1999. Bethel-Round Butte transmission line right-of-way studies: breeding bird surveys, amphibian surveys, down wood material. Pelton Round Butte Hydroelectric Project, FERC Rep. No. 2030. Portland, OR: Prepared for Portland General Electric [Publisher unknown].
- Triola, M.F. 1998. Elementary Statistics, 7th edition. Albanese, J.; Peterson, S.; Lee, C., eds. Menlo Park, CA: Addison Wesley Logman, Inc.
- Troendle, C.A. 1983. The potential for water yield augmentation from forest management in the Rocky Mountains. *Water Resource Bulletin*. 19: 359-373.
- Troendle, C. A., King, R.M. 1985. The Fool Creek Watershed—thirty years later. *Water Resources Research*. 21: 1915-1922.
- Troendle, C.A., King, R.M. 1987. The effect of partial and clearcutting on streamflow At Deadhorse Creek, Colorado. *Journal of Hydrology* 90: 145-157.
- Troendle, C.A., Kaufmann, M. 1987. Influence of Forests on Hydrology of Subalpine Forest. In *Management of Subalpine Forests: Building on Fifty Years of Research*. Tech. Rep. RM-149. Missoula, MT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station: 68-78.
- Troendle, C.A., King, R.M. 1985. The effect of timber harvest on the Fool Creek watershed, 30 years later. *Water Resources Research* 21(12): 1915-1922.
- U.S. Department of Agriculture, Forest Service. 1976. Forest Hydrology Part II: Hydrologic effects of vegetation manipulation. Missoula, MT: USDA Forest Service, Rocky Mountain Research Station. 229 p.

U.S. Department of Agriculture, Forest Service (USDA). 1978. Pacific Southwest Hazard Analysis I - reference and white paper Q/D Note #1 from Andrew Leven to Forest Hydrologists and Soil Scientists in Region 3 and 5. Bekeley, CA: USDA Forest Service, Pacific Southwest Research Station.

U.S. Department of Agriculture, Forest Service (USDA). 1979. Effects of Fire on Water, A State-of-Knowledge Review. Gen. Tech. Rep. GTR-WO-10. Washington D.C.: USDA Forest Service, Washington Office.

U.S. Department of Agriculture, Forest Service (USDA). 1981. Guide for Predicting Sediment Yields from Forested Watersheds. Northern and Intermountain Regions. Ogden, UT: USDA Forest Service, Intermountain Research Station.

U.S. Department of Agriculture, Forest Service (USDA). 1988. General Water Quality Best Management Practices. Portland, OR: USDA Forest Service, Pacific Northwest Research Station.

U.S. Department of Agriculture, Forest Service (USDA). 1989. Forest Service Manual 2670.44, Region 6 Interim Directive No. 6, August 15, 1989. (Region 6 Sensitive Species List). Portland, OR: USDA Forest Service, Regional Office.

U.S. Department of Agriculture, Forest Service (USDA). 1990. Forest Service Manual 2630.3, WO Amendment 2600-90-1, June 1, 1990. (Policy). USDA Forest Service, Washington Office.

U.S. Department of Agriculture, Forest Service (USDA). 1990b. Land and resource management plan. Bend, OR: USDA Forest Service, Deschutes National Forest, Supervisor's Office.

U.S. Department of Agriculture, Forest Service (USDA). 1990. Land Management Plan, Deschutes National Forest Final Environmental Impact Statement. Bend, OR: USDA Forest Service, Deschutes National Forest, Supervisor's Office.

U.S. Department of Agriculture, Forest Service (USDA). 1992. Land Resource Management Plan. Bend, OR: USDA Forest Service, Deschutes National Forest, Supervisor's Office.

U.S. Department of Agriculture, Forest Service (USDA). 1993a. Determining the risk of cumulative watershed effects resulting from multiple activities. Portland, OR: USDA Forest Service, Pacific Northwest Regional Office. 18 p.

U.S. Department of Agriculture, Forest Service (USDA). 1993b. Forest Ecosystem Management: An Ecosystem, Economic, and Social Assessment. Washington, D.C.: USDA Forest Service, Washington Office.

U.S. Department of Agriculture, Forest Service (USDA). 1993c. Protocol for surveying for spotted owls in proposed management activity areas and habitat conservation areas. USDA Forest Service, Washington Office.

U.S. Department of Agriculture, Forest Service (USDA). 1994. Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl: Standards and Guidelines for Management of Habitat for Late-Successional and Old-Growth Forest Related Species within the Range of the Northern Spotted Owl. USDA Forest Service, Washington Office.

- U.S. Department of Agriculture, Forest Service (USDA). 1994-2003. Sisters Ranger District Project Surveys and Wildlife Sightings Records. Unpublished survey documents. On file with: USDA Forest Service, Deschutes National Forest, Sisters Ranger District, Pine Street and Highway 20, PO Box 249, Sisters, Oregon, 97759.
- U.S. Department of Agriculture, Forest Service (USDA). 1995a. Davis Late-Successional Reserve Assessment, Fire Management Plan. Crescent, OR: USDA Forest Service, Deschutes National Forest, Crescent Ranger District.
- U.S. Department of Agriculture, Forest Service (USDA). 1995b. Deschutes Nation Forest Soil Monitoring. Unpublished USFS Report. Deschutes National Forest, Supervisors Office, Bend, OR.
- U.S. Department of Agriculture, Forest Service (USDA). 1995c. Forest Service Manual 2670.5[20], WO Amendment 2600-95-7, June 23, 1995. (Definitions). Washington, D.C.: USDA Forest Service, Washington Office.
- U.S. Department of Agriculture, Forest Service (USDA). 1995d. Forest Service Manual 2670-2671, WO Amendment 2600-95-7, June 23, 1995. (Policy). Washington, D.C.: USDA Forest Service, Washington Office.
- U.S. Department of Agriculture, Forest Service (USDA). 1995e. Inland Native Fish Strategy Environmental Assessment, Decision notice and finding of no significant impact for the interim strategies for managing fish-producing watersheds in eastern Oregon and Washington, Idaho, western Montana and portions of Nevada. Portland, OR: USDA Forest Service, Pacific Northwest Research Station.
- U.S. Department of Agriculture, Forest Service (USDA). 1995f. Metolius Watershed Analysis. Sisters, OR: USDA Forest Service, Deschutes National Forest, Sisters Ranger District.
- U.S. Department of Agriculture, Forest Service (USDA). 1995g. Revised, Environmental Assessment for the Continuation of Interim Management Direction Establishing Riparian, Ecosystem and Wildlife Standards for Timber Sales (Eastside Screens). Washington, D.C.: USDA Forest Service, Washington Office.
- U.S. Department of Agriculture, Forest Service (USDA). 1996a. Metolius Basin Watershed Analysis. Sisters, OR: USDA Forest Service, Deschutes National Forest, Sisters Ranger District.
- U.S. Department of Agriculture, Forest Service (USDA). 1996b. Metolius Late-Successional Reserve Assessment. Sisters, OR: USDA Forest Service, Deschutes National Forest, Sisters Ranger District.
- U.S. Department of Agriculture, Forest Service (USDA). 1996c. Metolius Watershed Analysis. Sisters, OR: USDA Forest Service, Deschutes National Forest, Sisters Ranger District.
- U.S. Department of Agriculture, Forest Service (USDA). 1997. Six Creek Stream Survey Report. Bend, OR: USDA Forest Service, Deschutes National Forest, Supervisor's Office.
- U.S. Department of Agriculture, Forest Service (USDA). 1998a. Best Management Practice Evaluation Program on-site component report. Unpublished report. On file with: USDA Forest Service, Pacific Southwest Region Headquarters, 1323 Club Drive, Vallejo, CA 94592.

- U.S. Department of Agriculture, Forest Service (USDA). 1998b. Deschutes National Forest Noxious Weed Control Environmental Assessment. Bend, OR: USDA Forest Service, Deschutes National Forest, Supervisor's Office.
- U.S. Department of Agriculture, Forest Service (USDA). 1998c. Forest Service Manual 2500, R-6 supplement 2500-98-1. Portland, OR: USDA Forest Service, Pacific Northwest Regional Office.
- U.S. Department of Agriculture, Forest Service (USDA). 1998d. General Water Quality Best Management Practices. USDA Forest Service, Pacific Northwest Regional Office. 104 p.
- U.S. Department of Agriculture, Forest Service (USDA). 1998e. Lower Fly Creek Stream Survey Report. Bend, OR: USDA Forest Service, Deschutes National Forest, Supervisor's Office.
- U.S. Department of Agriculture, Forest Service (USDA). 1999. Guide to Noxious Weed Prevention Practices. Unpublished report. On file with: USDA Forest Service, Deschutes National Forest, Sisters Ranger District, Pine Street and Highway 20, PO Box 249, Sisters, Oregon, 97759.
- U.S. Department of Agriculture, Forest Service (USDA). 1999. Metolius River Stream Survey Report. Unpublished report. On file with: USDA Forest Service, Deschutes National Forest, Supervisor's Office, 1645 Hwy. 20 E., Bend, OR 97701.
- U.S. Department of Agriculture, Forest Service (USDA). 2000b. Protecting People and Sustaining Resources in Fire-Adapted Ecosystems- A Cohesive Strategy. The Forest Service Management Response to the General Accounting Office Report GAO/RCED-99-65, April 13, 2000. Washington, D.C.: USDA Forest Service, Washington Office. 89p.
- U.S. Department of Agriculture, Forest Service (USDA). 2001a. Joint Aquatic and Terrestrial Programmatic Biological Assessment April 2001 – April 2003 for Federal Lands within the Deschutes Basin Administered by the Bureau of Land Management Prineville Office and for Federal Lands Administered by the Deschutes and Ochoco National Forests. Bend, OR: USDA Forest Service, Deschutes National Forest, Supervisor's Office.
- U.S. Department of Agriculture, Forest Service (USDA). 2001b. Tower Fire recovery project Environmental Impact Statement. Ukiah, OR: USDA Forest Service, Umatilla National Forest, North Fork John Day Ranger District.
- U.S. Department of Agriculture, Forest Service (USDA). 2002. Moose Post-Fire Project: Final Environmental Impact Statement. Hungry Horse, MT: USDA Forest Service, Flathead National Forest, Glacier View Ranger District.
- U.S. Department of Agriculture, Forest Service (USDA). 2003a. Burned Area Rehabilitation: Watershed, Fish, Wildlife, Air and Rare Plants. Unpublished report. On file with: USDA Forest Service, Deschutes National Forest, Sisters Ranger District, Pine Street and Highway 20, PO Box 249, Sisters, Oregon, 97759.
<http://www.fs.fed.us/biology/watershed/burnareas/>. 8 August 2003.

U.S. Department of Agriculture, Forest Service (USDA). 2003b. Joint Aquatic and Terrestrial Programmatic Biological Assessment April 2003 – April 2006 for Federal Lands within the Deschutes Basin Administered by the Bureau of Land Management Prineville Office and for Federal Lands Administered by the Deschutes and Ochoco National Forests. Bend, OR: USDA Forest Service, Deschutes National Forest, Supervisor's Office.

U.S. Department of Agriculture, Forest Service (USDA). 2003c. Roads Analysis Report: Eyerly Project Area. Unpublished report. On file with: USDA Forest Service, Deschutes National Forest, Sisters Ranger District, Pine Street and Highway 20, PO Box 249, Sisters, Oregon, 97759.

U.S. Department of Agriculture, Forest Service (USDA). 2004. Update to the Metolius Watershed Analysis [Draft]. Unpublished report. On file with: USDA Forest Service, Deschutes National Forest, Sisters Ranger District, Pine Street and Highway 20, PO Box 249, Sisters, Oregon, 97759.

U.S. Department of Agriculture, Rural Development (USDA RD). 1994. Executive Order 12898: Environmental Justice In Minority Populations, Environmental Compliance Library. <http://www.usda.gov/rus/water/ees/pdf/eo-12898.pdf>. 12 January 2004

U.S. Department of Agriculture, Forest Service; U.S. Department of the Interior, Bureau of Land Management (USDA, USDI). 1994. Final supplemental Environmental Impact Statement on management of habitat for late-successional and old-growth forest related species within the range of the Northern Spotted Owl. Portland, OR: USDA Forest Service, Pacific Northwest Regional Office.

U.S. Department of Agriculture, Forest Service; U.S. Department of the Interior, Bureau of Land Management (USDA, USDI). 1994c. Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl; and Standards and Guidelines for Management of Habitat for Late-Successional and Old-Growth forest Related Species Within the Range of the Northern Spotted Owl. Portland, OR: USDA Forest Service, Pacific Northwest Regional Office.

U.S. Department of Agriculture, Forest Service; U.S. Department of the Interior, Bureau of Land Management (USDA, USDI). 1995. Notice/decision record for the interim strategies for managing anadromous fish-producing watersheds in eastern Oregon and Washington, Idaho, and portions of California. Washington, D.C.: USDA Forest Service, Washington Office.

U.S. Department of Agriculture, Forest Service; U.S. Department of the Interior, Bureau of Land Management (USDA, USDI). 1997. Draft Eastside Environmental Impact Statement. Portland, OR: USDA Forest Service, Pacific Northwest Regional Office.

U.S. Department of Agriculture, Forest Service; U.S. Department of the Interior, Bureau of Land Management (USDA, USDI). 2000. Managing the Impact of Wildfires on the Communities and the Environment, A Report to the President In Response to the Wildfires of 2000. September 8, 2000. Washington, D.C.: USDA Forest Service, Washington Office.

- U.S. Department of Agriculture, Forest Service; U.S. Department of the Interior, Bureau of Land Management (USDA, USDI). 2001. Standards and Guidelines for Survey and Manage, Certain Cavity-Nesting Birds, Canada Lynx and Some Bat Roosts and Management Recommendations for Certain Cavity-Nesting Birds and Some Bat Roosts. Washington, D.C.: USDA Forest Service, Washington Office.
- U.S. Department of Agriculture, Forest Service; U.S. Department of the Interior, Bureau of Land Management (USDA, USDI). 2002. Restoring Fire-Adapted Ecosystems on Federal Lands – A Cohesive Fuel Treatment Strategy for Protecting People and Sustaining Natural Resources. Washington, D.C.: USDA Forest Service, Washington Office.
- U.S. Department of Agriculture, Forest Service; U.S. Department of the Interior, Bureau of Land Management (USDA, USDI). 2003a. Joint Aquatic and Terrestrial Programmatic Biological Assessment April 2003- April 2005. Bend, OR: USDA Forest Service, Deschutes National Forest, Supervisor's Office.
- U.S. Department of Agriculture, Forest Service; U.S. Department of the Interior, Bureau of Land Management (USDA, USDI). 2003b. Memorandum, Supplemental Information Report for the 2001 Record of Decision For Amendments to the Survey and Manage, Protection Buffer, and Other Mitigation Measures Standards and Guidelines of the 1994 Northwest Forest Plan. (A presentation of results of the 2002 Annual Species Review). Washington, DC.: USDA Forest Service, Washington Office. March 14.
- U.S. Department of Agriculture, Forest Service; U.S. Department of the Interior, Bureau of Land Management (USDA, USDI). 2004. Sufficiency analysis of stream temperature. Evaluation of the adequacy of the Northwest Forest Plan riparian reserves to achieve and maintain stream temperature water quality standards. Portland, OR: USDA Forest Service, Pacific Northwest Region Headquarters.
- U.S. Department of Agriculture, Natural Resource Conservation Service (NRCS). 1992. Soil Survey of the Upper Deschutes River Area, Oregon. Portland, OR: USDA Natural Resource Conservation Service.
- U.S. Department of Agriculture, Natural Resource Conservation Service (NRCS). 1999. Soil Survey of the Warm Springs Reservation, Oregon. Portland, OR: USDA Natural Resource Conservation Service.
- U.S. Department of the Interior, Fish and Wildlife Service (FWS). 1989. List of Endangered and Threatened Wildlife and Plants (March 1, 1989). Washington, D.C.: US Fish and Wildlife Service.
- U.S. Department of the Interior, Fish and Wildlife Service (FWS). 1994. Section 7 Consultation Guidance for the Forest Ecosystem Plan. Washington, D.C.: USDI Bureau of Land Management, USDA Forest Service, and US Fish and Wildlife Service.
- U.S. Department of the Interior, Fish and Wildlife Service (FWS). 1998. A framework to assist in making endangered species act determinations of effect for individual or group actions at the bull trout subpopulation watershed scale. Portland, OR: USDI fish and Wildlife Service.
- U.S. Department of the Interior, Fish and Wildlife Service (FWS). 2002. Bull Trout Recovery Plan. Spokane, WA: USDI Fish and Wildlife Service, Upper Columbia District.

- U.S. General Accounting Office (GAO). 1999. Western National Forests: Status of Forest Service's Efforts to Reduce Catastrophic Wildfire Threats, GAO/T-RCED-99-241. Proceedings, Testimony before the Subcommittee on Forests and Forest Health, Committee on Resources, House of Representatives: Statement of Barry T. Hill, Associate Director, Energy, Resources, and Science Issues, Resources, Community, and Economic, Development Division, GAO/T-RCED-99-241.
- Van Wagtendonk, J.W. 1996. Use of a Deterministic Fire Growth Model to Test Fuel Treatments: 1155-1165 In: Sierra Nevada Ecosystem Project: Final Report to Congress, Vol. II, Assessment and Scientific Basis for Management Options. Davis, CA: University of Cal., Davis, Centers for Water and Wildland Resources.
- Vance, N. 2003. Personal Communication. Botanist-Plant Physiologist, Pacific Northwest Research Laboratory, 4077 S.W. Research Way, P.O. Box 1148, Corvallis, Oregon 97339.
- Verts, B.J., Carraway, L.N. 1998. Land Mammals of Oregon. Berkeley, CA: University of California Press. 668pp.
- Volland, L. 1985. Plant Communities of the Central Oregon Pumice Zone. Ecol. Rep. R6-Ecol-104-1985. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Regional Office, Interagency Clearinghouse of Ecological Information.
- Volland, L.A. 1976. Plant Communities of the Central Oregon Pumice Zone. USDA Forest Service R6 Area Guide 4-2. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station.
- Volland, L.A. 1988. Plant associations of the central Oregon pumice zone. Ecol. Rep. R6-Ecol-104-1988. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Regional Office, Interagency Clearinghouse of Ecological Information. 216 p.
- Wagner, K. 2003. Personal Communication. Wildlife Biologist, Animal, Plant and Health Inspection Service, Wildlife Services, Portland, Oregon. In: U.S. Department of Agriculture, Forest Service. 2003. Canada lynx (*Lynx canadensis*) habitat mapping. Deschutes and Ochoco National Forests. Bend, OR: USDA Forest Service, Deschutes National Forest, Supervisor's Office.
- Wasniewski, L. 2003. Personal Communication. Assistant Forest Hydrologist and BAER team coordinator, Deschutes National Forest, 1645 Hwy. 20 E., Bend, OR 97701.
- Wemple, B. C.; Jones, J.A.; & Grant, G.E. 1996. Channel network extension by logging roads in two basins, western Cascades, Oregon. Water Resource Bulletin 32: 1195 - 1207. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station.
- Wilcox, M.; Wasniewski, L.; & Butler, D. 2002. Eyerly Fire Burned Area Emergency Response (BAER) Hydrology Report. Deschutes National Forest, Supervisors Office, Bend, OR.
- Wondzell, S.M., King, J.G. 2003. Postfire erosional processes in the Pacific Northwest and the Rocky Mountain regions. Forest Ecology and Management 178:75-87.
- Wright, H.E., Jr. 1976. The impact of forest fire on the nutrient influxes to small lakes in northeastern Minnesota. Ecology. 57: 649-663

Yimsuit, R. 2003. Eyerly Fire Salvage Project EIS Scenery Management System – A Sustainable Aesthetic Approach. Spec. Rep. Unpublished report. On file with: USDA Forest Service, Deschutes National Forest, Sisters Ranger District, Pine Street and Highway 20, PO Box 249, Sisters, Oregon, 97759.

Zettel, D.C. 1992. Gunsight Pass Road Widening Cultural Resource Inventory. Unpublished report. On file with: USDA Forest Service, Deschutes National Forest, Sisters Ranger District, Pine Street and Highway 20, PO Box 249, Sisters, Oregon, 97759.

Zettel, D.C. 2003a. Perry South Toilets Cultural Resource Inventory. Unpublished report. On file with: USDA Forest Service, Deschutes National Forest, Sisters Ranger District, Pine Street and Highway 20, PO Box 249, Sisters, Oregon, 97759.

Zettel, D.C. 2003b. Eyerly Fire Salvage Cultural Resources. Spec. Rep. Unpublished report. On file with: USDA Forest Service, Deschutes National Forest, Sisters Ranger District, Pine Street and Highway 20, PO Box 249, Sisters, Oregon, 97759.

APPENDIX H: AGENCIES AND INDIVIDUALS CONTACTED

The following listed agencies and individuals have been notified of the availability of the Eyerly Fire Salvage DEIS. Additional persons may be contacted following the release of the document, and continued expressed interest.

Name	Agency or Affiliation	Location
	BEND BUGLE	BEND, OR 97701
	BEND BULLETIN	BEND, OR 97701
	BLACK BUTTE RANCH	BLACK BUTTE RANCH, OR
	BLUE LAKE RESORT	SISTERS, OR 97759
	THE BURNS PAIUTE TRIBE	BURNS, OR 97720
	BUREAU OF INDIAN AFFAIRS	WARM SPRINGS, OR 97761
	CENTRAL OREGONIAN	PRINEVILLE, OR 97754
	CONFEDERATED TRIBES OF UMATILLA	PENDLETON, OR 97624
	CROWN PACIFIC	GILCHRIST, OR 97737
	EASTERN OR FOREST	PRINEVILLE, OR 97754
	EDGINGTON ROAD DIST.	SISTERS, OR 97759
	HANDCRAFTED LOG HOMES	SISTERS, OR 97759
	JAY DEMARIS LOGGING	CULVER, OR 97734
	JEFFERSON COUNTY	MADRAS, OR 97741
	THE KLAMATH TRIBES	CHILOQUIN, OR 97624
	KTVZ - NEWS DIRECTOR	BEND, OR 97708
	MADRAS PIONEER	MADRAS, OR 97741
	MAYOR OF SISTERS	SISTERS, OR 97759
	METOLIUS RECREATION	CAMP SHERMAN, OR 97730
	OREGON HUNTER'S	MEDFORD, OR 97501
	OREPAC	WILSONVILLE, OR 97070
	R.A. DICK HOWELLS CO	SISTERS, OR 97759
	SIERRA CLUB LEGAL	SEATTLE, WA 98104
	SISTERS-CAMP SHERMAN	SISTERS, OR 97759
	SWEENEY'S WORKENSP.	BEND, OR 97702
	TROUT UNLIMITED	ARLINGTON, VA 22209
	THOMAS CREEK LUMBER	STAYTON, OR 97383
	TOLLGATE PROPERTY	SISTERS, OR 97759
	TYKESON/ASSOCIATES	EUGENE, OR 97401
	U.S.E.P.A.	SEATTLE, WA 98101
	WILLAMETTE INDUSTRIES	MOLALLA, OR 97038
Colin & Alice Adams		CAMP SHERMAN, OR 97730
Paul W. Adams	Or State Univ - Forest	CORVALLIS, OR 97331
Ed Adams	Handcrafted Log Homes	SISTERS, OR 97759
Glenn Adams	Bend Mapping &	BEND, OR 97701
Daphene Alldredge		BEND, OR 97702
John Allen		SISTERS, OR 97759
Karen Allen	Deschutes Basin Land	BEND, OR 97701
Jim Anderson		SISTERS, OR 97759
Margaret Anderson		LAKE OSWEGO, OR 97034
Mike Andrews		BORING, OR 97009
Lloyd Anicker		BEND, OR 97701
Glen Ardt	Dept Of Fish & Wildlife	BEND, OR 97702
John Arena,	Bureau Of Indian	WARM SPRINGS, OR 97761

Name	Agency or Affiliation	Location
Brockaway, Tina		BEND, OR 97702
Brown, Ronald		REDMOND, OR 97756
Brunoe, Bobby	Gen'l Mgr. Nat'l Res.	WARM SPRINGS, OR 97761
Burley, Chuck	American For. Res. Council	BEND, OR 97701
C. Enyart, S. Tamiesie		PORTLAND, OR 97212
Calica, Charles (Jody)	Conf. Tribes of Warm Springs	WARM SPRINGS, OR 97761
Campbell, Vera Jean		SPRINGFIELD, OR 97478
Carlton, Don		DEADWOOD, OR 97430
Cash, Phillip		BEND, OR 97701
Chambers, Ken, Dr.	OSU – Botany Dept.	CORVALLIS, OR 97331
Chase, Al		SISTERS, OR 97759
Chaudet, Mollie		PRINEVILLE, OR 97754
Clipton, Jacob		EUGENE, OR 97405
Coburn, James		WARM SPRINGS, OR 97761
Fara Currim	Conf Tribes Of Warm Springs	WARM SPRINGS, OR 97761
Nicole Czamomski		EUGENE, OR 97440
Dalrymple, Scott		CAMP SHERMAN, OR 97730
Wayne Danforth		SISTERS, OR 97759
Bruce Daucsavage	Ochoco Lumber Co.	PRINEVILLE, OR 97754
Kim Davenport		PLEASANT HILL, OR 97455
Juniper Davis		PORTLAND, OR 97212
Vera Decker		REDMOND, OR 97756
Dr. James R, Delp		BEND, OR 97701
Paul Dewey		BEND, OR 97701
Sharon Dilley,	Black Butte Ranch Association	BLACK BUTTE RANCH, OR 97759
Jeffery Dillon,	Us Fish & Wildlife	PORTLAND, OR 97266
Mark Dohrmann		PORTLAND, OR 97210
Eric Dolson,	Sisters Nugget	SISTERS, OR 97759
Erhard & Elke Dortmund,	Friends Of Metolius	CAMP SHERMAN, OR 97730
David V. Douthit		BLACK BUTTE RANCH, OR 97759
Chuck Downen		LUMNI ISLAND, WA 98262
Gerald & Barbara Downey		LA PINE, OR 97739
Lei Durdan		SISTERS, OR 97759
Dale Duvall		SISTERS, OR 97759
Laurence Dyer		SISTERS, OR 97759
William Edwards		BLACK BUTTE RANCH, OR 97759
Marsha Eibert		SALEM, OR 97304
Stein Eileen,	City Of Sisters	SISTERS, OR 97759
Carol Enyart	Metolius Homeowners Assoc	PORTLAND, OR 97212
Arthur Erickson		PORTLAND, OR 97205
Ken Evans	Kle Enterprises	JOHN DAY, OR 97845
Lee J. Farm		CAMP SHERMAN,, OR 97730
Jim Fisher		SISTERS, OR 97759
Stephen Fisher		SISTERS, OR 97759
Donald Fontenot		PORTLAND, OR 97214
Mark & Toni Foster,	House On The Metolius	CAMP SHERMAN, OR 97730
Toni Foster, President	Friends Of The Metolius	CAMP SHERMAN, OR 97730
Marx Fred		REDMOND, OR 97756
Robert M. Freimark,	The Wilderness Society	SEATTLE, WA 98101
Don Frisbee		PORTLAND, OR 97204
Merra Frochen		AURORA, OR 97002
Kerry Fuller,	Redmond Saddle Club	BEND, OR 97701
Norma Funai		SISTERS, OR 97759

Supporting Data

Name	Agency or Affiliation	Location
Geer, Norm and Dorothy		LA PINE, OR 97739
George, Steve	OR Dept. of Fish & Wildlife	BEND, OR 97702
Gibson, Richard		SALEM, OR 97309
Hanson, Richard	MRFHA	WEST LINN, OR 97068
Hart, Trust, Kenneth		MOMO, OR 97039
Harvey, Neal B.		REDMOND, OR 97756
Helm, John, Mrs.	(Betsy Johnson)	SCAPPOOSE, OR 97056
Hogan, Ted		NEWMARK, CA
Hyde, Dayton		FEATHER LAKES, CO
Inkster, Jim		BEND, OR 97701
Jennings, Aaron A.	NW Env. Def. Ctr.	PORTLAND, OR 97219
William T. Johnson		CAMP SHERMAN, OR 97730
JOHNSON, Violet		EUGENE, OR 97405
Johnson, Becky	Samuel S. Johnson Found.	REDMOND, OR 97756
Ray Jones	Crown Pacific Lp	GILCHRIST, OR 97737
Ted Jones	Camp Tamarack	SISTERS, OR 97759
Michael G. Justin	Black Butte Ranch / President	BLACK BUTTE RANCH, OR 97759
David Kamin		PORTLAND, OR 97225
Gerald Keck,	D.R.Johnson Lumber Co	RIDDLE, OR 97469
Kay & Lucille Kelley		STAYTON, OR 97383
Charles And Jean Kern		BEND, OR 97701
Anne Kinnaman		WOODBURN, OR 97071
Anita Kirkaldy		SISTERS, OR 97759
Walt & Patty Knapp		BEAVERTON, OR 97007
James & Judi Knapp,	K/P Corporation	SISTERS, OR 97759
Mary Krenowicz	Samuel S. Johnson Foundation	REDMOND, OR 97756
Philip Krohn		OAKLAND, CA 94608
Leigh Kuhn		BEND, OR 97708
Kulongoski, Ted, Hon.	Governor of Oregon	SALEM, OR 97310
Wes & Ro Kvarsten	Kvarsten Tree Farm	SALEM, OR 97304
Craig Lacy	Oregon Trout	BEND, OR 97701
Tom & Madeleine Landis		CAMP SHERMAN, OR 97730
Delbert Langdon		SWEET HOME, OR 97386
Josh Laughlin	Cascadia Wildlands	EUGENE, OR 97440
David Lawrence		TERREBONNE, OR 97760
Carolyn Leighty		TURNER, OR 97392
Michael Leitheiser		LAKE OSWEGO, OR 97034
Michael And Leslie Leno		TERREBONNE, OR 97760
Charles & Glenda		HILLSBORO, OR 97123
Tim Lillebo	Oregon Natural Res.	BEND, OR 97701
Robert And Pat Lindsey	Santiam Alpine Club	SALEM, OR 97303
Marc Liverman	Oregon Dept Of Fish & Wildlife	PORTLAND, OR 97207
Marsha & Ernest Livingstone		PORTLAND, OR 97210
Scott & Denise Lomelino		Palmer, AK 99645
Sandy Lonsdale		BEND, OR 97708
Dale Luhman	Friends Of Metolius	KALISPELL, MT 59901
Terry A. Luther	Conf. Tribes Of Warm Springs	WARM SPRINGS, OR 97761
Gillian Lyons	Oregon Natural Desert Assoc	BEND, OR 97701
MacFarlane, Mark	Bend/Ft. Rock Ranger Dist.	WARM SPRINGS, OR 97761
Mann, Clifford		HILLSBORO, OR 97123

Name	Agency or Affiliation	Location
Mickle, Chris	Crescent Ranger Dist.	CRESCENT, OR 97733
Moses, Joseph, Mr.	Conf. Tribes of Warm Springs	WARM SPRINGS, OR 97761
Mount, Guy, III		SISTERS, OR 97759
Mullong, Bob		BEND, OR 97701
Nelson, Eric, CPM		BEND, OR 97708
Newport, Carl		BLACK BUTTE RANCH, OR
Noteboom, James D.	Riverpoint One	BEND, OR 97701
Parks & Rec.	OR State Parks, Scenic Waterways	BEND, OR 97701
Patt, Olney, Mr.	Conf. Tribes of Warm Springs	WARM SPRINGS, OR 97761
Raizin, Ruth		SISTERS, OR 97759
Rand, Runco		BEND, OR 97701
Rice, Bill	Sno-Go-Fers	BEND, OR 97701
Adele Rodriguez		MADRAS, OR 97741
Larry Rose,	Camp Davidson Christian Camp	SISTERS, OR 97759
Ronald Rosen, Md	(Mary Ellen Coulter, Md)	BEND, OR 97701
Kieth Ross,	K & D Contracting	REDMOND, OR 97756
Colleen Ross		BEND, OR 97701
Wayne Rowe	Or Dept Of Forestry	PRINEVILLE, OR 97754
Don Rowe		SISTERS, OR 97759
Dan Rutherford	Mt. Bachelor, Inc.	BEND, OR 97709
Sue Ryan	Kwso Radio	WARM SPRINGS, OR 97761
Pete Schay		CAMP SHERMAN, OR 97730
Alan Schoenberg		BROOKLYN, NY 11231
Edward & Doris		WOODBURN, OR 97071
Doug Shank		SWEET HOME, OR 97386
Jon Sheldahl,	Friends Of The Metolius	CAMP SHERMAN, OR 97730
Mark Shepard		LAKE OSWEGO, OR 97035
Ron Shephard	Blue Ribbon Coalition	NAMPA, ID 83686
Terence Shumaker		OREGON CITY, OR 97045
Steve Shunk		SISTERS, OR 97759
Diane Siebert		CULVER, OR 97734
Jim Simonson,	Willamette Nf	EUGENE, OR 97440
Caitlin Sislin		PORTLAND, OR 97205
Director, Sisters	Chamber Of Commerce	SISTERS, OR 97759
Mary Smith		SISTERS, OR 97759
William Smith,	Smith Properties	BEND, OR 97702
Doro Sokol,	Pine Meadow Ranch	SISTERS, OR 97759
Dr. Robert Sonnenburg		BEND, OR 97701
Mark Sougstad		DALLAS, OR 97338
Robert Speik		BEND, OR 97702
Douglas J Spillum		WEST LINN, OR 97068
De De Steel,	Us Fish & Wildlife Service	BEND, OR 97701
Fisher Stephen		SISTERS, OR 97759
Marc Thalacker	Squaw Creek Irr. District	SISTERS, OR 97759
Greg And Arlene Thomas		SISTERS, OR 97759
Arlene Thomas,	Odor	BEND, OR 97708
Dorris E. Thomas		BEND, OR 97701
Karen Thompson		BEND, OR 97701
Erin Tobin,	Nw Environmental Def. Ctr	PORTLAND, OR 97219
Brad Toman	Hillsboro, Or 97124	
Chairman Tribal Council,	Conf. Tribes Of Warm Springs	WARM SPRINGS, OR 97761
Erik Turner,	Hoodoo Recreation Serv	SISTERS, OR 97759
Merle & Marjorie Turner,	Friends Of Metolius	BLACK BUTTE RANCH, OR 97759
Richard And Kendra		LOS ALTOS, CA 94022

Supporting Data

		97759
Genevieve Watson		BEND, OR 97701
Mr. Jim Wendell,	Conf. Tribes Of Warm Springs	WARM SPRINGS, OR 97761
Bernice Werzberger		ATLANTA, GA 30324
Mindy Whaley		SISTERS, OR 97759
Roger & Kathy White,	Camp Sherman Store	CAMP SHERMAN, OR 97730
Janice Wickham		BEND, OR 97701
Robert Wiegand		PORTLAND, OR 97202
Ken Wiessner		LYONS, OR 97358
Ted Wise,	Oregon Dept Of F & W	BEND, OR 97701
Terry Witt,	Or's For Food & Shelter	SALEM, OR 97302
Darlene Woods,	Rosebud Contracting	BEND, OR 97708

APPENDIX I: RESPONSE TO COMMENTS AND AGENCY LETTERS

Introduction

The Eyerly Salvage Draft EIS document was sent to the public and appropriate local, state, federal, and tribal authorities beginning the week of December 15, 2003. The Notice of Availability was published in the Federal Register on December 19th. A required 45-day comment period (40 CFR Sec. 1506.10) was provided between December 20th, 2003 and February 2nd, 2004. Individuals and agencies who received the document were invited to comment; in addition the Public Affairs office of the Deschutes National Forest distributed a press release throughout Oregon describing the proposed action and inviting comments. Within the comment period, a total of 40 comments were received in the form of letters, public comment postcards, and a documented office visit. One agency comment was received after the comment period.

The Forest Service has documented, analyzed, and responded to those public comments received in response to the Eyerly DEIS (DEIS). This appendix describes the substantive comments received on the DEIS and provides the agency's response to those comments. This response complies with section 40 CFR 1503.4, Response to Comments, of the National Environmental Policy Act (NEPA) regulations. The public comments received remain in the Eyerly project record, on file at the Sisters Ranger Station, and are available for public review.

Comment Analysis Process

Public responses submitted regarding the Eyerly Draft EIS were documented and analyzed using a process called content analysis. This is a systematic method of compiling, categorizing, and capturing the all public viewpoints and concerns submitted during the official comment period in response to the Draft EIS. Information from public meetings, office visits, letters, emails, faxes, and other sources are all included in this analysis. Content analysis helps the USDA Forest Service clarify, adjust, or incorporate additional technical information in preparation of the Final Environmental Impact Statement.

Interdisciplinary team specialists read all public responses and identified separate substantive comments within them that relate to a particular concern, resource consideration, and/or requested management action. The Writer-Editor categorized each comment by using a numerical categorization or "coding" database structure that has been specifically tailored to record EIS project documents. Each relevant comment is coded and verified for accuracy and consistency. Next, each response's set of coded comments is entered verbatim into the project database. The interdisciplinary team members provided responses to comments where appropriate prepares a final content analysis summary report that includes a list of public concerns addressing the specific resource and management considerations.

Finally, it is important to recognize that the consideration of public comment is not a vote-counting process in which the outcome is determined by the majority opinion. Relative

depth of feeling and interest among the public can serve to provide a general context for decision-making. However, it is the appropriateness, specificity, and factual accuracy of comment content that serves to provide the basis for modifications to planning documents and decisions. Further, because respondents are self-selected, they do not constitute a random or representative public sample. NEPA encourages all interested parties to submit comment as often as they wish regardless of age, citizenship, or eligibility to vote. Respondents may therefore include businesses, people from other countries, children, and people who submit multiple responses.

Every substantive comment and suggestion has value, whether expressed by one respondent or many. All input is read and evaluated and the interdisciplinary team attempts to capture all relevant public concerns in the analysis process.

Two general and related principles guide analysts when coding comments. These two principles -encompassing both the need to maintain context and the need to capture respondents' sentiments and reasoning-are crucial to capturing the full range of public concerns. They also, however, underscore the complexity of the coding process. A single comment referring to two or more resource areas could be legitimately coded to any of several categories. Innumerable permutations among multiple resources, perspectives, and emphases add to the complexity. The specialists have made every attempt to classify comments in a way that fairly represents respondents' concerns, and that facilitates the planning team's efforts to respond to those concerns. This is accomplished, in part, through frequent interaction among analysts augmented by regular consistency checks.

Comment Response

Specialists use the database sorting capabilities to produce reports that are then reanalyzed to identify all of the respondents' concerns. Public concern statements that capture the theme of similar comments are then prepared.

The interdisciplinary team reviewed the public concern summary along with sample quotations, considered the substance of the concerns, evaluated whether they triggered a change in the environmental analysis, and drafted responses. For some concerns, they reviewed the original letters or other input to ascertain the full contexts for the concern statement.

The interdisciplinary team provided any recommendations for improvements to the DEIS analysis of documentation to the leadership of the Inyo and Sierra National Forests for review, consideration, and action.

Responses are written to address these public concerns. In general, the agency responded in the following five basic ways to the substantive public comments as prescribed in 40 CFR 1503.4.

1. Modifying alternatives.
2. Developing and analyzing alternatives not given serious consideration in the DEIS.
3. Supplementing, improving, or modifying the analysis that the DEIS documented.
4. Making factual corrections.
5. Explaining why the comments do not need further Forest Service response.

This response document follows the organization of the public concern summary as prepared by the interdisciplinary team. This organizational structure is developed using many different sources.

Comments Received on the Draft Environmental Impact Statement and Responses

This section of the appendix displays a list of the individuals and agencies who commented on the Eyerly DEIS document, followed by a large sampling of comments and interdisciplinary responses to those comments. This is not a complete list of the comments received, but an extensive sampling of comments voicing support, compliment, concern, and criticism. Comments listed are referenced by their database record number-comment number. The complete comment record and coded substantive comment database are kept within the Eyerly public record and are available for public review at the Sisters Ranger Station, Sisters, Oregon. A list of commentators is followed by a summary of the range and scope of issues addressed, accompanied by a sampling of specific comments and accompanying responses (where appropriate).

Table J-1: Public and Agency Comments Received

Date	Commenter	Organization	Record #
12/20/03	Jean L. Kern	N A (No affiliation)	1
12/24/03	Chris Coon	N A	2
12/24/03	Greg Concannon	PGE	3
12/25/03	Bill Leveille	N A	4
12/29/03	Richard B. Payne	N A	5
12/31/03	Mrs. Sam Johnson	N A	6
12/31/03	Del Langden	N A	7
12/31/03	Daphene Aldredge	N A	8
12/31/03	Jim Fisher	N A	9
12/31/03	Jerry Moore	N A	10
12/31/03	Chuck Crawford	N A	11
12/31/03	Noval T. Grubb	N A	12
12/31/03	Robert Sonnenburg	N A	13
12/31/03	Normand & Dorothy Geer	N A	14
12/31/03	David Douthit	N A	15
12/31/03	Spillum	N A	16
12/31/03	Unknown	N A	17
12/31/03	Delp	N A	18
12/31/03	Lee Garl	N A	19
12/31/03	Alan Shoriberg	N A	20
12/31/03	Unknown	N A	21
12/31/03	Unknown	N A	22
1/5/04	Vern K. Steiner	N A	23
1/6/04	John F. Ferguson	N A	24
1/8/04	Gregory McClaren	N A	25
1/8/04	Stephen Fisher	N A	26
1/15/03	Jeanette Kight	N A	27
1/22/04	unknown	N A	28
1/23/04	Everett Greer	N A	29
1/23/04	George Wilson	Juniper Group, Sierra Club	30
1/28/04	Paul W. Adams, Ph.D; Kevin Boston, Ph.D	Oregon State University, Dept. of Forest Engineering	31
1/30/04	Luann Danforth, Wayne Danforth	N A	32
1/30/04	John Morgan	Ochoco Lumber Co.	33
2/01/04	Asante Riverwind	LOWD-Blue Mountains Biodiversity Project	34
2/02/04	James Johnston	Cascadia Wildlands Project	35
2/02/04	Chuck Burley	American Forest Resource Council	36
2/02/04	Doug Heiken	Oregon Natural Resources Council	37
2/02/04	Lisa Blanton	PROWL Project	38
2/02/04	Paul Dewey	Sisters Forest Planning Committee	38
2/02/04	Judith Leckrone Lee	EPA Geographic Unit	39A
2/04/04	Nancy Gilbert, Jennifer O'Reilly	USDI Office of Environmental Policy & Comp	40

Beschta, Responsible Scientific Viewpoints Concerning the Efficacy of Post-fire Salvage, Insect Infestation, and East-side Ecosystems

A large number of comments received specifically address the DEIS *Appendix G: Responding to Recommendations of Beschta et al. (1995)*, in addition to landscape-scale scientific study from additional sources -including those presenting opposing scientific information- and how that data applies to the project and forest ecology in Central Oregon.

Comment: The DEIS devotes Appendix G to responding to the 1995 Beschta Recommendations. As the appendix states "the effects of the proposed salvage and alternatives on watershed, soils and other resources are described in the DEIS." And so they are. But describing the problems and admitting to a certain level of soil damage and promising to use Best Management Practices does not comply with Beschta. (30-9)

Comment: Nowhere is the DNF's analysis more logically and substantively flawed than in its discussion of fire and fuels. An honest discussion of fire and fuels would have revealed that the Forest Service does not know anything about the possibility of future fire, that fire in the area is probably inevitable, and that, if anything, salvage logging will increase, not decrease the risk of fire in the future. (35-26)

Comment: Finally, the reasoning that salvage needs to be done to reduce fuel loads isn't clear here. There is insufficient evidence to sustain that reasoning in the DEIS. (39-4)

Response: With the selection of either action alternative, the majority of trees (both dead and dying) greater than 20 in. diameter would be left to meet snag retention levels on p. 40 of the DEIS- this conclusion is based on field marking of about ¼ of the acres proposed for salvage under Alternative 2. Snag retention levels are based on biological needs identified in the Metolius LSRA and on natural ranges of variability among plant association groups, and not on an arbitrary percentage like 50 percent as found in the Beschta Report. This retention is in addition to the approximately 10,000 acres of stands that experienced stand replacement and mixed severity burning outside of units that will have no removal of dead and dying trees. Our landscape snag analysis indicates that over the fire area the salvage under Alternative 2 would reduce the 21 in. and greater dead tree component by about 20 percent. Reproductive rates and territoriality of woodpeckers leads one to the conclusion that not every snag can be utilized by these species in the post-fire environment.

According to the FEIS p. 220, approximately 15-25 snags per acre greater than 9 in. diameter, and 6 snags per acre greater than 16 in., would be left on the average across the landscape- some areas would have more, and some would have less. This type of landscape diversity is what the current science is saying would benefit the greatest number of species.

In regards to the reburn potential of the sites within the Eyerly Fire, it is well established that these ponderosa pine and dry mixed conifer sites were historically in frequent fire regimes. Lightning-caused ignition will occur within these types, as witnessed by this fire, Cache Mt. Fire, B and B Complex Fire, within the last two years on the Deschutes NF. Given the historical frequency of fire in this area, there is no question that fires will again start in these areas during the stand initiation phase of the forests burned at Eyerly.

The only point of discussion is what effect these fires will have on the developing stands and on the soil resource.

According to Brown et al (2003) “reburn results when falldown of the old burned forest contributes significantly to the fire behavior and fire effects of the next fire.” These authors say that a high to extreme fire hazard exists when coarse woody debris (fuels greater than or equal to 3 in.) exceeds 30-40 tons per acre. They recommend coarse wood debris levels of 5-20 tons per acre for warm, dry ponderosa pine and Douglas-fir types, such as found at Eyerly. Although coarse woody debris does not contribute to rate of spread in current fire behavior models, it does contribute to development of large fires and fire severity. The plant associations found in the Eyerly Fire contain the volatile shrubs bitterbrush, Greenleaf manzanita, and snowbrush ceanothus, which will contribute significantly to surface rate of spread within the next 10-20 years. Modeling using FVS-FFE shows that a fire hazard will develop 20 to 30 years in the future (FEIS p. 331).

Comment: There is no empirical evidence that the proposed activities reduce fire risk and behavior nor insect epidemics and in fact, the evidence that does exist would lead largely to the opposite conclusion: that commercial timbering and thinning (taking out the largely inflammable structure and leaving the volatile fine fuels) will actually increase the immediate risk of stand-replacing fire or unnatural fire conditions and insect infestations. There is also evidence that timber harvest in areas that have experienced natural disturbance such as fire and insect pathogens may remove the very genetic diversity that is critical for future tree generations able to withstand these processes. meet the habitat requirements for the indicator species and that any post fire logging would benefit the habitat and its associated species, the DEIS may not be in compliance with the NEPA or the Deschutes’ LRMP. (30-6)

Response: It is difficult to prove that salvage logging reduces bark beetle epidemics, and as such, no claim is made in the EIS that says an outbreak will be averted by the proposed action. However, the opportunity does exist to dampen the effect of the outbreak that may occur by removing the type of material that harbors bark beetles and enables them to build larger populations. The trees to be harvested are ones that either have died (suitable for bark beetles) and some of the ones that are very likely to die in the next two or three years (also suitable for bark beetles). The commenter says there is evidence that salvage logging would actually lead to increased outbreaks, but provides no such evidence. As far as we know, there is no evidence that removing dead or dying host material would increase bark beetle populations. It is difficult to understand the relevance to this project of the statement that “timber harvest” removes genetic diversity critical to withstanding disturbance processes.

Comment: Surveys have found use of the burned areas by woodpecker species, including pileated and black-backed woodpeckers as well as sapsuckers. The DEIS for this project needs to disclose research, and conduct its own site-specific research, regarding pileated and black-back use of burned forests in general and the Eyerly project area in particular. It is likely that the area, even burned, is an essential foraging area for pileated and other woodpeckers due to the widespread adverse cumulative impacts to the area’s forests from extensive past logging. As such, this area may be utilized by resident woodpeckers much more than would be found among burned areas

adjacent to intact, unlogged late and old structure forest. Logging this area would result in the extirpation of many of these foraging and resident species, including the likely mortality of some individuals. (34-10)

Response: The Eyerly Fire has created over 20,000 acres of habitat for woodpeckers and other fire-related species and only a small portion of that habitat is being treated in the salvage project. Furthermore, the differences in biotic potential between the insect opportunists that utilize recently dead wood and the avian predators that utilize those insects make it highly unlikely that significant foraging opportunities would be lost through the proposed action of this project.

Comment: The agency must retain all large snags because they are the most likely to last the longest and fill the snag recruitment gap as the post-fire landscape recovers from the fire. The so-called “brain book” that agency staff use to clarify the direction in the Northwest Forest Plan ROD urges the agency to use the requirements from the final Draft Recovery Plan for the Northern Spotted Owl which requires retention of all scorched trees that “may live” as well as all snags over 20 inches because these live trees and larger snags are most likely to last more than 100 years and help to fill the temporal gap in snag recruitment as the post-fire stand develops. Denton K, 1994. “SEIS Team/Scientific Analysis Group Qs &As [Summary]” May 6, 1994 (“[T]hese responses represent what the SEIS Team intended for many of the standards and guidelines. (34-63)

Response: Studies of snag fall rates show that about half of the snags created by a disturbance event are on the ground within ten years. Miller and Keen (1960) reported on studies of snag longevity in large-diameter beetle-killed ponderosa pine. They found that 85% of the snags were still standing after five years, but that between 5 and 12 years, the rate of fall increased rapidly. At the end of 10 years, about 40% of the snags remained (50% of the snags had fallen by the eighth year after death). About 10% of the snags were still standing after 32 years. Projecting these numbers further would lead to the conclusion that there are probably very few snags that stand for 100 years.

Comment: The forests of the Eastern Cascades evolved with fire, insects, drought, and disease as integral, essential components of the forest ecosystem. (34-82)

Response: Numerous reviewers make statements about how the Eastside forest ecosystems have evolved with fire, with the implication that there are inherent adaptations within those systems to coexist with fire as a disturbance agent. Those adaptations are undeniably in play for frequent, low-severity fires, but it is inappropriate to assume that they work the same way after large-scale uncharacteristic fires such as Eyerly. We have absolutely no evidence that high-severity disturbances of such a magnitude ever occurred in the ponderosa pine, dry mixed conifer plant associations that characterize most of the Eyerly analysis area. The snag numbers and fuel levels that accompany these disturbances are not natural. Our experiences with natural recovery, wildlife habitat effects, subsequent “reburn” potential, etc. are limited because there have not been the opportunities to monitor large burned areas for long periods of time. (Most of the fires of this magnitude in this Fire Regime have occurred in the last 15 years, and most of the science only refers to observations made immediately after the event, or a short time thereafter). However, we

do know that fuels were at a high level when the fire occurred, and they will remain at a high level unless they are removed. Even though the “reburn potential” is discounted by a number of reviewers, they should acknowledge that if these are frequent fire systems, then those subsequent fires will occur, and we need to plan accordingly.

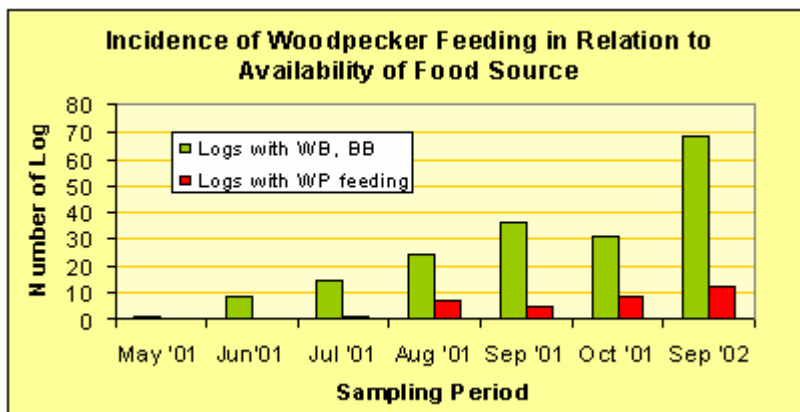
Comment: Nature has evolved many natural checks and balances which prevent insects from destroying vast tracts of forests. Among these are many species which predate upon insects such as bark beetles as well as tree defoliators. Black-backed woodpeckers are one of the keystone species which help post-fire forests survive. This species prefers burned forest habitat and adjacent green forest edge areas for nesting, roosting, and foraging. Numerous other species, including neotropical and native birds, also nest and forage within intact (unlogged) burned forests. If habitat provisions are maintained for these many species, the fabled ravages and spread of insect population “outbreaks” are minimal and well within the range of historic natural variability. However, black-backed woodpeckers, and many other species which select for burned areas, depend upon the “fire-killed and fire-damaged” trees throughout the fire area as habitat, both for their foraging and nesting potential as well as the remaining canopy closure these give—as protection against predators for themselves and their fledgling young. As has been the case in many national forest areas this past century, when burned areas are commercially logged, among the many harmful impacts is the loss of viable habitat for black-backed woodpeckers and other post-fire associated species. Among the significant irreparable harms caused by such logging, are: 1. the loss of species in the area which predate upon bark beetles and other insects, 2. serious continuing population declines of black-backed woodpeckers (Oregon State listed as Sensitive) and forest dependent neotropical migrant birds, and 3. significant increases in the adverse impacts of unchecked bark beetle populations. Additionally, as the Forest Service concluded in its study (Crater Lake) on decades of attempting to utilize commercial “salvage” logging to control—or minimize—the spread and adverse impacts of bark beetles, such a method is doomed to failure, as it would require the logging destruction of the very forests they were attempting to “save.” By eschewing ecologically damaging logging, and instead working with nature; protecting the essential habitat for the many native forest species which both help keep insect populations in check as well as help post-fire forests to recover, the Eyerly area has the best chance for recovery. Failure of the DEIS to disclose these pertinent facts and the scientific studies which have documented them violates the NEPA. (34-83)

Response: The East-side forests have indeed evolved with fires, but *not* with fires of the severity and magnitude of the Eyerly Fire. The East-side dry forest system is adapted to frequent low-severity fires that do not create large openings and that do not kill large numbers of trees in a single event. In recent decades, the forested landscape has developed in a way that has produced unnatural conditions and these conditions lend themselves to disturbances that are not in line with “natural checks and balances.” “Natural” disturbance agents operating on an “unnatural” landscape such as we have now will not produce “natural” outcomes. We do not know all of the ramifications of disturbance events of this magnitude but we do know it is presumptive to expect things to correct

themselves through “natural checks and balances” when no one has followed the outcomes of these uncharacteristically large disturbances over a long period of time.

Many bark and wood-infesting insects have special adaptations to quickly find burned host trees and they usually colonize those trees within the year of the fire or shortly thereafter. The biotic potential of forest insects such as bark beetles is far greater than that of their avian predators. It is a basic biological principal that in a predator-prey relationship, the predator does its most effective job of being a “natural check and balance” when prey populations are low, and becomes very ineffective as a regulator when prey populations are high. Studies by Burke in the Klamath Forest, (cited by Miller and Keen 1960) reported that barely 50% of the 700 trees colonized by western pine beetles were fed upon by woodpeckers. Woodpeckers feeding was described as “light” on 13% of those trees, “moderate” on 39% and “heavy” on 1%. Similarly, Hopkins (1909) reported that insectivorous birds are most important in situations where few trees are killed, but when many trees are being killed, the limited number of birds can have little or no effect on insect populations. A recent local study done on the Hash Rock Fire also showed that woodpeckers were not able to utilize all of the insect biomass that suddenly became available in that fire and the woodpecker populations lagged far behind their available food source (Eglitis, 2004, in press) (graph shown below). Furthermore, the “population regulation” done by woodpeckers is not entirely positive from the perspective of controlling bark beetles. Woodpeckers feed on beneficial insects as well as on bark beetles. Miller and Keen (1960) refer to the unpublished work of Person who found that hairy and white-headed woodpeckers fed upon the clerid predator *Enoclerus lecontei* more often than on the western pine beetle which was deeper in the bark than the predator.

Figure J-1. Number of insect-infested sample logs with evidence of woodpecker feeding, Hash Rock Fire, August 2000.



The most important population regulator for most organisms is available habitat.

There is no documentation provided for the comment about “irreparable harms” from salvage logging.

Comment: One aim of the Eyerly DEIS is to avoid infestations of insects (DEIS p. 261). But reducing the incidence of insect infestation and disease is not a benefit of salvage but rather a detriment, because insects not only provide food for many species of terrestrial, aquatic, and avian animals but they also help regulate forest density. The DEIS needs to disclose and

consider the benefits of a healthy population of insects or a possible healthy surge in insect populations post-fire. (35-29)

Response: The beneficial roles of bark beetles and wood borers are discussed in the Insects and Decay Environmental Consequences section of the EIS. The issue once again is one of scale. The Eyerly Fire produced a very large amount of suitable habitat for these opportunistic insects that depend on large-scale host availability to build large populations. As stated previously and shown in the graph from Hash Rock Fire, the “healthy populations of insects” resulting from this disturbance event are likely to be far greater than can be utilized by the predators and parasites that depend on these insects as a food source.

The way in which bark beetles “regulate forest density” is not compatible with the goal of replacing large trees on the landscape as quickly as possible. Bark beetles typically kill groups of trees and often thin stands “from above” by infesting and killing the largest trees in the stand (Sartwell 1971). In other words following a “thinning by bark beetles”, that average diameter of remaining trees is often smaller than it was before the infestation occurred.

Comment: “There is now evidence that in many cases forests are more healthy after an insect outbreak,” said Tim Schowalter, an OSU professor of entomology. “The traditional view still is that forest insects are destructive, but we need a revolution in this way of thinking. The fact is we will never resolve our problems with catastrophic fires or insect epidemics until we restore forest health, and in this battle insects may well be our ally, not our enemy.” (35-30)

Response: The revolution in thinking about forest insects that Dr. Schowalter discusses has indeed occurred, and is being applied to our management of East-side forests. There is no question that in a natural forest these insects are an important part of the ecosystem and they contribute to the overall function of that system. However, many of our forests are not in a natural condition and we are occasionally placed in a situation where we still react in the “traditional” way, sometimes because of other values that have come into play that cannot be resolved in the short term through “natural” processes. An example would be the recent spraying of the Douglas-fir tussock moth in unnatural stands that were providing a critical habitat feature that had to be protected in the short term. When uncharacteristically large events such as Eyerly Fire occur, we attempt to do what we can to affect the level at which native organisms will respond to that event. Part of that effort is to try to limit the extent of additional tree mortality likely to occur from an uncharacteristic disturbance in adjacent undamaged stands.

Comment: Historically, Schowalter said, destructive forest insects such as the mountain pine beetle or tussock moth were native to Pacific Northwest forests and served an essential role in keeping them healthy. When trees became too crowded the insects would eliminate weaker trees and reduce competition. But since the beetles’ reproductive pheromones only carried effectively about 15-20 feet, naturally open stands of mature pines were protected against widespread outbreaks.

In these same forests today, fire suppression has allowed shade-tolerant, fire-intolerant species to crowd the understory, create an entire forest stressed for

water and nutrients, and beetles can skip from one weak tree to another across entire stands. But the solution in cases such as this, Schowalter said, is to address the fundamental issue of overcrowding through forest thinning, controlled fire and insect attack, allowing the pine beetles to actually help in the long-term process of restoring forest health.

It now appears that insects, which are the most abundant and diverse animals on Earth, are anything but destructive pests. Rather, they are major architects of the plant world in both structure and function, and in natural balance help to maintain healthy and productive forest ecosystems.

According to the new report, insects can influence their environment in five key ways:

1. Insects aid decomposition, stimulate the breakdown of organic materials, enhance soil fertility and plant growth, burrow in soils and increase its porosity and water-holding capacity.
 2. Insects are herbivores that eat plants, influencing where they can grow. Sometimes they kill trees and other plants to reduce competition, and many times feed on trees without killing them in ways that actually improve the health and long-term growth of trees and forests.
 3. Insects are a key food source for vertebrates and other animals, and play a major role in the food chain.
 4. Insect are dispersal agents to carry seeds, fungal spores, and even other invertebrates from one place to another.
 5. Insects are pollinators, and in this role also help control the movement of plant species.
- (35-31)

Response: All of these roles of insects are valid and are recognized, but mentioning them in the context of Eyerly Fire and our proposal for salvage is not relevant. None of those functions are being impaired by the salvage proposal, and the ones that are relevant (decomposition, food source, etc.) have been addressed in the EIS.

Comment: Through this multiplicity of roles, forest insects can help to control plant succession, dictate which plants will be allowed to grow or thrive in particular areas, and generally invigorate plant communities, the report said. Studies suggest herbivory levels as high as 40-50 percent make little or no difference to plant growth and survival, and this type of moderate herbivory clearly should not be “fought” with costly controls. Wood production in western U.S. pine forests reached or exceeded pre-attack levels 10-15 years following mountain pine beetle outbreaks, research has shown, and the more an individual Douglas-fir tree is defoliated by the tussock moth, the more it compensates afterwards with increased growth, given sufficient resources. The herbivory may alleviate drought stress by reducing a tree’s demand for water, and also encourage more competitive interactions between plant species that ultimately work to the benefit of the tree.

(35-32)

Response: A valid comment, but for another setting, not the Eyerly Fire.

Comment: Insects may be so important to soil fertility that they may be a better barometer of forest ecosystem health than the larger trees or animals which live there, researchers say. In natural forest communities there are more than 200 species of arthropods and more than 200,000 individuals in a square meter of soil, and the numbers of these arthropods can tell more than chemical tests about soil concerns such as compaction and nutrient cycling. A study by another OSU researcher showed residual impacts on soil invertebrate populations from a site that had been clearcut and slash burned 40 years earlier. (35-33)

Response: Other studies discuss the recolonization of burned sites by mites and springtails three years after the disturbance. However, that recolonization would have to originate from refugia of unburned duff and organic matter adjacent to the burned areas. How does a clear cut and slash-burned area compare to a wildfire that covers 20,000 acres in terms of effects on soil mesofauna? If you are concerned about one, you should be concerned about the other as well.

Comment: In their natural role, insects are usually helpful to the forest and rarely cause large epidemics. (35-34)

Similar Comment (37-153)

Response: A true statement for natural systems but again, the scale of the Eyerly Fire is beyond the normal range of variation for fires in these dry systems. At least one reviewer questioned the statement that bark beetle outbreaks can develop from large fire events such as the Eyerly Fire. The bark beetles of concern here are opportunists that initially require weakened hosts in order to be successful in reproducing. In the natural setting, suitable hosts are typically scattered and few in number. As such, the single most important regulator of bark beetle populations is dispersal loss as the insects leave their host. In the “natural” setting, the beetles leaving the host in which they developed must fly in search of another suitable host and over two-thirds of them are unsuccessful in finding one. When trees are stressed, either by drought, other insects or wildfire, the availability of suitable hosts increases dramatically and the dispersal loss is no longer a significant regulator of beetle populations. Given their high reproductive capability (50-100 eggs laid per female), their capacity to attain large populations sizes in a short amount of time is well documented.

Comment: “When you have a highly destructive insect epidemic, what that really should be telling us is not that we have an insect problem, but that we have a forest health problem,” Schowalter said. “It’s monocultures and fire suppression that cause insects to become nuisances. The pests that plague us are all too often of our own making.”

As these systems become more fully understood, Schowalter said, it should be possible to work with insects, rather than against them, to produce new solutions to maximize the yield of forest commodities while achieving conservation goals and healthier ecosystems.

“It’s really simple on one level,” Schowalter said. “We have to pay more than lip service to the balance of nature.”

For the full report see:

<http://www.sciencedaily.com/releases/2001/10/011030230203.htm>. See also: Insect Ecology - An Ecosystem Approach Edited by Timothy D. Schowalter Academic Press. 2000. and Schowalter, TD and J. Withgott. 2001. Rethinking insects: What would an ecosystem approach look like? Conservation Biology In Practice 2(4): 11-16. (35-35)

Similar Comments (37-5, 37-152)

Response: We have known for a long time that many “destructive” insect outbreaks are the result of systems out of balance and we are trying to build that thinking into the systems we manage. If we accept Dr. Schowalter’s statement that these forests are out of balance then we should also accept that a stand-replacing fire occurring in them is also out of balance. An important point to consider is that there is very little information to draw from on how these systems do in fact recover from uncharacteristic disturbances because there have not been many opportunities to gather that information.

The scale of the Eyerly Fire disturbance was outside of the “natural range” of disturbances and we believe that natural agents operating in unnatural settings may not necessarily produce “natural” outcomes.

Comment: Deschutes Forest desired future conditions [state]: a. “decision framework considers the desirable and undesirable roles of pests ...” (p 4-5). (37-12)

Response: The desirable and undesirable effects of forest insects were considered, and are discussed in the Insects and Decay Environmental Consequences section of the EIS.

Comment: The Forest Service also want to target large trees because they produce larger beetle broods, but the f- has not answered these two very important threshold questions:

Are the insect population a problem at all, or are they just part of the post-fire system playing their role feeding the birds and further thinning the forest?

On balance, are the large trees more valuable in the long-term as wildlife habitat than they are harmful in terms of temporary insect sources? (37-34)

Response: Bark beetle populations do often build up following wildfires. There is considerable variability in how this occurs, but numerous outbreaks have been documented in the West that can be attributed to wildfires (Miller and Keen 1960). More recently, we have observed a high level of tree mortality outside the perimeter of the Hash Rock Fire on the Ochoco NF. Many of those dying trees experienced no fire damage and are probably being colonized by insects that originally infested dead and dying trees within the fire.

Comment: Page 115 (and elsewhere in the EIS) claims that removal of dying trees will help reduce insects and save habitat. This analysis is incomplete. The Forest Service must disclose and consider the following:

Since the EIS admits that insect populations were low before the fire (p 258) they are unlikely to be a major mortality factor after the fire (see the Biscuit fire EIS); (37-104)

Response: Insect populations were low before the Hash Rock Fire as well, yet extensive beetle-caused tree mortality in ponderosa pine is being reported outside the perimeter. As described earlier each fire situation and potential for insect activity is considered on a site specific basis.

Comment: Salvage logging itself will remove far more habitat than the insects; (37-105)

Response: Salvage logging will remove both habitat and insects.

Comment: Insects are in fact beneficial in terms of both thinning the forest and providing food for predators. (37-106)

Response: The “thinning” that bark beetles do is quite different from the thinning that we do. Bark beetles often “thin from above”, removing some of the larger trees (Sartwell 1971), and prolonging the time it takes to arrive at a stand dominated by large-diameter trees. In addition, bark beetles tend to kill trees in groups due to the aggregating pheromone that is produced and thus create holes in the canopy without affecting tree density in many parts of an affected stand of trees.

Comment: The salvage logging will likely occur after the insect populations have already subsided, so the benefit will be almost non-existent. (37-107)

Response: Within fire-damaged ponderosa pine stands, one can expect the western pine beetle to colonize the trees that were killed by the fire but still retain suitable cambial tissue for brood development. This is expected to happen within the first two years after the fire. (This pattern was confirmed in the trees killed by the Hash Rock Fire; the trees initially colonized by western pine beetle were of large diameter [25-30”dbh], had bole scorch averaging 50 feet and crowns of brown needles). Because these dead trees offer no resistance to bark beetles, one can expect a significant population to be available to colonize additional fire-damaged trees in year three and possibly four after the fire. There is a great deal of variability from one fire event to another, which makes it difficult to predict the outcome. Our thinking is that if it is important to protect large-tree LSR values in the adjacent unburned stands, then we should be looking at opportunities to reduce the risk of adverse effects and remove a readily available food source for those disturbance agents that are capable of compromising those values.

Comment: Page 261 says that large trees must be remove because they can produce bigger broods. Is it the size of a few large broods that matters or the total number of insects? Maybe large numbers of smaller broods produced in smaller trees is more significant. Please consider that there are many more small trees than large trees so the total number of smaller trees may provide a larger total volume and surface area of phloem or other substrate for insects. (37-108)

Similar Comment (38-13)

Response: Large trees often produce many times more beetles than were involved in killing them. Small trees often produce fewer beetles than it took to kill them and in those cases, act as a population sink rather than as a population source. Studies on the western pine beetle, reported in Miller and Keen (1960) described the brood production that could be expected from large ponderosa pines 16 to 30 inches in diameter infested by the western pine beetle. They found an average of a five-fold increase in brood emerging versus infesting their host trees (25 beetles per square foot colonizing the tree and producing 115 progeny adults per square foot, on the average). Eglitis (1980, Ph. D. dissertation) found dramatic differences in brood production between large and small diameter Douglas-firs colonized by the Douglas-fir beetle. Perhaps the most dramatic example of the relationship between host size and brood production is that of the pine engraver, *Ips pini*, where as many as 150 beetles per square foot have been reared from large-diameter ponderosa pine, while a 3-inch diameter host serves as a population sink (more beetles colonize the host than are produced in the next generation). Another important point to consider is that the bark beetles colonizing small trees (mountain pine beetle, pine engraver) tend to prefer small trees, while those colonizing larger trees (western pine beetle, Douglas-fir beetle) prefer those larger-diameter hosts.

Comment: Page 260 says that the Forest Service want to limit insects and prevent population booms. This is an unattainable goal and an ecologically inappropriate goal. Population booms are part of the natural cycle and help thin the forest, create structures, and feed the birds and bats. (37-119)

Response: It is difficult to talk about “natural” processes as applied to an uncharacteristic disturbance such as a 20,000-acre fire in dry forest types. The goal is to try to limit additional disturbances that arise from this one to a scale that is more in keeping with natural processes for this ecosystem.

During the drought years of the early 1930s, the western pine beetle was considered to be in “outbreak” status when infestation levels reached one dead tree per three acres per year (200 trees per section). Following the Pine Springs Fire in 1990 (Burns, OR), about half of the large ponderosa pines on one section near Horton Canyon were killed by the western pine beetle within two years. Although this example is an extreme case of beetle-induced mortality following a large fire, it does put into perspective that “natural” disturbances may not be of the same magnitude as ones following “unnatural” events.

Comment: Pileated woodpeckers play a unique role in the forest ecosystem

- a. They excavate cavities in trees that are later used by numerous other species not just for nesting, but also for roosting and foraging.**
- b. Their excavations accelerate wood decomposition and nutrient cycling.**
- c. The pileated woodpecker’s ability to excavate large cavities in relatively sound trees that are in the early stages of heart wood decay, means that the resulting cavity trees may provide uniquely long-lasting habitat.**
- d. The combined foraging activities of pileated woodpeckers and all the species they assist tend to mediate insect outbreaks. (37-138)**

Response: No reference is given to the statement that pileated woodpeckers mediate insect outbreaks. We believe (as stated before) that woodpeckers and other predators are not capable of “mediating an insect outbreak.”

Comment: Salvage operations typically assume that many living trees will soon die and then salvage becomes a self-fulfilling prophecy. Trees that may survive the fire are an extremely valuable feature of the future forest. Providing scarce canopy and shelter in the short-term and providing scarce large snag and down wood habitat in the long-term, during a period when forest-fire landscapes are typically depauperate in snags and large wood. The NEPA analysis failed to adequately disclose and analyze this and an EIS is necessary to consider the effects of harvesting numerous trees that may survive.

See: Residual Trees as Biological Legacies, CCEM Communiqué #2. Sept. 1995. <http://www.fsl.orst.edu/ccem/pdf/95Comque.pdf>

The agency must recognize the large trees are more likely to survive fire and retain large trees with any signs of life. Large are more likely to survive due to two factors: (1) they are tall so more of their canopy is above the scorch height, and (2) their bark is thicker and better protects their cambium. See: Reinhardt, E.D. and K.C. Ryan. 1989. Estimating tree mortality resulting from prescribed fire in Symposium proceedings: Prescribed fire in the Intermountain Region edited by Baumgartner, D.M., D.W. Breuer, B.A. Zamora, L.F. Neuenschwander and R.H. Wakimoto. Washington State University 41-44.

<http://www.fs.fed.us/r1r4/spf/fhp/publications/survival/appip2.htm>

And see: RAYMOND J. DAVIS, 3/17/03, APPLE FIRE LARGE SNAG AND LOG SURVEY RESULTS; UMPQUA NATIONAL FOREST, NORTH UMPQUA RANGER DISTRICT;

ESTIMATING FIRE MORTALITY

Fire mortality was estimated on plots using probability of mortality information from Reinhardt and Ryan (1989). If the tree exhibited crown scorch (by volume) as shown in Table 1, then it was assumed that the tree had a greater than 80% chance of dying and therefore was tallied as a snag. As an example, a 20-inch dbh Douglas-fir tree had to have 95% or more of its crown (by volume) scorched to be tallied as a snag. Larger Douglas-fir (≥ 22 in dbh) needed 100% crown scorch to be tallied.

Table 1. Crown scorch volume percentages used to predict a $\geq 80\%$ probability of mortality.

SPECIES DIAMETER AT BREAST HEIGHT

	10"	12"	14"	16"	18"	20"	22"	24"	26"	28"	30"	35"	40"
Douglas-fir	70%	75%	80%	85%	90%	95%	100%	100%	100%	100%	100%	100%	100%
Ponderosa Pine	65%	70%	75%	80%	85%	90%	95%	100%	100%	100%	100%	100%	100%
Sugar	70%	80%	85%	90%	95%	100%	100%	100%	100%	100%	100%	100%	100%

Pine													
White Fir	55%	60%	65%	70%	75%	80%	85%	90%	90%	95%	100%	100%	100%
Hemlock	50%	55%	60%	65%	70%	75%	75%	80%	85%	90%	95%	100%	100%
Cedar	50%	55%	60%	65%	65%	70%	75%	75%	80%	85%	85%	90%	100%
W. White Pine	45%	50%	55%	60%	60%	65%	70%	70%	75%	75%	80%	85%	90%

http://www.fs.fed.us/r6/umpqua/projects/apple_fire_snag_and_log_survey.pdf

Forest Service entomologist Julie Weatherby found that many large pines that were expected to die from fire damage and beetles after a fire on the Payette National Forest have in fact lived beyond their expectations. See Sonner, Scott, AP, "Salvage trees may grow after all," Eugene Register Guard, Aug 31, 1997. "Currently our biggest errors are associated with trees that living which have been expected to die from our selection guidelines." Weatherby said in her report. The NEPA document for this project must disclose the risk and consequences of false positive findings of tree mortality. (37-148)

Response: The guidelines used to predict tree survival incorporate the work of Reinhardt and Ryan, Wagener, Furniss and many other authors. The reports by Scott and others (1996, 2003) summarizes the information contained in these other papers and proposes guidelines that include crown scorch and cambial damage, recognizing that different species and different tree sizes within a species have different damage thresholds that they can withstand. Ryan (1988) stated the general rule that if a tree sustains cambial damage in more than a quarter of its bole circumference, its likelihood of survival is greatly reduced. We used >50% cambial damage (as determined from bole scorch) as a rule of thumb, and thus are proposing the leaving of many trees we suspect are not very likely to survive.

Comment: "Most white fir that experienced any degree of crown and/or bole scorch has already been attacked by the fir engraver beetle." (DEIS Section 2.8.1.2) Why use the word "attacked?" (38-12)

Response: The authors of "Western Forest Insects" (Furniss and Carolin 1977) use the word "attack" to describe the process of insects colonizing their hosts. Our use of the word should not be taken to mean that we are purely focusing on "negative effects" and are incapable of seeing the complete picture of how insects function in the forest ecosystem.

Comment: Recovery of burned timber will delay not accelerate vegetation recovery (Sexton 1998; Busse et al. 1996). (37-3, 37-28d, 37-42, 37-151)

Response: Disagree. Although logging of dead trees could delay vegetative recovery in skid trails or landings by damaging newly established vegetation, the associated action of planting conifers would accelerate overall stand recovery. This is especially true in stand replacing burn areas where the trees were burned prior to seed. Conifer planting in salvaged areas is part of the proposed action, whereas, under the "No Action" alternative

it is not foreseeable due to funding limitations and management priorities. In addition, impacts to newly established vegetation (using detrimental soil condition as a surrogate) would be limited to less than 20% of the project area as stated in the Forest Plan.

Review of the Sexton (1998) thesis and continued research does not support that salvage logging impedes conifer recovery. In Sexton's thesis (1998) only tree height in 1994 was statistically greater in unplanted control plots compared to unplanted salvage plots. However, this had a p-value of 0.2 which does not provide enough evidence to reject the null hypothesis (Triola 1997) and should not be considered statistically significant. In addition, this data was preliminary because it only included 1 to 2 seasons of regrowth. Continued research on these same plots 6 to 7 years after the salvage show no statistical difference between control plots or treatment plots regardless of planting (Malaby 2002). However, when natural and planted control plots were compared to natural and planted salvage plots, tree density, height, and diameter were significantly greater ($p \leq 0.01$ for diameter, $p \leq 0.1$ for density and height) in planted plots than in naturally regenerated plots. This supports the USFS assumption that revegetating salvaged units with 2-year old conifers would give these areas a "head-start" on evapotranspiration recovery.

In addition, the study by Busse and others that reports the negative effects of thinning on pine growth rates, appears to deal with live tree logging not salvage. It is also not applicable to this situation because logging practices used 30 years ago are much more destructive than practices used today.

Alternatives

Many comments voice support for the salvage harvest and fuels treatment outlined in Alternative 2.

Comment: My opinion is that burned areas (and beetle-killed areas too, by the way) need to be treated -not just left to rot- by cutting down and utilizing dead or dying trees; that burned or otherwise dying brush should be cleaned up; and that replanting take place. I think Ms. Weldon is right, that Alternative #2 best accomplishes what needs to be done. (27-1)

Similar comments (5-1, 9-1, 10-1, 11-1, 12-1, 13-1, 14-1, 15-1, 21-1, 22-1, 23-1, 24-1, 28-1, 29-1, 32-1)

Range of Alternatives

A small number of commenters expressed dissatisfaction that the alternatives presented did not adequately propose salvage harvest to the full extent possible, or did not fulfill requirements of the National Environmental Policy Act (NEPA).

Comment: Alternative 2 more than meets the Forest Plan standards and guidelines for resource management protection. You have more flexibility and lead way to treat more acres. (33-4)

Comment: As an initial matter, we are disappointed to see the range of alternatives developed and believe you have not satisfied the requirements of the law in providing an adequate range of alternatives. (39-1).

Comment: The proposed "Eyerly" project is also part of the agency's series of post-fire logging projects throughout Eastern and Central Oregon's National Forests...in a very similar formula-driven pseudo-NEPA process...the Forest Service has chosen to irresponsibly defy NEPA's requirements, and to force

their formula-driven management upon the environments of these separate post-fire forest areas...tailored to fit the larger cloth of a logging-driven agenda...The DEIS fails to include restoration as part of its focus and alternatives, instead stating that restoration measures will be developed in a separate NEPA process later. (34-49)

Response: The alternatives developed for this project are related to the stated purpose and need for the project, and are specific to the Eyerly Fire project area- they are based on the site-specific conditions found in this area, and on the need for economic recovery of burned timber and restoration of the Metolius LSR.

The purpose and need for this project was stated explicitly in the FEIS pp. 9-13. Restoration activities outside of this scope, which have been identified by resource managers for this area and are stated on pp. 6-7 of the FEIS, are not connected to salvaging timber, treating fuel loadings, and planting conifers in areas of treated fuels, and so are not included in the alternatives.

The land base considered for alternative development was as follows:

- Salvage is allowed within management area/allocation under existing plans- Management Direction, FEIS p. 18.
- Area is outside of the Metolius Roadless Area
- Area is outside of riparian reserve/RHCA
- Area is outside of steep slopes above perennial streams
- Area is outside of the following LRMP management areas (FEIS p. 22):
 - SIA's, Intensive Rec., Dispersed Rec., Metolius Heritage, Metolius SIA, Castle Rock SIA, and Metolius Wild and Scenic River
- Area is suitable for timber management (can be reforested and managed without irreparable resource damage) and has economic volumes of merchantable timber which can be salvaged

The range of alternatives is directly related to the key issues identified during scoping (FEIS pp. 33-35):

- Soils
- Water
- Fish Habitat
- Wildlife Habitat

Alternative 3 responded directly to these issues in the following ways:

- Wider stream channel buffers to protect water and fish habitat
- Increased use of helicopter yarding to reduce soil disturbance and protect water quality
- Higher retention levels of dead and dying trees for wildlife habitat
- Dropping of units due to concerns over noxious weed spread

Other alternatives responding to the purpose and need were considered but eliminated from detailed study (FEIS p. 35). These included an alternative that would have salvaged an additional 5 million board feet within the Metolius Roadless Area, and an alternative that would have expanded non-commercial fuels treatments within the fire area.

Economics

Several comments specifically addressed the relative importance of providing economic benefit to the community, and how the EIS document's economic analysis meets (or fails to meet) the purpose and need of recovering economic value through salvage harvest.

Comment: The DEIS Preferred Alternative has been chosen largely to provide economic value by salvaging merchantable timber. However, it fails to make the case that this can be a profitable venture. (30-10)

Comment: Harvesting timber in the burn area, as proposed under Alternative 2, makes sense!! It creates much needed jobs, supplies timber to mills for processing, and provides money to help pay for replanting and other restoration work. (32-2)

Comment: While timbering is still an important sector of the economy, the communities in the eastern Cascade Mountains region—especially in the Bend/Sisters area—are no longer timber-dependant: that is, timber production and milling, while still sources of income, are no longer the primary source of income for most of these localities.

Comment: The DEIS is incomplete because it fails to provide an adequate economic analysis of the proposed project....even if this ill conceived sale(s) is sold- a dubious assumption at best, given the falling prices of timber and the low quality of timber in the planning area- there is no support in the DEIS that the timber will be milled in the counties from which it is harvested, or that the project will result in a positive return to the United States Treasury. (34-86)

Comment: The f.s. Will likely lose money on this project-even without appeals and lawsuits. Won't be able to get as much money for burned wood and market value is lower. (38-1)

Comment: The socio-economic impacts were still not addressed to the extent that they should have been. Again, most of the value will be lost when and if this project gets completed. Proposing to treat only 4,877 acres in this project is not enough when considering that over 12,000 acres suffered from stand replacement severity. (33-3)

Comment: Alternative 2 more than meets your forest plan standard and guidelines for protection of resource values. But it falls short of providing for the social and economic values. (36-2)

Response: The economic and social analysis in pp. 316-317 of the FEIS show a positive net value of about 2 million dollars for Alternative 2, the proposed action. This analysis has been updated, and based on current market conditions the sales would still generate about 2.3 million dollars in receipts to the federal government (see table below). The helicopter units now show a slight positive value due to recent improvements in log prices.

The economic analysis in the FEIS is appropriate for the purpose and need of the project, namely the recovery of the economic value of burned and damaged timber, and acceleration of the development of late and old forest conditions within the Metolius LSR. Reforestation costs are not included in the analysis, because the need for reforestation was created by the fire, not this salvage project. Salvage will provide a needed source of additional funding for reforestation efforts within the LSR, as well as the rest of the salvage units.

Table J-2: Net Value (Expected Stumpage Value) of Alternative 2

System	Acres	Total Volume (mbf)	Volume/Acre (mbf)	Species	Pond Value (PV)(\$/mbf)	Stumpage Value (\$/mbf)	Total Stumpage (Net Value)
Ground-WT	1573.5	14,140	7353	\$350.00	\$202.88	\$147.12	\$1,081,769.67
Ground-CTL	1573.5	14,389	7482	\$350.00	\$231.72	\$118.28	\$884,992.85
Cable	203	1,662	864	\$350.00	\$279.80	\$70.20	\$60,672.67
Skyline	501	7,414	3855	\$350.00	\$289.41	\$60.59	\$233,585.63
Skyline-TRC	144	2,334	1214	\$350.00	\$318.26	\$31.74	\$38,526.45
Helicopter	330	4,912	2554	\$350.00	\$337.49	\$12.51	\$31,962.48
Total	4325	44,851	23,323				\$2,331,509.76

Time Delay of Project

Commenters provided input on the protracted project timeline, and relationship to the value of the timber proposed for harvest.

Comment: Already, too much time has elapsed during drafting of this DEIS for public review. You are close to a year behind where you should be. Because of this lengthy time delay, much of the salvageable produce value has been lost. (33-2)

Comment: Timing is very important in these matters and you've already taken an inordinate amount of time between the fire and the DEIS. Because of this, much of the value has been lost and restoration activities have been needlessly delayed. This will undoubtedly result in adverse impacts that could have been mitigated had action been taken sooner. (36-4)

Similar comments (23-2, 32-9)

Response: We recognize the negative effects of delay in terms of recovering economic value from fire-killed timber. Unfortunately, most of the delay was beyond our control. Procedural requirements of the NEPA process and personnel shortages have combined to push back the date of a final EIS. The fire season of 2003 saw four large fires on the Deschutes NF, and this had impacts on the availability of individuals and our program of work.

There is no evidence to support a conclusion that the delay in salvaging timber has resulted in accelerated erosion and degradation of fish habitat- monitoring of the area does not support this. Post-fire restoration was carried out on the highest priority areas using burned area funds- among the treatments done were drainage improvements to roads, grass seeding and contour felling to reduce erosion, and noxious weed control.

The main watershed concern identified for the Eyerly Fire, which could be ameliorated through management, is existing roads that are contributing sediment due to their location next to stream channels. Salvage receipts could potentially provide a source of funding for decommissioning of these roads, but it is not likely that there would be much funding available after contributions to the salvage sale fund and KV for reforestation are accounted for.

Reforestation within the fire area is ongoing- about 700 acres were planted in the spring of 2003. It is true that additional reforestation could happen at a faster rate if KV funds are

available from the salvage sale receipts. Much of the sale receipts will go towards replenishing of the salvage sale fund, however, so appropriated funds will be drawn upon heavily (for this and other large fires, as well). Unfortunately, when appropriated funds are used for reforestation our funding of thinning for hazardous fuels reduction is decreased by an equal amount (there are no additional dollars available).

Proposed Salvage: Size of Trees

Commenters voiced concern over management direction and the ecological importance of large, dead trees being left in place.

Comment: By setting a minimum diameter of 14 inches for Ponderosa pine and 12 inches for Douglas-fir to be logged, Forest Service plans to act in a way that is extremely contrary to the "enhance the development of late and old forest conditions within the Metolius Late-Successional Reserve" portion of the stated Purpose and Need for this project. The Forest Service needs to adequately analyze the following impacts of logging large trees:

- 1) By removing the majority of remaining mature and old-growth structure within the logging units, the Proposed Action would further reduce habitat for mature and old-growth forest dependent species.**
- 2) As was mentioned previously, targeting trees of this size for logging removes the least flammable woody components. As they decay, larger (12" and over) snags and downed logs store moisture during dry periods.**
- 3) Removal of large snags, logs, and living trees creates negative soil impacts such as compaction, erosion, disturbance of mychorizal fungi.**
- 4) Snags and downed logs help create landscape diversity and opportunities for some trees and other plants to regenerate because of the protection, shade and moisture they provide. (38-5)**

Comment: The Regional Forester's Plan Amendment #2 known as the "eastside screens" requires that: All sale activities (including intermediate and regeneration harvest in both even-age and uneven-age systems, and salvage) will maintain snags and green replacement trees of >21 inches dbh, (or whatever is the representative dbh of the overstory layer if it is less than 21 inches), at 100% potential population levels of primary cavity excavators. This should be determined using the best available science on species requirements as applied through current snag models or other documented procedures. Many of the trees proposed for logging are currently living and larger than 21 inches dbh. Every false-positive prediction that a large tree will soon die and should be removed is a violation of the eastside screens. (35-124)

Response: The "Eastside Screens" do not apply "to those portions of these forests to which the Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl, April 1994, applies." (Revised Environmental Assessment, "Eastside Screens", p. 6). All salvage within areas of this project where the "Eastside Screens" are applicable is within stands that are no longer late and old structure because they have experienced a stand replacing event- Appendix B of the "Eastside Screens" EA (p. 2, #3) exempts salvage sales with incidental green volume from the interim ecosystem standard.

There is no minimum diameter for size of trees to be salvaged. The FEIS states that the “minimum diameter of salvage trees would generally be 12 inches for ponderosa pine, and 12 inches for Douglas-fir; smaller diameter trees would be salvaged if markets exist at the time of harvest operations.” (FEIS pp. 36-37). Post-salvage fuels treatments would also treat much of the remaining smaller material in excess of coarse woody debris needs (FEIS pp. 39:44). According to Brown et al (2003), a high to extreme fire hazard exists when coarse woody debris (fuels greater than or equal to 3 in.) exceeds 30-40 tons per acre. They recommend coarse wood debris levels of 5-20 tons per acre for warm, dry ponderosa pine and Douglas-fir types, such as the Eyerly Fire. Although coarse woody debris does not contribute to rate of spread in current fire behavior models, it does contribute to development of large fires and fire severity. The plant associations found in the Eyerly Fire contain the volatile shrubs bitterbrush, Greenleaf manzanita, and snowbrush ceanothus, which will contribute significantly to surface rate of spread within the next 10-20 years. Modeling using FVS-FFE shows that a fire hazard will develop 20 to 30 years in the future (FEIS pp. 335-337).

The post-fire conditions found at Eyerly refute the notion that large fuels (> 12 in.) are not flammable and that they do not dry out during the fire season. Large fuels were completely consumed over extensive areas of the fire, contributing to tree mortality and severe soil burning.

Proposed Salvage: Harvest of Dead Trees

Several comments addressed the ecological value of retaining dead trees for forest habitat and natural post-fire recovery processes; additionally, fuel loading was an issue of concern.

Comment: No upper diameter limit has been set for the harvest prescriptions which could result in the harvest of trees over 20” within proposed activity units.” (page 336 Eyerly DEIS)—This is in direct contravention to Beschta recommendations which also call for leaving at least 50% of the snags of all diameter classes. While the DEIS discloses these differences indirectly, the authors do not address or substantiate why they are proposing logging activities not based upon science or ecological needs. (34-34)

Comment: Current science shows that 4 snags/acre minimum are required for 100% population potential for woodpecker species associated with snag cavities. Wolf Vegetation Management EA, Wallowa-Whitman National Forest, May 2001, page 57. “Historic snag levels could have been much higher, closer to 6-14 snags/acre. (Harrod, Gaines, Hartl, and Camp, 1998).” Additional snags should be left because future fires (both managed and unmanaged) and illegal firewood cutting is almost certain to take a heavy toll on snags over the next several decades. (35-9)

Comment: Recognize that dead and down wood are key elements of the forest ecosystem. (37-147)

Comment: A burned forest is still a forest. Burned and partially burned trees play a key role in the land's natural recovery. Standing dead trees and fallen logs provide critical habitat for wildlife, control erosion of fragile soils, and return critical nutrients to the forest floor that help new trees grow. (38-18)

Comments: The fuel loading in many of the riparian and other protected areas will cause greater fire risk into the future. More should be done in

these areas now. Consider risking a little more today to protect and enhance resources into the future, (short term risks for long term benefits).

Response: Field marking of approximately ¼ of the proposed salvage acres indicates that about ½-2/3 of the dead/dying tree component will be removed within the actual units-most of this removal will be dead, as the majority of dying trees will be left to meet the snag retention guidelines on pp. 53-54 of the FEIS. This retention is in addition to the approximately 10,000 acres of stands that experienced stand replacement and mixed severity burning that will have no removal of dead and dying trees. Our landscape snag analysis indicates that over the fire area the salvage under Alternative 2 would reduce the 21 in. and greater dead tree component by about 20 percent.

According to the FEIS pp. 220-221, approximately 15-25 snags per acre greater than 9 in. diameter, and 6 snags per acre greater than 16 in., would be left on the average across the landscape- some areas would have more, and some would have less. This type of landscape diversity is what the current science is saying would benefit the greatest number of species.

It is acknowledged that leaving a high level of snags in the untreated areas is creating a future fire hazard, with its concomitant risk of a reburn. It was felt that the salvaged areas would break up fuel loading across the landscape, and reduce the potential for a large-scale fire to occur. The un-salvaged areas also are providing high levels of snag habitat, and the riparian reserves are providing protection from soil moving into the channels. These areas are part of a landscape strategy to meet the purpose and need for the project while addressing the key issues identified during scoping.

Comment: Page 41 appears to target wildlife trees for salvage. One of the criteria for damaged trees to be removed includes “evidence of woodpecker feeding” This means that woodpeckers are benefiting from these trees so the Forest Service want to target them for removal. If you found a lush meadow for elk grazing would the Forest Service want to target it for destruction and ruin all wildlife value? That’s exactly what they are doing to woodpeckers. (37-33)

Response: The reference to woodpecker feeding is made as a means to identify trees that have died. As stated elsewhere in our response to comments, there is far more insect biomass present in burned trees than the woodpeckers are possibly able to utilize, and much of that biomass is in trees that are not scheduled for removal.

Proposed Harvest: Dying Green Trees

Commenters voiced concern with the harvest of healthy trees and damaged trees that experienced non-lethal burn conditions.

Comment: Some of the Eyerly area was only under-burned and/or lightly burned, and is composed of mostly green forest areas. Our surveyors have questioned just what would be logged within the boundaries of mostly green under-burned forest units if the agency is truthful in its claims that only fire-killed and dying trees would be logged? The agency needs to disclose the condition of these and other units within the fire perimeter and the Eyerly project area. (34-7)

Comment: Guidelines for assessment of tree survival must account for the fact that large trees are more likely to survive fire because they have thicker bark and higher crowns. If trees have any green needles they are extremely valuable for habitat and must be retained. Surviving green trees provide valuable refugia for beneficial soil organisms, they provide valuable live tree habitat now and in the future, and they help provide a snag recruitment source to help fill the critical snag gap expected in the future. The Forest Service cannot predict with accuracy which trees will die and which may survive and if they start guessing there will be false positives that are very harmful to LSR values as well as general wildlife and long-term site productivity. (37-32)

Similar Comments (37-137, 37-148)

Comment: We are concerned that the damaged tree characteristics are so broad as to allow very liberal interpretation of what is damaged enough to allow logging. What is your definition of "abundant" in regards to evaluating boring dust and pitch tubes on boles. We do not support choosing to log trees that show clear evidence of woodpecker foraging, which seems to be the current plan. Yes, once the bark is starting to fall off the trees it is more likely that they are dead or will die, but they are providing important habitat. (38-15)

Comment: Many of the trees proposed for logging are currently living and larger than 21 inches dbh. Every false-positive prediction that a large tree will soon die and should be removed is a violation of the eastside screens. (35-22)

Response: As stated in the FEIS on pp. 36-37, the proposed salvage would only remove dead or severely damaged (i.e. dying) trees. The specific guidelines for determining what trees are likely to die are spelled out in pp. 56-58 of the FEIS, and a discussion of the effects of insects is found in FEIS pp. 363-368. These criteria are based on recent research in Eastern Oregon (also drawing on over 70 years of research on fire-damaged tree survival, and local work done on the Hash Rock Fire) and are being applied so as to err on the side of leaving damaged trees. They are based on the most physiologically important factors, i.e. remaining live crown and amount of cambium damage, and on the presence of wood borers and bark beetles in the tree. Based on field marking of about 1100 acres of the proposed salvage, the majority of these damaged trees (especially the larger diameter trees) will be left in order to meet the guidelines for wildlife tree retention on pp. 53-54 of the FEIS, and to serve the values that the commenters discuss.

In addition, all healthy green trees will remain, even those with evidence of fire damage, i.e. trees with low-moderate crown and bole scorch, trees with healthy live crowns at least 20 percent of the total height of the tree, and trees with little or no evidence of bark beetles. These trees will provide genetic diversity through their seed to the regenerating stands.

The mixed severity units may present a challenge to those not trained to ascertain fire damage on living trees. These units experienced patches of tree crowning which resulted in groups of dead trees, and a hot underburn which consumed all of the duff layer and most of the coarse woody debris. Examples of this situation are the immature (12-16 in. diam.) ponderosa pine stands in the northern part of the fire (units 71, 72, and 74-76)-after the fire most trees in these units still had green crowns, but substantial cambium damage was noted on these trees during field surveys (as evidenced by taking cambium samples and the presence of wood borers). By fall of 2003, many of these trees had

turned red, and more can be expected to do so as bark beetles continue to kill weakened trees. The mixed severity Douglas-fir stands (with some ponderosa pine and white fir) in the southern part of the fire (units 32, 35, 37-39, 41, 42, 93, and 94) experienced the same type of fire as mentioned above. The white fir in these units has already been attacked by the fir engraver, and a majority of the Douglas-fir are susceptible to infestation by the Douglas-fir beetle- the situation is being monitored, and if Douglas-fir beetle populations increase in these units, salvage would be undertaken to reduce further loss of large tree habitat. The FEIS contains more discussion of this topic in pp. 366-367.

“Abundant” pitch tubes mean a sufficient number, as viewed around the entire circumference of the bole, to satisfy yourself that the tree has been entirely colonized and is in fact dead. Dry boring dust, such as that produced by ambrosia beetles is also an indicator that the tree has lost its ability to produce resin and to defend itself. The evidence of woodpecker feeding is taken as an indication that insect brood were beneath the bark; something that generally does not occur on a living tree. Again, not every tree fitting this description is proposed for removal. A number of them, in accordance with appropriate numbers for this vegetative type, are left as wildlife trees and green tree replacements for snags.

Large trees have a different standard than smaller trees, and all of them have a unique threshold at which they are considered likely to die after the fire. We know that there is considerable variability in tree survival and as such, we have taken a conservative approach, identifying those trees that are very unlikely to survive for more than one or two years under most circumstances.

Areas do exist within proposed salvage unit boundaries that experienced an underburn and have little or no tree mortality. These areas are generally along the final or interior containment lines and along roads, and were not always possible to exclude from the unit due to the need for road access to the unit boundary. Some areas also may end up having higher than expected tree survival at the time of implementation, and again trees in these areas will be evaluated using the guidelines on p. 59 of the FEIS, so that only trees expected to die will be removed. Areas where the majority of trees are healthy and green will be excluded from the unit where possible, or designated as no-treatment areas within units to provide natural seeding and wildlife habitat.

Proposed Salvage: New Plantations

A number of comments addressed the planting trees within proposed activity units, biodiversity, natural revegetation, and Forest Service policy.

Comment: Page 45 says that 8500 acres may be replanted. Please do not create new plantations that are a fire hazard, as well as being on a potentially unalterable trajectory that is not toward healthy complex old growth. If you must plant do it patchy and very low density. Use planting to create seed sources, not to immediately re-establish conifers... If this project involves artificial planting, avoid dense replanting that creates dense homogenous plantations. Such areas inhibit biodiversity and also represent dangerous fuel conditions. Please replant in patches and/or at a fairly low density and avoid the need for future thinning and other stand management costs. Let's be patient and allow these stands recover slowly as diverse early seral communities. Diverse early seral plant communities are becoming less common and we should encourage slow and easy regeneration of forest

communities. This is consistent with the research being done by Nathan Poage which indicates that many stands developed over much longer time periods than we typically allow under the agricultural model of forest management. (37-40)

Comment: "Plantation Creation" does not equal restoration or reforestation. We have concerns that the ongoing tree planting in the Eyerly burn area may have more negative than positive effects. Natural revegetation often takes longer, but the result is a more healthy, resilient ecosystem. Plantations tend to support a concentration of pocket gophers which the Forest Service often responds to be putting out toxic poisons in an attempt to "control" them. Fire is a very natural part of the ecosystem here and the land will recover at it's own pace. We are concerned that that salvage logging and other activities planned for in the Eyerly DEIS will hurt the recovery that is already happening in the area. (38-16)

Comment: It also states that "The recovery of economic value from burned trees also generates a source of funding to plant trees within activity units". From this we must assume that because of internal policies, the Forest Service must perform salvage logging to be able to afford to replant trees. These sorts of economic justification point out that perhaps you should attempt to change Forest Service policies rather than cut trees. (30-11)

Response: Alternative 2 of this project would plant trees on approximately 3918 acres of salvage in stand replacement conditions. The remainder, about 7000 acres of stand replacement outside of existing plantations, would be left to regenerate naturally and would proceed through a longer period as grass/forb/shrub and eventually seedlings/saplings. While fire is unquestionably a natural process in the forests at Eyerly, the type of fire that this area experienced was outside of the historic range of variability, and a seed source for natural regeneration is lacking in many areas. Because of this lack of seed source, and because of competition from the shrub communities found in this area, regeneration of forest cover would be a slow process (perhaps 60-100 years) over much of the area.

The objectives of conifer planting are to more quickly establish tree cover for species needing it, i.e. goshawks, spotted owls, and deer and elk, on about 4400 acres of the fire area. This would involve planting at a wide spacing (12 by 12 feet, or about 300 trees per acre) and using big game repellents as necessary. Control of gophers is not expected to be necessary. It is expected that planting at this density would eliminate the need for precommercial thinning, and leave about 100-150 trees per acre averaging around 14 in. diameter at age 80. At that time, future land managers would have the options of opening up the stands more for creating large tree habitat faster or maintaining the existing canopy cover for species needing higher levels (such as goshawks and spotted owls). The societal need for wood products may also enter into the decision making at that future time.

According to research being done by Nathan Poage, who studied the development of old growth Douglas-fir in west central Oregon, most trees exhibited rapid early growth early in their lives. The open spacing proposed for planted trees for the Eyerly area is consistent with this finding. It should be noted that Mr. Poage's research is from the west side of the Cascades a much more productive site, and an ecosystem with a different fire disturbance regime than that found within the Eyerly Fire area.

There is no evidence within the Eyerly Fire to support the contention that plantations burn hotter or at higher percentages of stand replacement. Overall, about 70 percent of the FS

lands within the fire perimeter burned as stand replacement- about 55 percent of the plantations burned as stand replacement. Recent fires in SW Oregon with the same historic fire regimes as Eyerly (Quartz Fire and Squires Peak Fire) experienced about the same percentages of stand replacement in plantations as in old growth (Atzet, personal communication). In future management of plantations, we would attempt to introduce fire into the stand at an early age (about 30 years), and then do periodic maintenance burns, to reduce potential for stand replacing fires- this may require mowing or other manual treatments of the shrub component to reduce flame lengths.

Funds generated from the receipts from salvage timber sales are an additional source of funding for reforesting burned areas. The FS can also request appropriated funds for reforestation in these areas. However, appropriated reforestation funds and thinning for hazardous fuels reductions come out of the same budget line item. Therefore, the use of appropriated funds for reforestation has historically resulted in a direct proportional reduction in thinning funds (FEIS pp. 313-314).

Old-Growth (MA15)

Two commenters voiced concern over the proposed replacement of a designated old-growth stand burned in the Eyerly Fire.

Comment: ...Any replacement old growth area to be designated should also be sugar pine. We also believe that the old growth within these old growth areas (as well as all old growth elsewhere in the area) should not be logged- to maintain that structure for wildlife. (39-3)

Comment: DEIS proposes “relocating” old-growth groves. This would require an amendment to the Deschutes LRMP and the NWFP (DEIS p. 7). There is no analysis that indicates whether old-growth habitat provided by existing groves has been destroyed, or that the new groves will compensate for this loss. (35-21)

Response: The MA 15 area that is proposed for salvage has experienced a stand replacing event over at least 2/3 of its area. This area no longer meets the definition of old growth. During salvage, all types of structural elements will be retained- healthy green trees, the majority of dying trees, snags, etc. Patches of healthy green trees will be retained as wildlife clumps. These elements will provide structural diversity to the regenerating stand. Any healthy sugar pine will be retained, and some rust-resistant sugar pine will be planted.

The areas selected for the replacement of the burned MA 15 represent the best examples of ponderosa pine and mixed conifer old growth within the Eyerly Project Area. Sugar pine is a relatively small component of the stands on Green Ridge, this is a disjunctive population, and unfortunately the fire killed a high percentage of all the sugar pine in this area. It was not possible to find a replacement stand with a component of sugar pine that came anywhere near the size criteria for this MA. Live old growth sugar pine are still scattered throughout the area and should contribute progeny to the next generation. Also, sugar pine will be planted on appropriate sites during reforestation activities.

Re-allocation of Old-growth can be found in the FEIS on pages 223-225. The distribution and minimum size of old growth areas were based upon the habitat requirements of the northern goshawk for ponderosa pine and marten for mixed conifer. However, both areas suffered stand replacement fire. Therefore, the old-growth areas are not meeting habitats

requirements that they were set aside for, and designation of new areas that meet the habitat definitions for goshawks and martens have been designated according to LRMP guidelines.

Roads and Transportation

Several commenters voiced concern over the current and proposed condition of the Forest transportation system within the Eyerly project area.

Comment: Remaining open roads (which need to be brought within wildlife viability thresholds) which are retained need to be improved so they are not adversely impacting area streams and springs. (34-27)

Response: Road maintenance is outside the scope of this project, except on roads that would be used for hauling. Existing roads that would be used for hauling in the Action Alternatives would be improved, if necessary. This work typically involves grading and the addition of a few drain-dips, water-bars or culverts to improve surface drainage and reduce erosion, including brushing and limbing as needed to improve sight distance and safety.

In addition, as an associated action, approximately 3.8 miles of road would be decommissioned in the Action Alternatives, 2.5 miles of which is located within riparian reserves.

Comment: The Forest Service should take this opportunity to close roads that have the potential to cause serious erosion. Such projects have the additional advantage of rewilding areas. With so little of our National Forests in a wilderness condition, we should consider increasing roadless acreages. (30-2)

I think all roads within the area, including the “temporary” roads should be left as roads. Close so[m]e off from the public perhaps, but keep them there in case of another fire. (27-2)

Response: Closing roads is outside the scope of the purpose and need of this project. However, as an associated action, approximately 3.8 miles of the 1170800 road system are proposed to be decommissioned following salvage operations with the selection of either Action Alternatives. The Eyerly Roads Analysis recommended decommissioning approximately 42 miles of road and closing (inactivation) of approximately 22.5 miles; therefore, additional road decommissioning and closure is a future foreseeable project. The cumulative effects of future road decommissioning and the proposed action have been analyzed in the FEIS (Ch. 3.4.2 Existing Condition / Sedimentation / Roads).

Comment: It is perplexing that there are road closures to protect the resources in this area and the Forest Service is planning intensively ground-disturbing industrial logging, roadbuilding and road reconstruction. (38-17)

Response: The connected activity of decommissioning the 1170800 road system, after salvage operations, will utilize project funds to remove road related flow and sediment delivery into the adjacent Spring Creek intermittent tributary. However, to accommodate the hauling of salvaged timber, portions of this road will need minor reconstruction.

Comment: Section 3.14.3.3 states that "Approximately 33.4 miles of road are shown to need reconstruction in both action alternatives." and that "The cost of reconstruction, including crushed aggregate surfacing or resurfacing, is estimated at this time to be \$40,000 per mile." If these numbers are even approximate, the cost to reconstruct those 33.4 miles of roads would be about \$1.33 million. (30-3)

Similar Comment (38-8)

Response: Approximately 33.4 miles of road are shown to need reconstruction in both action alternatives. However, this is only an estimate. When the road condition surveys and economic analysis has been completed, it is expected that this quantity will be adjusted as appropriate. It is also estimated that the 33.4 miles of road reconstruction may include up to 8 miles or more of surfacing, resurfacing or spot surfacing with crushed aggregate. The cost of reconstruction, including crushed aggregate surfacing, is estimated at this time to be \$40,000 per mile. Reconstruction activities without crushed aggregate surfacing would be considerably less.

Comment: Implementation of Alternative 2 requires an estimated three miles of temporary roads to access harvest units that are inaccessible using existing roads... The DEIS states, in the Roads and Transportation Environmental Consequences Section 3.14.3.4, that temporary roads will be obliterated following timber harvest operations. The Department recommends clarification of this project activity in the FEIS. (40-7)

It is true that many people use forest roads for recreation. It is our hope that some roads remain open to the public for OHV and cars. Not everyone can get around in the forest on foot. Alternative 2 provides for much needed maintenance and repair of existing roads. Some of this repair would improve run off toward area streams. (32-8)

Response: The reconstruction activities on forest system roads listed in Table 3.15-1 may include work items such as the reconditioning of the existing traveled way, surfacing and/or resurfacing with crushed aggregate, spot surfacing, and drainage restoration as required.

If crushed aggregate surfacing material is needed, it can be obtained from the new East Sullivan Rock Quarry on the east side of Green Ridge near the project area. An environmental assessment for this quarry has been prepared and a Decision Notice was signed on May 11, 1995. The initial clearing and overburden removal, for the first stage, has been completed by the Forest road crew. However, if the quantities of crushed rock are small it may be cost effective to obtain the material from a commercial source.

Comment: We do not support the creation of three miles of "temporary" roads as part of the proposed action, including the creation of one mile of temporary road on a fire line that should be rehabilitated. Such "temporary" roads have long term impacts to the environment, including soil compaction and displacement, habitat fragmentation, spreading noxious weeds, and increased sedimentation to streams. Additionally, inadequate closures contribute to long term illegal usage of roads that were intended to

be temporary. Creating temporary roads as part of this project will significantly increase the number of designated "hazard" trees, especially since it's a burn area, which translates to logging more old growth and mature trees. Our concerns over logging old-growth and mature forest habitat have already been stated. By choosing not to create roads in the project area, there will be far fewer "hazard" trees to worry about and fewer negative ecological impacts as well.

(38-7)

Response: Implementing the Eyerly Fire Salvage Project would result in the decommissioning of 3.8 miles of road, which will reduce the overall transportation system mileage. A separate Eyerly Road Management Environmental Assessment (EA) document would be accomplished to assess the remaining activities specifically related to road management within the Eyerly Project Area as identified in the Road Analysis Report.

Comment: The DEIS for this proposed project fails to disclose if functional roads, including skid trails, were addressed in the roads assessment or included in the DEIS totals. (34-28)

Response: Road density calculations are clarified in the FEIS. All roads, including non-system roads, were included in the road density estimates in the DEIS and FEIS. Skid trails and landings were included in the detrimental soil acres calculations (Ch. 3.4.2 Existing Condition \ Sedimentation \ Roads; and Ch. 3.4.2 Existing Condition \ Sedimentation \ Past Timber Harvest in FEIS).

Comment: Concerns with limited access in and out of Monty Campground. Believes it is a transportation safety issue for both the recreating public and firefighters who could potentially utilize these roads for future wildfire suppression. (26-5)

Response: While the transportation engineer and Forest staff value concerns about public and agency safety, increasing transportation access to Monty Campground is beyond the scope of the Eyerly Fire Salvage Project.

Project Design: Hydrologic Function

Several Commenters voiced concern over how the project design elements would mitigate or protect water quality, stream buffers, streamflow, and sedimentation processes.

Comment: The Forest Service admits that there will be logging in riparian reserves. Failing to quantify or qualify the impacts from this violates the ACS. (74-126)

Response: Disagree. There is no proposed logging in RHCA/RRs under either action alternative (Chapter 3.4.3 Water Quality Environmental Consequences \ Sedimentation \ Impacts from Alternative 2 of the FEIS). There may be tail trees and/or skyline corridors within RHCA/RRs, the impacts of this action is addressed in Chapter 3.

Comment: The FS also asserts that maintaining stream buffers and “harvest systems tailored to site conditions” (a meaningless phrase) will prevent all hydrologic impacts (Id.). These claims are unsupported by scientific evidence and violates NEPA. (35-13)

Response: Disagree. The conclusions in the DEIS and FEIS are based on the best available data. Applicable scientific studies of post-fire logging sedimentation and peak flow effects are minimal, primarily due to the overwhelming effects of wildfire (USDA Forest Service 2000). A compilation of post-fire logging studies found only one replicate study with a control (important for potentially allowing inferences to other locations) that analyzed sediment or peak flow (USDA Forest Service 2000). This extensive study was conducted by Chou and others (cited in McIver and Starr 2000) after the Stanislaus fires in the central Sierra Nevada Mountains. They found no detectable difference in sediment output between logged and unlogged units.

Due to the limited amount of scientific study of post-fire logging effects, attempts were made by the USFS to disclose the sedimentation and water yield risks by discussing soil disturbance and compaction effects (Chapter 3.4.3 Water Quality Environmental Consequences \ Sedimentation \ Impacts of Alternative 2). In addition, the statement from the DEIS that Mr. Johnston refers to was in reference to landslide potential. The statement in the FEIS is as follows, “risk of catastrophic landslides resulting from salvage activities would not increase because of the use of streamside buffers, harvest systems tailored to site conditions, and location of temporary roads on ridge tops” (Chapter 3.4.3 Water Quality Environmental Consequences \ Channel Condition \ Impacts of Alternative 2 & 3).

Comment: There will clearly be impacts to water resources as a result of these activities that needs to be disclosed. (35-14)

Response: The activities referred to by Mr. Johnston (i.e. logging, log haul, use of tail trees, and skyline yarding) would not occur within riparian reserves as he suggested, with the exception of log hauling. The effects of log hauling on existing roads in RHCA/RRs are discussed in Chapter 3.4.3 Water Quality Environmental Consequences \ Sedimentation \ Impacts from Alternative 2 of the FEIS. No new roads or temporary roads are proposed in RHCA/RRs. Amendments to the Project Design Elements have been made to make this more clear (Ch. 2, Section 2.8.1.2).

Comment: The Forest Service uses an improper baseline for analysis throughout the DEIS: “Predicted increases in sediment as a result of these activities [logging] is difficult to assess but are likely to be minimal when compared to those resulting from the fire (DEIS p. 92).” NEPA does not require the Forest Service to qualify impacts in relation to the fire, it requires the agency to quantify what precisely those impacts will be. (35-15)

Response: The baseline definition for hydrologic analysis has been expanded in the FEIS. The quote from the DEIS that Mr. Johnston refers to is taken from Chapter 3.3.3 Soil Quality Environmental Consequences. A more detailed discussion of sedimentation effects associated with the Action Alternatives is found in the FEIS: Chapter 3.4.3 Water Quality Environmental Consequences \ Sedimentation \ Impacts from Alternative 2.

Comment: [DEIS] Page 36 says that activities would not impact bank stability but peak flows are already going to significantly increase due to the fire and increase a little more due to salvage logging and fuel reduction, so in fact this project will increase peak flow and cause bank erosion and bank instability. (37-26a)

Response: Disagree. The proposed action would have a negligible effect on streamflow because no live trees would be removed and soil compaction is not at a magnitude that would significantly effect streamflow. By not increasing streamflows, especially the more erosive high flows, the action alternatives would not increase the risk of stream erosion (pp. 133-135 of FEIS). Also, large riparian buffers would prevent most of the upland erosion caused by activities in the action alternatives from being transported to the streams; thereby, having a negligible effect on sediment deposition and associated channel erosion. Risk of catastrophic landslides resulting from salvage activities would not increase because of the use of streamside buffers (described above), harvest systems tailored to site conditions, and location of temporary roads on ridge tops. Removing dead trees would not compromise slope stability because tree roots would not be altered. Therefore, the proposed action would have a negligible effect on streamflow or bank stability.

Comment: What are the [peak flow] consequences for bull trout and other aquatic species? (37-26b)

Response: There would be no effects on bull trout from peak flows. Bull trout spawning habitat does not exist in Street or Spring Creeks. Secondary rearing habitat is available in Street Creek and is expected to be maintained regardless of change in peak flows as caused by the effects of the fire. The project will not affect the peak flows of the Metolius River or water levels of Lake Billy Chinook. Redband trout most likely spawn in Street Creek and use the stream for rearing.

Comment: [DEIS] Page 36 seems to indicate that the Forest Service uses a 25% ECA as a threshold of concern, but what is the basis for this threshold, especially in a burned landscape? (37-27)

Response: An ECA threshold is inappropriate. Project Design Element #1 under Cumulative Effects to Watershed Condition (DEIS p. 36) was replaced in the FEIS (pp. 26-27) with, "The alternatives are designed so that increases in evapo-transpiration (ET) are negligible." This is true because no live tree would be harvested.

Comment: Pages 36 and 47 say there will be no increase in ECA but that is based on an erroneous assumption that removing the canopy of dead and dying trees has zero effect on hydrology. (37-28)

Response: Disagree. Salvage logging would not significantly effect streamflow because no live trees would be harvested and compaction would not be a magnitude that would significantly increase streamflow. Streamflow effects are disclosed in Chapter 3.4.3 Environmental Consequences / Streamflow / Impacts from Alternative 2.

Comment: In fact salvage logging will significantly affect hydrology in the following ways that the EIS must account for:

a. The canopy of dead trees intercepts a small amount of rain and snow; (37-28a)

Similar Comment (37-69b)

Response: The DEIS acknowledged that, “Although some precipitation adheres to dead trees and returns to the atmosphere, harvest would not measurably reduce interception or evaporation.” The statements on page 36 and 47 are amended in the Final EIS to better reflect this (FEIS, p. 123). In addition, only 27% of the burn area is proposed for harvest and within that area all the live trees and a specified amount of downed wood and snags (in accordance with the Northwest Forest Plan) would be left. Therefore, more than 70% of the fire area would be unaffected.

Comment: The canopy of “dying” trees intercepts an even large amount of rain and snow; (37-28b)

Response: Only 450 acres in Alternative 2 and none in Alternative 3 are proposed for harvest in mixed mortality (moderate severity) stands (FEIS pp. 359-360). In a mixed mortality stand between 25 and 75% of the trees are live and will not be affected by the proposed action. The remaining trees are dead or dying; therefore, only a small portion of the trees within the 450 acres are “dying”. By the time of the proposed salvage, at minimum two years would have passed and many of the “dying” trees would be dead.

Comment: The method of converting burn severity into ECA results was not disclosed. (p 64) [of DEIS]. (37-48)

Response: The method for converting burn severity into ECA results was not disclosed in the DEIS, but has been disclosed in the FEIS. District silviculturists and hydrologists developed ECA coefficients for different harvest prescriptions and stand burn severities based on the proportion of basal area typically removed in the treatment or fire (Chapter 3.4.2 Existing Condition \ Streamflow \ Hydrologic Analysis).

Removal of Down Wood

A number of comments discuss the importance of down wood’s hydrologic functions, including the trapping of sediment, replenishment of lost nutrients, and effect during rain on snow events.

Comment: Project proposes removing down wood and future down wood which is important for hydrologic function. (37-14c, 37-16, 37-28, 37-134, 37-175)

Response: While the project does propose removing down wood and future down wood, the quantity proposed would not impede hydrologic function. Sediment and runoff stored on land by down wood reduces water quality effects. Sediment and runoff is most likely to be transported to waterbodies from disturbed areas adjacent to waterbodies. No harvest activities are proposed in Riparian Reserves or Riparian Habitat Conservation Areas (RR/RHCAs) in order to maintain a viable riparian buffer. In addition, down wood within and outside RR/RHCAs will rapidly increase in the next few years as dead trees fall. Fuel loading, as a result of falling dead trees, will rapidly increase over the next 10 years and within the next 50 years it is predicted to exceed Forest Plan standards (FEIS p. 334-338). Only 21% of the burn area is proposed for harvest and within that area a specified amount of down wood and snags (in accordance with the LSRA and Northwest Forest Plan) would be left. In addition, none of the logs that were contour felled would be

removed by the proposed activities. Therefore, more than 80% of the post-fire down wood would be unaffected and would meet LSRA and Northwest Forest Plan standards for down wood in all units. Given that no wood would be removed from RHCA/RRs and that an abundance of down wood and future down wood would be left in the Metolius Watersheds, the amount of logs proposed for removal would have a negligible effect on sediment transport or streamflow.

Comment: [DEIS] Page 103 admits that nutrient spikes may occur in Street Creek but the EIS fails to acknowledge that logs (if retained rather than removed) are short-term nutrient sinks that can help alleviate this problem. (37-67)

Response: Agree. Some nutrients attached to soil will be trapped by down wood. Also refer to response to previous comment.

Comment: [DEIS] Page 103 says that a portion of the fire occurred in rain-on-snow zone but fails to disclose which harvest units are in the rain on snow zone... (37-68a)

Response: The FEIS did not disclose which units are within the rain-on-snow zone because the relevance of this information was unclear. Units 1-33, 35-42, 47, 51-52, 54, 56, 58, 60-71, 73-78, 80, 90, 93, 94, 97, 125, and 126 are within the rain-on-snow zone. Approximately, 73 units totaling 2343 acres are within the rain-on-snow zone under Alternative 2. As mentioned in Chapter 3.4.2 Existing Conditions, created openings in areas subject to rain-on-snow could largely increase peak flows due to increased snow accumulation and melting. However, the risk in the Eyerly burn area is low because less than 10% of any subwatershed experienced a stand replacing fire in the rain-on-snow zone. The additional openings created by removing dead trees would be minimal.

Comment: [DEIS] fails to acknowledge that large logs help anchor snowpacks and buffer peak flow events. (37-68b)

Similar Comment (37-69a)

Response: Disagree. Removing down wood in the rain-on-snow zone would not increase peak flows by destabilizing the snow pack. The relevance of the anchoring effect of logs to the snow pack on peak flows is unclear. Rain falling on snow would melt the snow and the water would runoff over the snow pack. If the snow pack was not anchored the same process would occur but the snow could slide, depending on slope. Regardless, the same amount of water would reach the stream at the same time. Refer to Issue #4 response for additional discussion of effects of removing down wood.

Sedimentation and Erosion

The effects of the road system and proposed activities on erosion, delivering sediment, and their effects on the landscape were voiced as concerns.

Comment: Sediment also occurs from transport traffic along log haul routes. Removal of large and medium diameter trees and snags which currently are holding area soils, and which would continue to hold soils even after they've

fallen—if not removed by logging, would also increase sedimentation and erosion. (34-25a)

Response: The effect of haul roads on sedimentation is discussed in Chapter 3.4.3 Water Quality Environmental Consequences \ Sedimentation \ Impacts from Alternative 2 in the FEIS.

Comment: The effects of the logging loss of these trees would impact the area's water systems for from several years to decades, and potentially over time, result in increased instances of landslides. (34-25b)

Response: The amount and location of harvest proposed would have a negligible effect on sedimentation and landslide risk; thereby, not impeding the water system (Chapter 3.4.3 Water Quality Environmental Consequences \ Sedimentation \ Impacts from Alternative 2 in the FEIS). The amount of downwood is predicted to rapidly increase over pre-fire conditions in the next 10 years. Only 27% of the burn area is proposed for harvest and a specified amount of downed wood and snags (in accordance with the LSRA and Northwest Forest Plan) within this area would be left. In addition, none of the logs that were contour felled would be removed by the proposed activities. More than 70% of the post-fire down wood would be unaffected and would meet the LSRA and Northwest Forest Plan standards for down wood in all units. In addition, riparian buffer effectiveness and instream wood recruitment would be unaffected by the proposed actions because no wood would be taken from RHCA/RRs. Therefore, the amount of logs proposed for removal would have a negligible effect on sedimentation and sediment transport.

Comment: Area roads have adversely impacted stream systems, including channeling sediment into streams, limiting riparian vegetation and adequate accumulation of woody materials, and harmfully influencing stream channel morphology. (34-26)

Response: Road effects are disclosed in Chapter 3.4.2 Existing Condition \ Sedimentation \ Roads in the FEIS.

Comment: The water quality indicator must include the number of road stream crossings, and the miles of haul road that have ditches hydrologically connected to the stream system. (37-14d)

Response: Agree. Water quality analysis should include indirect effects from haul roads and hydrologically connected ditch segments. These subjects are expanded upon in the FEIS. There are approximately 304 stream crossings in the analysis area (Chapter 3.4.2 Existing Condition / Sedimentation / Roads). Haul roads cross intermittent streams approximately 54 times in Eyerly Salvage area. The riparian buffer of approximately 45 of those units about proposed units. Therefore, assuming all these roads are insloped and do not have a relief culvert prior to confluence with a stream channel, approximately 90 ditch segments along the haul routes are hydrologically connected to the stream network. The effects of log hauling are discussed in Chapter 3.4.3 Environmental Consequences / Sedimentation / Impacts from Alternative 2 in the FEIS. To reduce the risk of sediment transport to the streams via the ditch network, the following mitigation would be implemented:

Trees or equipment would not be dragged or cross through ditches that are hydrologically connected to streams. In addition, landings or loading areas would not be located in ditches hydrologically connected to streams.

Comment: The project design elements for sediment and substrate are inadequate to prevent harm. These measures erroneously assume that activities outside of Riparian Reserves have no effect on sediment and substrate. The Forest Service has no monitoring data to support this assumption, especially not for post-fire landscapes. In fact, many activities outside of Riparian Reserves can and will cause erosion and sedimentation. (37-21)

Response: Disagree. The FEIS acknowledges that activities outside RHCA/RRs cause erosion and that some of that could be transported to the streams (Chapter 3.4.3 Water Quality Environmental Consequences \ Sedimentation \ Impacts from Alternative 2 in the FEIS). Project design elements would also help mitigate (not prevent) sedimentation effects.

Comment: [DEIS] Page 35 indicates that pile burning will be allowed within Riparian Reserves. This will cause serious soil effects and likely lead to erosion and sedimentation. (37-22)

Response: The DEIS erroneously implied that burning would occur with Riparian Reserves. No harvest or burning activities are proposed within Riparian Reserves or RHCA's. Project Design Element #5 under Sediment and Shade (DEIS p. 35) was removed in the Final EIS.

Comment: [DEIS] Page 36 says rather naively that road use and log hauling will not contribute to siltation off the roadway. This is a virtual impossibility. Log hauling along roads with ditches that are hydrologically connected to streams will cause siltation. (37-23)

Response: Agree. Road use in riparian areas could contribute sediment to streams. The effects of log hauling are discussed in Chapter 3.4.3 Water Quality Environmental Consequences \ Sedimentation \ Impacts from Alternative 2 in the FEIS. To mitigate the potential sedimentation from hydrologically connected ditch segments, salvage activities would not be allowed in these ditch segments (i.e. no dragging logs or driving equipment through hydrologically connected ditches or constructing landings in these ditches). In addition, units that drain into hydrologically connected ditches would be targeted for subsoiling, which has been shown to restore infiltration (USDA Forest Service 1995b). Also, design elements would restrict skid trail from being constructed perpendicular to these ditches and no equipment would drive within 50 feet of the edge of the ditch.

Design Element #7 under Sediment and Substrate (FEIS p. 51) implies that hauling would occur during wet periods which is not true. This design element was replaced in the FEIS with "Hauling, associated with the proposed action, would not occur when roads are excessively wet to reduce erosion and sedimentation. In addition, during dry periods dust abatement materials would be used."

Comment: [DEIS] Page 36 appears to anticipate road use during wet periods. The consequences of this MUST be disclosed and this practice must be rejected. (37-25)

Response: Agree. Hauling should not occur when roads are excessively wet. Design Element #7 under Sediment and Substrate (FEIS p. 51) implies that hauling would occur during wet periods which is not true. This design element was replaced in the FEIS with “Hauling, associated with the proposed action, would not occur when roads are excessively wet to reduce erosion and sedimentation. In addition, during dry periods dust abatement materials would be used.”

Sediment Filtering and Effects to Streamflow

A few commenters expressed interest in how the proposed salvage would affect riparian and instream sediment functions.

Comment: Burned riparian buffers are not effective sediment filtering strips. (34-56, 37-24, 37-64)

Response: Burned riparian buffers are still effective in reducing sedimentation associated with salvage activities. The effect of the fires on riparian buffers was disclosed (Ch. 3.4.2 Existing Condition \ Channel Network and Condition \ Riparian Condition in FEIS) and the effectiveness of the burned buffers in filtering sediment was discussed (Ch. 3.4.3 Water Quality Environmental Consequences \ Sedimentation \ Impacts of Alternative 2). This section states, “Although 24% of RHCA/RRs within the subwatersheds affected by the Eyerly Fire were completely denuded (stand replacing fire) they are still beneficial. The burned riparian buffers still provide a linear distance between any activity and a waterbody and the new ground cover and down wood helps trap sediment. In addition, no harvest activities are proposed in RHCA/RRs; therefore, not affecting buffer effectiveness or instream sediment storage potential from large wood recruitment.”

Comment: The Aquatics sections of the DEIS fail to accurately address the significant sedimentation which would definitely result from the proposed logging activities—which includes logging on steep slopes above area creeks. (34-23)

Response: Disagree. Sedimentation effects are disclosed in Chapter 3.4.3 Water Quality Environmental Consequences \ Sedimentation \ Impacts from Alternative 2 in the FEIS.

Comment: The streamflow/peakflow indicator must account for the fact that salvage logging will interfere with infiltration pathways and remove logs that help anchor snowpacks and retard runoff. (37-14e)

Response: Impacts to infiltration and runoff should be considered when determining streamflow effects. The FEIS discloses that 474 acres could be compacted (i.e. detrimental condition) by logging activities in Alternative 2 and 249 acres in Alternative 3. Also, approximately 2.1 miles of temporary road would be constructed along ridgetops, one mile of which is a fire line. It also acknowledges that although some of these acres would be subsoiled (including all temporary roads), units that do not exceed the detrimental

condition threshold after logging and are not near stream buffers or hydrologically connected ditch segments may remain compacted.

The relevance of the anchoring effect of logs to the snow pack on runoff is unclear. Rain falling on snow would melt the snow and the water would runoff over the snow pack. If the snow pack was not anchored the same process would occur but the snow could slide, depending on slope. Regardless, the same amount of water would reach the stream at the same time. Refer to Issue #4 response for additional discussion of effects of removing down wood.

Project Design: Monitoring

Several commenters voiced their concern that resource monitoring has not been accomplished, or has not been adequately addressed in the EIS document.

Comment: Many of the stream reaches within this area—post-fire—are likely to fail to meet Forest Plan standards for fine sediment. Additionally, peak flow, sediment loads, turbidity, mass wasting, and other potential problems exist post-fire. Added to this are the impacts from fire-fighting activities—including bull-dozed fire-lines which crossed Spring, Street, and Fly creeks 19 times, with 84 total miles of bulldozer line in the project area—which will also result in increased soil erosion and sedimentation into area waterways. However, while the DEIS mentions these issues, it appears that much of the information requisite to credible analysis has not been gathered or researched. It would have been appropriate to have installed sediment monitoring devices, temperature gauging stations, conducted fish surveys, as well as water quality and toxicity studies post-fire, to accurately assess potential cumulative impact problems which may be compounded by the proposed project. Apparently this has not been done however, despite many months having transpired since the fire occurred. An adequate assessment of the cumulative impacts to water quality and listed fish species requires much more than merely listing the various potential problems piecemeal on paper. The DEIS fails dramatically in both acquiring the necessary information—or following NEPA by explaining why this has not been done—and in bringing this information together into a comprehensively thorough analysis. Substituting the mere parroting of rhetorical, wishful “disclosures” and unsubstantiated conclusions, having more to do with the agency’s bias to log this area than with ecological reality, fails the legal requirements of the NEPA. Such irresponsible agency failure to begin to collect this information—despite knowing full well of this planned project for many months (and despite the ease of simply establishing sediment monitoring boxes and temperature gauging stations along area creeks, etc.), violates the clear requirements of the NEPA which gives the agency two choices—either gather the needed information—or state why collecting this information was not possible. (34-22)

Response: Disagree. The DEIS has supplied enough data to meet the legal requirements of NEPA; however, additional explanation of monitoring data is supplied in the FEIS. Monitoring of erosion, vegetative recovery, streambank stability, instream wood recruitment, fish habitat, and water temperature has been conducted in the Eyerly Fire area and is on-going. Silt fences were installed to monitor sediment immediately after the fire

and the preliminary results are discussed in Ch. 3.4.2 Existing Condition \ Sedimentation \ Wildfire of the FEIS. Fine sediment has been monitored in Street Creek in 1999, 2002, and 2003, and is on-going. Vegetation recovery and post-fire stream survey data were collected and are discussed in Ch. 3.4.2 Existing Condition \ Channel Network and Condition in FEIS. Water temperature was monitored in the summer of 1999 and 2003 in Street Creek and is being monitored in the summer of 2004. Nutrient monitoring was conducted in LBC reservoir prior to the fire and will resume in the 2005 (Ch. 3.4.2 Existing Condition \ Water Temperature and Ch. 3.4.2 Existing Condition \ Water Chemistry in FEIS).

Throughout the Metolius 5th field watersheds water temperature, nutrients, and fine sediment have been monitored in various tributaries and within the mainstem Metolius River. Fine sediment has been monitored in the Metolius watersheds since 1988, although there are no numeric standards for fine sediment in the Deschutes National Forest Plan or in the Northwest Forest Plan. Those results and the cumulative sedimentation effects are discussed in Chapter 3.4.3 Water Quality Environmental Consequences \ Cumulative Effects \ Sedimentation.

Comment: The DEIS (p 32) says that water quality BMPs would be moderately effective, but the EIS lacks monitoring data to support this, especially monitoring data that was conducted in post-fire situations. Also, the EIS fails to disclose the environmental consequences of moderately effective BMPs. (37-19)

Response: Disagree. The DEIS on pages 32-33 (FEIS p. 50) describes the design elements for soils and water quality BMPs, including their effectiveness in mitigating effects on these resources based on research, existing data, or professional judgment. Proposed design elements have “moderate” and “high” effectiveness ratings derived from quantitative monitoring used to develop the publication *General Water Quality Best Management Practices, Pacific Northwest Region, 1988*. The USDA Forest Service uses State and EPA certified BMPs listed in this publication and additional BMP effectiveness monitoring comes from Region 5 of the Forest Service. This monitoring measured the effectiveness of water quality BMPs such as riparian buffers, skid trail spacing and design, landing design and location, timber sale administration, road maintenance, stream crossings, temporary road construction, and protection of roads during wet periods. These BMPs mitigated effects in more than 70% of the cases, and for most BMPs effects were mitigated in more than 80% of the cases measured (USDA 1998c). Although the post-fire environment may reduce the physical effectiveness of some BMPs such as riparian buffers, the majority of BMPs proposed to mitigate project effects on water quality would remain fully effective under these conditions.

The FEIS acknowledges that BMPs would help mitigate, but not necessarily eliminate effects to the soil resource and water quality. BMPs having moderate effectiveness ratings generally relate to designated harvest systems. The DEIS acknowledged that implementing designated harvest systems would cause various amounts of gouging, compaction, and soil displacement (DEIS pp. 113 – 114; FEIS p. 134), including approximately 800 acres of detrimentally compacted soil within ground-based harvest units under alternative 2 (DEIS p. 82; FEIS pp. 94-95). The FEIS also states that subsoiling mitigations proposed to rectify compaction incurred by the proposed activities would still have some short-term effects on soil characteristics and erosion susceptibility (Chapter 3.4.3 Water Quality Environmental Consequences \ Sedimentation \ Impacts

from Alternative 2 in the FEIS). Although there would be some sedimentation effects caused by the proposed activities, project design elements such as maintaining riparian buffers would help reduce the transport of sediment to the streams.

Comment: The forest plan says that water quality will be continuously monitored but the EIS admits that it has not been monitored. This project should not move forward until monitoring or other compelling analysis shows that the cumulative effects of the fires, fire suppression, roads, log hauling, salvage logging, activity fuel treatment, site prep, planting, brush control, FMZs, prescribed fire, etc. will not cause unacceptable impacts on water quality which Threatened bull trout are so dependent upon. (37-63)

Response: Cumulative effects conclusions for this project and other past, present, and future foreseeable projects are based on monitoring data and analysis. After the analysis for the DEIS was conducted, the B&B and Link fires occurred and additional cumulative impact analysis was added to the Final EIS (Chapter 3.4.3 Environmental Consequences / Cumulative Effects). Water temperature and chemistry data have been collected in some of the streams and significant monitoring has been conducted in Lake Billy Chinook reservoir. These data were used to establish the existing condition (i.e. establish effects of past activities on water quality) at the watershed scale (5th field) for cumulative effects analysis. Although the FEIS states on page 147 that minimal water quality data has been collected in the Eyerly Salvage analysis area, it is a result of limited perennial water, not of unimplemented monitoring requirements.

Comment: Logging will degrade water quality. Required monitoring is not done, effectiveness of BMPs in unknown, and Threatened bull trout that are dependent on very high quality water will be harmed. (37-163)

Response: The FEIS discloses the effects of logging on water quality (Chapter 3.4.3 Environmental Consequences) and states that the proposed project would not degrade water quality.

Monitoring of the effectiveness of BMPs as stated in LRMP Standard and Guideline WT-2 is to be accomplished at the Forest Program level and is not required under the Forest Plan at the project level. The Forest does not have quantified effectiveness data on BMPs and the analysis defers to the quantified effectiveness ratings of individual BMPs based on a number of monitoring sources and professional judgements. The USDA Forest Service uses State and EPA certified BMPs listed in *General water Quality Best Management Practices, Pacific Northwest Region, 1988*, to protect waters of the State of Oregon in accordance with the Clean Water Act (USDA Forest Service 1988). The BMP manual includes effectiveness ratings for each BMP developed from quantitative monitoring throughout Region 6. Additional BMP effectiveness monitoring comes from Region 5 of the Forest Service which measured water quality BMPs (i.e. riparian buffers, skid trail spacing and design, landing design and location, timber sale administration, road maintenance, stream crossings, temporary road construction, and protection of roads during wet periods) as more than 70% effective, and for most BMPs more than 80 percent effective (USDA 1998c).

Threatened bull trout are dependent on high water quality and the FEIS analysis shows that the project would not change stream temperatures and sediment levels enough to harm bull trout. The FEIS acknowledges that there would be sedimentation effects caused by salvage logging and that BMPs would help mitigate but not necessarily eliminate these

effects. The Biological Assessment for Fisheries states that the proposed project would not likely adversely affect bull trout in streams located within the project boundary.

Project Consistency with Management Direction and Regulatory Framework

A number of individuals requested clarification on project consistency with ACS objectives, INFISH, and other federal and state standards.

Comment: The huge number of acres (1203) and log hauling miles (13) with potential sedimentation are cause for serious concern about ACS compliance. How will the Forest Service ensure compliance with the ACS objectives at all scales? (37-43)

Similar Comment (35-125)

Response: The project meets ACS objectives as detailed in Ch. 3, section 3.5.4 Aquatic Conservation Strategy.

Comment: The NWFP explicitly prohibits the Forest Service from relying on short-term mitigation fixes like placement of in-stream material for preserving long-term recruitment. NWFP S&G WR-3 instructs the Forest service: “Do not use mitigation or planned restoration as a substitute for preventing habitat degradation (S&Gs p. C-37). Failure to address this issue and provide for recruitment of future wood violates the ACS.

Response: The project does not propose placement of instream wood as a mitigation. Future instream wood recruitment would not be affected by the project because harvesting is not proposed within RHCA/RRs. ACS objectives are addressed individually in Chapter 3.5.1, and Ch. 2.9.2 in the FEIS.

Comment: Salvage will retard achievement of riparian management objectives in violation of TM-1 of INFISH. Attainment of riparian objectives is related to natural vegetation recovery and development pathways and natural sediment regimes, both of which will be adversely affected by the proposed salvage. (35-124)

Response: Disagree. No activities are proposed within RHCAs. A purpose and need for the proposed action is to help restore forest vegetation and fuels conditions more in line with those occurring historically under a short-interval fire adapted ecosystem. The action would also help restore natural sediment regimes associated with historic forest vegetation and fuels conditions in the upland forest areas. Funds generated from salvage logging would be used to replant salvaged areas with conifers. If there is additional money it may be used to replant burned riparian areas but there is no guarantee. Currently, approximately 5000 riparian and conifer species are being planted in RHCA/RRs within Street and Spring Creek subwatersheds and will be completed by June 2004.

Comment: Salvage will retard attainment of RMOs in violation of INFISH. (37-172)

Response: Disagree. Alternative 2 is not in violation of INFISH RMOs or INFISH TM-1 or NWFP TM-1 because no harvest activities are proposed within RHCA/RRs. In addition, upland harvest activities would have a negligible effect on streamflow and sedimentation; therefore, not adversely effecting channel condition (FEIS Ch. 3.4.3 Water Quality Environmental Consequences).

Comment: The DEIS does nothing to indicate how post-fire logging and road reconstruction in the Eyerly planning area – in addition to logging and road building in on private lands in the area – will meet water quality standards (35-18)

Response: Disagree. The FEIS discloses the State standards that could be affected by the project and then states that the project would have a negligible effect on those parameters. The only State standards that could be affected by the Action Alternatives are turbidity and total dissolved solids in the rivers and pH and chlorophyll *a* in Lake Billy Chinook Reservoir. Water temperature would not be affected by the proposed project because logging activities would not occur in RHCA/RRs. State standards would not be violated because the proposed Action Alternatives would have only a negligible effect on sedimentation. The effects of post-fire logging and temporary road construction are discussed in Chapter 3.4.3 Water Quality Environmental Consequences \ Sedimentation \ Impacts from Alternative 2 of the FEIS.

Comment: A recent case in Montana affirmed that further degradation of water quality in streams that are already out of compliance with water quality standards is unacceptable unless baseline data is available showing the assimilative capacity of local streams will not be exceeded by the logging (e.g., a TMDL must be prepared). (35-19)

Response: The project is not in violation of the Clean Water Act because the effects of the proposed project are negligible (i.e. undetectable, not measurable) and would not affect sediment or nutrient loads. The Oregon Department of Environmental Quality (ODEQ) is working on a TMDL for the Upper Deschutes River Sub-basin and it is scheduled for completion in 2006.

Project Disclosure of Cumulative Effects

Commenters felt that a more complete discussion of cumulative effects be included to clarify how the Eyerly Fire and Eyerly Salvage Project would impact the landscape and watershed in conjunction with recent fires and management activities.

Comment: Cumulative impacts from past and ongoing management on both public and private lands within the area (including the adjacent areas) must be disclosed. Included in this are: past, current, and planned logging, livestock grazing, mining, roading, recreation, and development on both public and private area lands. Cumulative impacts associated with the recent fire on area lands must be disclosed. (34-79)

Comment: There's no analysis of cumulative impacts of these fires [B&B Fires and other fires on p. 118 of DEIS] when taken together with the Eyerly Fire, the proposed harvest, and the harvest that will be proposed for these other fires. (35-128)

Response: The DEIS did disclose cumulative water quality and quantity effects (p. 118-121 in DEIS) and they have been expanded in Chapter 3.4.3 of the FEIS. The FEIS (pp. 147-156) includes a discussion of the cumulative effects of the B&B Complex Fire.

Comment: About the DEIS states: "Although, it is possible that nutrients in the Eyerly fire area, from both burned vegetation/soil and retardant, will leach into the groundwater, most groundwater is discharged directly into the Metolius or Lake Billy Chinook reservoir, and the nutrient concentration is quickly diluted." Yet this contention of the DEIS is not only unsubstantiated with corroborating information, it is indeed contradicted by State of Oregon and Confederated Tribes of Warm Springs monitoring and standards. The Lake is already failing to meet water quality standards, with whatever dilution of phosphorus already occurring being insufficient to meet these standards. In the aftermath of the fire, additional phosphorus—from both the fire as well as chemical retardants—will be washed and leached into the area's streams and lake. Cumulatively it is highly likely that the current water quality impairment will be further exacerbated by these conditions. However, the DEIS fails to adequately analyze or disclose this potential, nor does it sufficiently acknowledge the additional adverse impacts upon area water quality likely to occur by implementation of the proposed logging in the area. Logging will increase the quantity of leachate in area streams, as more surface acres of soils are disturbed and compacted by the logging operations. Peak flows will be increased, resulting in increased surface flows, increased erosion and sedimentation, and increased scouring of area stream channels—which again will lead to increased levels of both fire added, retardant added, as well as naturally occurring phosphorus in the areas waterways, ultimately further impairing Lake Billy Chinook—in violation of both Oregon State and federal water quality laws. The DEIS's failure to adequately analyze and disclose this also violates the requirements of the NEPA. (34-21)

Response: Disagree. Nutrient effects of the proposed Action Alternatives and the cumulative nutrient effects are disclosed in the FEIS (Ch. 3.4.3 Water Quality Environmental Consequences \ Nutrient Effects \ Impacts of Alternative 2 and Ch. 3.4.3 Water Quality Environmental Consequences \ Cumulative Effects \ Nutrients). The FEIS states very clearly that the Eyerly Fire could increase nutrient concentrations in LBC reservoir, which is listed on the 2002 303(d) list for pH and chlorophyll *a* (parameters which can be adversely affected by increases in nutrients). The cumulative effects section the FEIS states, "short-term (1 to 2 years; Spencer and Hauer, 1991; Debano, 1998) increases in nutrient and possibly retardant concentrations would be expected in the tributaries and possibly the lower 1.6 miles of the Metolius River and LBC reservoir. Nutrient spikes from the Eyerly Fire would most likely occur before the proposed Eyerly Salvage activities would be implemented."

In addition, the statement from the DEIS that Mr. Riverwind quotes, refers to nutrient leaching, not nutrient transport via attachment to soil particles. The FEIS acknowledges

the risk of nutrient transport to the streams and LBC via sediment transport from the Action Alternatives and discloses those risks in the Nutrient Effects section.

Comment: The Eyerly DEIS fails to adequately address impacts to area soils and waterways from the bulldozing which occurred during fire suppression activities. Both the bulldozing and the proposed logging will increase the spread of sediments directly into flowing streams. Area water quality, which is already impaired from the fire, would be further exacerbated by sedimentation and erosion in logging units and from existing and constructed roads during logging. These impacts must be adequately disclosed and assessed in a new EIS for this project. (34-78)

Response: The effects of bulldozer lines on sedimentation are discussed in Chapter 3.4.2 Existing Condition \ Sedimentation \ Roads. Cumulative sedimentation effects, including effects from bulldozer lines and the fire, are disclosed in Chapter 3.4.3 Water Quality Environmental Consequences \ Cumulative Effects \ Sedimentation. Sedimentation effects from the proposed Action Alternatives, including temporary road construction and logging, are in Chapter 3.4.3 Water Quality Environmental Consequences \ Sedimentation \ Impacts of Alternative 2.

Comment: The peak flow analysis on page 113 considers only one factor (removal of live trees). This is not adequate. (37-70)

Response: Disagree. The streamflow analysis considers the effects from harvesting dead trees and compacting the soil. In terms of removing trees the primary effects are a reduction in evapotranspiration and an increase in soil compaction, both of which can affect water yield and peak flows. The project does not propose harvesting live trees; therefore, transpiration would not be affected. The FEIS acknowledges that precipitation could adhere to dead trees, which could slightly affect interception and evaporation. In addition, the FEIS discloses that 474 acres could be compacted (i.e. detrimental condition) by logging activities in Alternative 2 and 249 acres in Alternative 3. Also, approximately 3 miles of temporary road would be constructed along ridgetops, one mile of which is a fire line. It also acknowledges that although some of these acres would be subsoiled (including all temporary roads), units that do not exceed the detrimental condition threshold after logging and are not near stream buffers or hydrologically connected ditch segments may remain compacted.

Comment: Pages 106 107 disclose that there are 436 road stream crossing but fails to say how many of these will be used for log hauling and other salvage-related activities. (37-71)

Response: The DEIS failed to mention how many of the stream crossings would be used for hauling. This has been updated in the FEIS. Haul roads cross intermittent streams approximately 54 times in Eyerly Salvage area.

Comment: Page 110 minimizes the risk of channel erosion in intermittent stream but fails to recognize that these streams do flow continuously during spring run-off and can and will erode their banks and bottoms during this period. Page 124 says that intermittent reaches of street creek have increased

in bank instability by 500% after the fire. Salvage logging will exacerbate this serious situation. Logging-related sediment could fill pools and reduce the effectiveness of pools as thermal refugia. (37-72)

Response: Disagree. The DEIS acknowledged that there is a risk of channel erosion in intermittent streams due to the fire effects and that relationship is made more clear in the FEIS. Street Creek is most susceptible to channel erosion because of predicted increases in water yield and/or peak flow, predicted increases in sedimentation, existing bank instability, and high road density and number of stream crossings. The FEIS acknowledges that salvage activities could increase channel erosion but the effect would be negligible. Erosive peakflows are not predicted to significantly increase because no live trees would be harvested and compaction would not significantly increase. In addition, riparian and channel condition would not be disturbed because no activities would occur within RHCA/RRs. (37-72)

Sedimentation effects regardless of flow regime (intermittent or perennial) were analyzed for each alternative based on the amount of activity in the sediment delivery zone (FEIS p. 135-142; Table 3.4-16). No units were in the sediment delivery zone adjacent to perennial streams in either action alternative. An additional 4% (Alt. 2) of sediment could reach Street Creek (primary fish habitat) from salvage activities in the sediment delivery zone give a large rainstorm event. Most of this sediment would be stored behind obstructions or deposited in slow velocities areas in the upstream intermittent reach adjacent to the sediment delivery zone. Instream wood in these areas and other burn areas is predicted to increase over the next 10 years as standing dead trees in RHCA/RRs fall into the channel; thus helping to trap sediment and create new pools. Although a negligible amount of logging-related sediment may reach pools that fish inhabit, it is not enough to detrimentally effect overall pool habitat.

Comment: The EIS repeatedly asserts that various effects are no measurable, and uses this to deflect concern over important environmental impacts. However, the EIS fails to explain that effects that may not be measurable may none-the-less be very significant. It is true that many natural features are highly variable in time and space making it difficult to separate treatment effects from the background. However, the effects of management may still be significant and should be considered important in spite of the difficulty in measuring them. For instance, peak flows, sedimentation, and future wildfire effects are all highly variable and difficult to measure but that does not mean we can dismiss the effects of management. The EIS must be fair. Since the Forest Service raises concerns about future fire effects (which are not measurable) then they must be equally concerned about peak flows and sediment which are also hard to measure. (37-74)

Response: The DEIS did not try to deflect concern over important environmental impacts by claiming they are not measurable. The DEIS used the term “not measureable” to mean too small (negligible) or insignificant to measure. This point is clarified in the Final EIS. Regardless, the EIS acknowledges that changes in sediment, peak flows and future wildfires are effects associated with logging and analyzes these for each alternative (Chapter 3.4.3 Environmental Consequences in FEIS).

Comment: Page 112 makes a completely unsupported statement that any increase in soil compaction will be offset by increased rates of vegetation recovery. First, the effects of soil compaction are related to many ecosystem processes, other than overland flow and peak flow, so vegetation recovery will not mitigate for these. And second, as the EIS admits many times, the action alternatives will in fact delay, not accelerate, vegetation recovery, so soil compaction will exacerbate rather than mitigate the concern. (37-75)

Response: Disagree. The statement in the DEIS on page 112 (FEIS p. 134) regarding the increase in compaction being offset by an increase in vegetation recovery is not unsupported. This statement is under the “Streamflow” heading and only refers to streamflow. Effects of soil compaction on other resources such as soil productivity are analyzed under the appropriate resource section. Also, the DEIS stated that under action alternatives units harvested would be replanted. The FEIS further explains that planting with 2 year old conifers gives these units a head start on evapotranspiration recovery (Chapter 3.4.3 Environmental Consequences / Streamflow / Impacts from Alternative 2 & 3).

Comment: In spite of the many admissions that salvage logging will delay vegetation recovery, the EIS still inappropriately relies of vegetation regrowth to mitigate the effects of logging. (p 120). (37-76)

Response: Disagree. The DEIS did not mention that increased vegetation regrowth from the project would mitigate the effects of logging on page 120. However, in other parts of the document the beneficial effects of conifer planting associated with the proposed project are disclosed. The proposed planting of 2 year old conifers, would provide a “head start” on evapotranspiration recovery and would help reduce the adverse effects from the fire, especially in stand replacing areas that have lost their seed source.

Comment: The EIS does not make clear that the Forest Service has identified and buffered all potentially unstable areas that could deliver LWD as required by the Northwest Forest Plan. (37-77)

Response: The FEIS clarifies that riparian areas are important sources for providing LWD and that under both action alternatives they are buffered and no trees would be removed from these areas.

Comment: Page 112 says that action alternatives will not affect stream shape, but it is in fact likely that salvage logging, activity fuel treatment, site prep, planting, brush control, FMZs, prescribed fire, etc. will cause erosion, sediment and fill pools and interstitial spaces thereby harming fish. (37-78)

Response: Disagree. Activities associated with salvage logging would have a negligible effect on stream shape or fish as a result of increased erosion and sedimentation. The FEIS acknowledges that the salvage activities would occur within the sediment transport zone. However, no units are proposed in the sediment delivery zone adjacent to perennial streams in either action alternative. An additional 4% (Alt. 2) of sediment could reach Street Creek (primary fish habitat) from salvage activities in the sediment delivery zone give a large rainstorm event. Most of this sediment would be stored behind obstructions or deposited in slow velocities areas in the upstream intermittent reach adjacent to the

sediment delivery zone. Instream wood in these areas and other burn areas is predicted to increase over the next 10 years as standing dead trees in RHCA/RRs fall into the channel; thus helping to trap sediment and create new pools. Although a negligible amount of logging-related sediment may reach pools that fish inhabit, it is not enough to detrimentally effect overall pool habitat.

Comment: Page 113 [analysis] relies on replanting that is not part of this decision. (37-79)

Response: Disagree. Conifer planting in salvaged areas is part of the proposed action, whereas, under the “No Action” alternative it is not foreseeable due to funding limitations and management priorities.

Comment: Page 113 says that landslide risk is not increased because tree roots would not be affected. In reality salvage logging will gauge the soil, and break roots. (37-80)

Response: Disagree. Salvage logging activities would not alter tree roots because only dead trees would be removed. Therefore, harvesting dead trees would not kill the root system. In addition, harvest activities would not significantly alter the already dead roots because trees would be cut and stumps would be left. The soil stabilizing capacity of the tree roots was significantly reduced by the fire and will continue to decrease as the roots decompose regardless of the proposed action.

Comment: Page 113 says that salvage “harvest” and “fuel reduction” will reduce sediment yields. What????!! They will in fact cause erosion increase sediment. (37-81)

Response: Disagree. The proposed harvest and fuels reduction would not significantly increase erosion and sedimentation. The statement on p. 113 of the DEIS is referring to a long-term reduction in sediment yields if the removal of fuels through harvest and pile burning reduces the risk of another catastrophic wildfire. This is clarified in the FEIS pp.138-139.

Comment: Page 116 says there will be no measurable effect from sedimentation. Could the Forest Service estimate the tons of sediment, like they have done in many other salvage logging proposals? The FS could use disturbed WEPP (only as a starting point because this model can only handle only one disturbance per slope). Couldn't the Forest Service measure the change in stream macroinvertebrate populations? (37-82)

Response: Modeling and measuring sedimentation is very difficult because the processes that govern sediment production, transport and deposition are spatially complex and controlled by multiple factors resulting in high natural background variability (MacDonald 1993). Measurement techniques are still limited making it difficult to obtain representative samples. On an annual basis, the timing and distribution of sediment loads are highly variable, usually concentrated in a few short periods. Harris and Clifton analyzed 34 years of streamflow data and 11 years of suspended sediment data from the Barometer Watershed on the Umatilla National Forest and found “1) high spatial and

temporal variability in annual sediment loads between stations, and at the same station year to year, and 2) a lack of correlation between streamflow and sediment indicating complex streamflow and sediment supply relationships” (1999).

Due to the high natural variability of sediment, only relative differences between alternatives or before and after fire should be used for interpreting sediment estimates. A model similar to disturbed WEPP is used in the DEIS to explain the relative differences between the alternatives based on the amount of acres in the sediment delivery zone. In the FEIS this model is expanded upon to show the percent increase in sedimentation by alternative for each subwatershed. Measuring the change in macroinvertebrate populations would only show post-fire and/or post-salvage effects and would not help distinguish between alternatives or predict the effect of the proposed action.

Comment: Page 125 says that the local streams have low sediment transport capacities. This would indicate special concern for adding more sediment, but the EIS does not account for this special sensitivity. (37-85)

Response: Disagree. The FEIS acknowledges the low sediment transport capacities of spring-fed streams and accounts for this sensitivity by buffering riparian areas from harvest activities. All perennial, fish bearing streams would be buffered 320 feet on both sides of the stream and all non-fish bearing perennial or intermittent streams would be buffered 160 ft on both sides of the stream (DEIS p. 113; FEIS pp. 136-142). Although the perennial reaches of Spring and Street Creek are primarily spring-fed during summer low flow, in other seasons these reaches are only partially spring-fed. Therefore, these streams have the ability to transport sediment, especially during periods when sedimentation is most likely to occur (rainy periods).

Comment: The agency seems to claim that the direct sediment input from timber harvest in addition to any other sources of sediment will be sufficiently mitigated by the use of Best Management Practices (BMPs). While the use of BMPs is to be encouraged in timber projects, we note that the use of these measures are not themselves sufficient to ensure compliance with the Clean Water Act (CWA). Northwest Indian Cemetery Protective Ass'n v. Peterson 795 F.2d 688, 697 (9th Cir. 1986) (holding that compliance with BMPs does not equate to compliance with the CWA). Indeed, the agency assumes that the implementation of BMPs will sufficiently mitigate any problems that the proposed project will have on aquatic systems, but offers no proof of this assertion. Consequently, this assumption is flawed and violates the law. (37-141)

Response: The FEIS acknowledges that BMPs would help mitigate, but not necessarily eliminate effects to the soil resource and water quality. However, through the use of State and EPA certified BMPs, project design elements, mitigations, and compliance with Forest standards and guidelines the proposed project would have negligible effects on water quality, thus meeting State water quality standards and the requirements of the CWA. Best Management Practices are specifically designed to protect water quality and are the primary mechanism to enable the achievement of water quality standards under Section 319 of the CWA (EPA 1987; USDA and USDI 1999). The Oregon Administrative Rules, Chapter 340, Division 041, states that, “Pursuant to Memoranda of Agreement with the U.S. Forest Service and the Bureau of Land Management, water quality standards are expected to be met through the development and implementation of water quality

restoration plans, best management practices and aquatic conservation strategies” (ODEQ 2003).

Comment: Until the agency is able to substantiate its proposed mitigation measure – i.e., that they are appropriate, will be implemented, and will be effective – the agency must withdraw the proposed project. Further logging in this watershed threatens further violations of State water quality standards. This triggers an EIS and also requires that a TMDL/water quality management plan precede further actions that could increase stream temperature, nutrients or sediment. (37-142)

Response: Disagree. The DEIS, on pages 32-33, described the design elements for soils and water quality BMPs, including their effectiveness in mitigating effects on these resources based on research, existing data, or professional judgment. Proposed design elements have “moderate” and “high” effectiveness ratings derived from quantitative monitoring used to develop the publication *General Water Quality Best Management Practices, Pacific Northwest Region, 1988* (USDA Forest Service 1988). The USDA Forest Service uses State and EPA certified BMPs listed in this publication and additional BMP effectiveness monitoring comes from Region 5 of the Forest Service. This monitoring measured the effectiveness of water quality BMPs such as riparian buffers, skid trail spacing and design, landing design and location, timber sale administration, road maintenance, stream crossings, temporary road construction, and protection of roads during wet periods. These BMPs mitigated effects in more than 70% of the cases, and for most BMPs effects were mitigated in more than 80% of the cases measured (USDA 1998c).

The FEIS acknowledges that BMPs would help mitigate, but not necessarily eliminate effects to the soil resource and water quality. Although there would be some sedimentation effects caused by the proposed activities, project design elements such as maintaining riparian buffers would help reduce the transport of sediment to the streams. Timber sale administrators are required to oversee the sale contract and insure that all project design elements, mitigations, and BMPs are being implemented. The units proposed in this EIS have already been designed to exclude riparian buffers and to limit ground-based harvest to slopes less than 30%. The Deschutes National Forest is currently developing a Water Quality Restoration Plan (WQRP), which will outline steps for implementing the management actions listed in the Water Quality Management Plan (WQMP) to meet the Total Maximum Daily Load (TMDL) requirements for the Upper Deschutes Sub-basin. The WQRP is scheduled for completion by December 2004 and the WQMP and TMDL are scheduled for completion in 2006.

Comment: [Cited] Steps and issues to be addressed in this forthcoming Metolius Basin Cumulative Effects Programmatic EIS include:

2.a. Stand replacing fire in riparian areas reduces the sediment filtering function and the bank stabilization function and the stream shade (so upland and road-related erosion, peak flows, and shade reduction are of more concern compared to unburned areas), (37-159)

Response: Agree. Fire effects are disclosed in Chapter 3.4.2 Existing Conditions in FEIS.

Comment: [Cited] Steps and issues to be addressed in this forthcoming Metolius Basin Cumulative Effects Programmatic EIS include:

2.b. Stand replacing fire reduces the snag and down wood recruitment over large areas (so mid-term and long-term snag and down wood levels are of great concern compared to unburned areas. This concern is not limited to wildlife habitat but all the many essential ecological and hydrological function provided by snags and logs.); (37-160)

Response: Agree. Effects from the loss of down wood are disclosed in Chapter 3.4.2 Existing Conditions / Sedimentation / wildfire in FEIS.

Comment: Steps and issues to be addressed in this forthcoming Metolius Basin Cumulative Effects Programmatic EIS include:

2.d. Post-fire environments are subject to the effects of “compound disturbance” from fire, fire suppression, rehab, salvage logging, fuel treatment. (so the effects of disturbance add up faster in a more sensitive environment compared to project in unburned areas) (37-161)

Response: Agree. Cumulative hydrologic effects are disclosed in Chapter 3.4.3 Environmental Consequences / Cumulative Effects in FEIS.

Comment: The cumulative effects analysis repeatedly says that the adverse effects of the fire overwhelm the adverse effects of salvage logging, but this is really irrelevant. If the area has exceeded the thresholds of concern the Forest Service should not be making a bad situation worse, especially when the Forest Service’s rosy predictions could be off by several orders of magnitude. (37-162)

Response: Agree. The concern is the project causing deleterious effects not the fire. The point of the statement “the effects (i.e. sedimentation, increased water yield, etc.) of the fire overwhelm the effects of salvage logging” is to acknowledge that regardless of the implementation of the proposed project, adverse effects to water quality could still occur from the fire. In the cumulative effects section (Chapter 3.4.3 Environmental Consequences / Cumulative Effects in FEIS), the impact of the proposed salvage project in addition to the Eyerly Fire and other past, present and future foreseeable projects and events (i.e. B&B fire, Metolius Basin project, etc..) was analyzed and found not to be a significant water quality concern.

Comment: Undisturbed litterfall after wildfire reduces soil erosion caused by both rain and overland-flow. By disturbing needle cover and effectively reducing the soil coverage, logging and yarding will cause increased in erosion compared to not logging. Pannkuk, C. D., and P. R. Robichaud. 2003. Effectiveness of needle cast at reducing erosion after forest fires, *Water Resources Research*, Vol. 39, No. 11, doi:10.1029/2003WR002318, 2003. (37-164)

Response: Approximately 91% of the units proposed for harvest under Alternative 2 are in stand replacement burn areas and all the duff and needles were consumed. Some

sediment buffering would be provided by the newly established vegetation (over 2 years of growth by implementation), existing downed wood, and riparian reserves.

Comment: Beschta et al. (1995) noted that even relatively low impact logging systems such as helicopter yarding should be avoided where sedimentation is already a major problem for salmonids or other sensitive aquatic species, because any activity that disturbs litter layers of soil surface horizons, either pre- or post-fire can accelerate soil erosion and sediment delivery to aquatic systems. (37-165)

Response: All Beschta concerns are addressed in the FEIS and this particular statement is addressed on pages 444-445.

Comment: Pages 114-115 says that log hauling will occur on 13 miles of riparian reserves and that contract clauses will mitigate for this, However, the EIS fails to consider and disclose that these contract clauses are very often waived in order to expedite recovery of economic value. What are the consequences of log hauling on wet roads? (37-166)

Response: Contract clauses are not waived in order to expedite recovery of economic value. Since the sales are sold to independent parties, it does not benefit the Forest Service to break contract clauses, especially at the expense of a resource. Very often logging is temporarily shut down during wet periods or during extreme fire danger. Hauling on an excessively wet road could damage the road and/or route sediment to the stream (depending on the location of the road).

Comment: Page 320 discusses ACS objective #1 and claims that salvage logging will jump start restoration. However this entire analysis fails to consider what the natural range of variability for post-fire landscapes within the region and the natural range of variability for complex young forest with abundant legacies might be. The fire and its natural recovery are part of the “distribution, diversity, and complexity of watershed and landscape features.” The fact is that young homogenous plantations are far above the natural range of variability, while young complex forest that have not been simplified by salvage logging are under-represented feature on the landscape, so salvage logging cannot jump-start anything of any value. It will only push the system farther from the natural range of variability. (37-167)

Response: Disagree. The project considers the natural range of variability for post-fire landscapes because it treats less than 5% of the burned area within the Upper and Lower Metolius watersheds (5th field); therefore, *maintaining* the distribution, diversity, and complexity associated with natural recovery. The project attempts to *enhance* the distribution, diversity, and complexity of watershed and landscape features by replanting approximately 12% of the stand replacing burn area in the Upper and Lower Metolius watersheds. The Eyerly and Link Fires burned prior to seed maturation and the viability of the seed bank in the soil is unknown in the stand replacing burn areas. By planting conifers in the stand replacing burn areas, the conifer recovery process is “jump started” and species and age class diversity within the watershed is enhanced. In addition, planted areas would not be homogenous because stands would be planted to resemble the serial

stage of their plant association group and plantation densities would be near natural levels to reduce the need for thinning. Also, the landscape pattern of the plantations would be determined by the burn area thus mimicking the complexity of natural recovery.

Comment: The proposed salvage activities are in fundamental conflict with the Northwest Forest Plan Aquatic Conservation Strategy objectives. (37-176)

Response: Disagree. ACS objectives are addressed individually in Chapter 3.5.4.

Comment: The ACS analysis of water quality and sediment are biased advocacy pieces rather than hard looks as required by NEPA. (37-168)

Response: The ACS discussion in the FEIS is an in-depth analysis (consistent with the NEPA requirement) at the 5th field watershed scale based on the Metolius Watershed Analysis Update, monitoring data, models, literature, and professional judgement.

Comment: [DEIS] Page 324 confuses conifer recovery with recovery of vegetation and sediment regimes. Salvage logging will in fact retard not accelerate vegetation recovery. Sediment does not care if soil is covered by natural regen or plantations, but recovery of the sediment regime will be aided if ongoing natural recovery is allowed to continue unmolested, and the sediment regime will be adversely affected by salvage logging that disturbs ongoing recovery and retards vegetation recovery. (37-169)

Response: The statement on page 324 refers to the long-term benefit from stand recovery of increased slope stability (thus a reduction in erosion caused from slope failures). Salvage logging would not retard vegetation recovery because the removal of vegetation from proposed activities would be minimal because ground vegetation was already reduced from the fire. Although some ground vegetation would have re-established in the burn areas prior to salvage activities it would still not be fully recovered by the time salvage activities would be implemented. Only vegetation and ground cover in the skid trails or landing would be affected; therefore, less than 20% of the ground cover in a unit would be affected. The recovery of shrub and other herbaceous vegetation within activity units is not likely to be inhibited significantly in the short-term following harvest activities and would be expected to provide cover capable of reducing raindrop impacts at levels similar to areas left unsalvaged within 3 to 4 years (Chou et al. 1994). In addition, woody material would be contributed immediately to the ground during harvest operations where it would function as sediment traps and energy dissipaters of overland flows.

Comment: The soil analysis on [DEIS] page 334 completely fails to confront the underlying premise that salvage logging causes unacceptable impacts on sensitive soils. Page 335 says that the Forest service considered sensitive areas, but this is not documented in the EIS and it is belied by the proposed extensive and intensive logging in LSR's, CHU's, and AWAs, steep slopes and unsuitable soils. (37-170)

Response: Sensitive soils within the project area are identified in the DEIS pp.58-59 (FEIS pp.80, Appendix B: Table B-5) and have been mitigated or excluded from proposed activity units. Sensitive soils were considered regardless of their location within or outside

of LSR's, CHU's and AWA's, which are administrative allocations under the Deschutes LRMP. All activity units with slopes exceeding 30% over the majority of their area are proposed for hand-felling and either skyline or helicopter yarding to reduce impacts to the soil resource. Activity units with unsuitable soils identified in the Forest planning level database were assessed in the field and determined to be suitable for regeneration following harvest activities (DEIS p.60; FEIS p. 80).

Comment: On October 14, 2003, US District Court Judge Marilyn Patel of San Francisco ruled that the EPA has erred in exempting timber harvesting from the requirement of obtaining a stormwater runoff permit under the Clean Water Act. The case was brought by environmentalists against Pacific Lumber Company operations in northern California. Judge Patel reached her findings based on the fact that harvest unit erosion often enters roadside ditches and passes through culverts, thus making it point source pollution subject to the NPDES permitting requirements of the Clean Water Act. This project will similarly cause erosion, and discharge polluted ditch water to streams. The agency should obtain a NPDES permit. The EPA put the Forest Service and BLM on notice of this new permit requirement during a IAC meeting November 5th, 2003. ("In October of 2003, Judge Marilyn Hall Patel, a U.S. District Court Judge for the Northern District of California, ruled that once runoff from a silvicultural activity enters a conduit, such as a drainpipe, ditch or culvert, the runoff ceases to be "natural runoff", and that silvicultural businesses [sic] cannot be absolved of the CWA's point source requirements. This means that where those engaging in silvicultural enterprises employ point sources, they must comport with the NPDES's attendant permit requirements.")"

<http://www.reo.gov/library/iac/letters/1899iac.htm>. (37-171)

Response: The court opinion of October 14, 2003 in the case mentioned in this comment upheld that Environmental Protection Agency's (EPA) development of 40 CFR 122.27, in which point and non-point sources in need of NPDES permits are defined, was not arbitrary and capricious, and that it be construed in a manner consistent with the intent of the Clean Water Act (CWA). However, it also states that "section 122.27 may not disturb... any... aspect of the CWA's section 502(14) "point source" definition. The opinion validates the plaintiff's claim that ditches and culverts that carry stormflow waters containing pollutants (i.e. sediment) fall within section 502(14) "point source" category, and that "section 122.27 cannot alter or remove this definition." Although the opinion disposes the plaintiff's motion for summary adjudication premised on whether or not section 40 CFR 122.27 constitutes an *ultra vires* act; it also notes, however, "that this disposition does not effect the legitimacy of... [the plaintiff's] other claims for relief, and the court's interpretation of section 122.27-namely, that it cannot remove 'point sources' from the scope of the CWA's existing "point source" category-governs those remaining claims." The court's subsequent decision of January 23, 2004 upholds that the plaintiff's "complaint states a claim for which relief may be granted" but the court has not yet ruled on that claim or declared the level or type of relief. The January 23, 2004 decision rules only on a motion of dismissal by the defendant, which was denied based primarily on the court's opinion dated October 14, 2003.

The link included in the comment references the Intergovernmental Agency Committee (IAC) meeting notes, and not the actual court ruling. Dave Powers of the EPA updated the committee at that meeting on a couple of cases involving point and non-point source

definitions and apprised the members of the possible implications of this case if the judge ultimately ruled in the plaintiff's favor. The EPA did not put the Forest Service and BLM on notice of a new permit requirement during the IAC meeting of November 5th, 2003. There has been no official USDA Forest Service direction within Region 6 regarding this issue and sedimentation from logging operations is currently considered to be non-point source pollution exempted from a NPDES permit under the EPA's re-promulgated silvicultural-source regulation (40 CFR 122.27[b][1]).

Comment: Based on results from watersheds having various proportions of their areas burned by wildfire (e.g., Minshall et al., 1995, 2001b; Minshall, personal observation), it is probable that the amount of timber removed should not exceed about 25% of the merchantable timber (unless contradictory information is available). (37-173)

Response: Disagree. Alternative 2 (preferred alternative) is only proposing to harvest 21% of the merchantable volume which is below the threshold proposed by ONRC. On average 50% of the merchantable timber within the proposed units would be left for wildlife and other resources. Although the proposed harvest is below the threshold suggested by ONRC, this threshold is taken out of context. Minshall et al. (2001b) states that the threshold for the initiation of effects on stream macroinvertebrates from fire has not been determined but probably lies between 25 and 50%. In addition, other studies have shown that timber harvest effects on streamflow and timing are highly variable (FEIS p. 121).

Comment: In addition, fire lines should be obliterated prior to logging, and road construction or other major ground-disturbing activities should be avoided in order to prevent additional runoff and erosion. (37-174)

Response: Fire lines were rehabilitated after fire suppression and no new roads are proposed. Three miles of temporary road are proposed which would be on ridgetops and obliterated after harvest.

Comment: BLM assumes that temporary and semi-permanent new roads will have no effect because they are temporary. BLM has shown no scientific evidence for this assumption. In fact, scientific research has shown exactly the opposite. Effectiveness of Road Ripping in Restoring Infiltration Capacity of Forest Roads. Charles H. Luce, USDA Forest Service Intermountain Research Station, 1221 S. Main, Moscow, ID 83843. September 1996. Restoration Ecology, Vol. 5, No. 3. page 268. (37-177)

Response: Disagree. This statement does not apply because the USFS, not the BLM, is the agency that wrote the EIS and we are proposing subsoiling, not ripping. Monitoring of subsoiling around the Deschutes National Forest has shown this technique to be effective in reducing the effects of excessive soil compaction (refer to Soils Report). Bulk densities were reduced, in many cases, to natural levels. The USFS acknowledges the short-term sedimentation effects of subsoiling; however, believes the long-term benefits of increased infiltration outweigh the short-term risks, especially since the proposed temporary roads are located on ridgetops.

Comment: Riparian areas in the watershed are also being impacted by non-native species. (37-178)

Response: Agree. Project design elements and mitigations are in place to prevent the spread of noxious weeds. No harvest is proposed within Riparian Reserves; however, some roads used for hauling pass through Riparian Reserves. To help prevent the spread of weeds various mitigations, including washing equipment that passes through weed sites, would be implemented (FEIS p. 60-63).

Comment: Also, further decreases in evapotranspiration resulting from logging and added increases in streamflow due to logging are not mentioned. Instead, the table states that for Alternatives 2 and 3 "Recovery of evapotranspiration, interception and streamflows would be more rapid under Alternatives 2 and 3 because more acres would be replanted, facilitating more rapid forest vegetative establishment." (38-9)

Response: Disagree. Evapotranspiration and streamflow effects were disclosed on p. 112 of the DEIS (FEIS pp. 134-141) and are discussed in further detail in Chapter 3.4.3 Environmental Consequences / Streamflow / Impacts from Alternatives 2 & 3.

Comment: Alternative 1 is evaluated based on conditions during the year after the fire, and does not evaluate changed conditions after natural revegetation occurs and with the retention large tree structure in the area. (38-10)

Response: Recovery rates for each parameter and the effects of not logging were discussed for Alternative 1. In the FEIS these relationships are made clear (Chapter 3.4.3 Environmental Consequences).

Comment: Section 3.3.2.1, Streamflow: The third sentence is not clear... The drainage area is 316 sq. mi; however, the hydrologic drainage boundary is uncertain because of interbasin groundwater exchange. (40-11)

Response: Agree. The sentence referred to had a typo. The FEIS states, "Drainage area at this gage is 316 mi² and the period of record is from 1922 to the present. The Metolius River is a spring dominated system and precipitation inputs are stored and released slowly resulting in a generally flat hydrograph (small range between high and low flows)" (Chapter 3.4.2 Existing Condition / Streamflow).

Comment: Section 3.3.3.2, Streamflow: The Department recommends clarifying the intended meaning of the second paragraph, last sentence,... The relationship of "increase in compaction," "would be compensated by an increase in vegetation recovery rates," and "action alternatives would have no measurable effect on streamflow," seems counterintuitive and needs further explanation. (40-12)

Response: Agree. Clarification is made in the FEIS (Chapter 3.4.3 Environmental Consequences / Streamflow / Impacts from Alternatives 2 & 3).

Effects to Fish Populations

Individuals voiced concern over the breadth of analysis and the measurement of project effects on aquatic habitat.

Comment: No indicators are listed for fish habitat (page 17). (37-15)

Response: The FEIS includes indicators for fish habitat; it reflects the analysis of fine sediment, <5.4 mm diameter and wood as measurements for trout spawning and rearing habitat.

Comment: DEIS page 35 claims that no activities are proposed that would reduce stream shade, but it fails to note whether there will be sky roads cut through RHCAs or Riparian Reserves. (37-20)

Response: The potential for sky roads across channels may occur. Areas would be limited to stands of dead. No green trees would be felled for this purpose. Perennial water on Spring Creek is limited to the Perry South Campground, an area treated only for hazard trees. Street Creek has lost most of its shade from the Eyerly Fire. These potential corridors are not near the perennial flowing sections of Street Creek. Felling of some dead trees to will not create large scale openings of sufficient size to raise water temperatures above what has occurred as a result of the Eyerly Fire. No skyline will cross the Metolius River.

Comment: The EIS says that the Metolius River and tributaries has bull trout and several non-native fish species that may be competitive with Bull trout. The Forest Service should consider that salvage logging and associated activities will make conditions more favorable for brown trout and less favorable for bull trout. This will violate NFMA and the ESA. (37-83)

Response: Impacts of concern are for Spring and Street Creeks. Page 122, lists Spring Creek and Street Creek as suspected to provide additional secondary rearing habitat for bull trout. Page 123 states that no bull trout have been observed in Spring Creek, Page 124 states that juvenile bull trout in Street Creek is limited to an occasional sighting. These same pages discuss the species composition within each stream as well as species within Lake Billy Chinook. Water temperatures measured pre-fire in Street Creek are less optimal for bull trout and are more closely associated with redband trout. The effects of reduced canopy closure will increase water temperatures until riparian vegetation becomes more established. Actions proposed in the Eyerly Salvage will not further exacerbate the water temperatures concern. Brown trout are established in Lake Billy Chinook and were known in Street Creek and Spring Creek prior to the Fire. Sampling of Street Creek during the summer of 2003 found almost an equal composition between brown trout and redband trout. The opportunities of establishing a self-sustaining bull trout rearing population in these two streams are fairly low and will continue to remain low regardless of the actions of the Eyerly Salvage. Consultation with the USFWS will occur on the actions of the Eyerly Salvage on the individuals of Street Creek that might inhabit Street Creek.

Comment: Page 124 says that the low numbers of bull trout are especially vulnerable to disturbance and stochastic events, and the local streams are

below the recommended levels of LWD. Salvage logging will make a bad situation worse and could push bull trout out of these systems. (37-85)

Response: Current levels of large wood of certain size class is low, acknowledged on page 124. Recruitment is also expected and acknowledged on page 124. In channel wood recruitment will occur as a result of dead trees weakened from the fire and slowly becomes recruited to the system from windthrow, bole breakage and lateral channel migration. Bisson and Bilby (2001) and Benda and 6 others (2003) further explain wood recruitment processes of channels which include the effects of wildfire. The current and future levels of wood will not decide whether juvenile bull trout become established in Street or Spring Creeks. These processes will be more clearly explained in the FEIS Fish habitat wood section.

Comment: The LSRA mentions *Apatania tavalala* (the Cascades apatanian caddisfly) but the EIS does not address this species. It is very likely that salvage logging will adversely alter the aquatic needs of this rare and sensitive species. (37-128)

Response: *Apatania tavalala* is listed as a LSRA focal species because its habitat was defined in spring streams and associated with wood. It has been identified in the Metolius River and Roaring Creek; both sites well upstream of the project area. Within the LSRA water is mostly intermittent streams, not suspected habitat for this species. *A. tavalala* was once part of the Region 6 sensitive species during the mid 1990's. The USFS region 6 has since removed them from the list.

Comment: The DEIS admits that “Due to low numbers of bull trout small disturbances can significantly impact bull trout populations; therefore bull trout growth and survival are functioning at unacceptable risk (DEIS p. 124).” Yet it only contains a few short sentences worth of analysis of risk to bull trout...These assertions are totally unsupported by any scientific evidence, in fact they fly in the face of all available research, and are inconsistent with NEPA’s requirement to take a “hard look” at environmental impacts. (35-16)

Response: Page 124 refers to bull trout having the opportunity to use Street Creek for secondary rearing habitat. Page 124 state only two bull trout have been documented in Street Creek. The role of Street Creek providing secondary rearing habitat for displaced bull trout of the Metolius sub-population. Because we are unsure of the historical use of Street Creek as bull trout habitat and the fact that fry have been observed in that stream, we question that disturbances can impact individuals in this stream. Review of Street Creek suggests that occasional individuals might define this as secondary rearing habitat. It is not spawning habitat for bull trout. The population would be considered part of the Metolius River sub-population of the Deschutes Recovery group. Currently, the Metolius River sub population is healthy and supports annual harvest in Lake Billy Chinook.

Comment: The Forest Service must consult with the USFWS and NMFS for impacts to listed fish species. There is no evidence that this consultation has been completed. To be consistent with NEPA, the Forest Service must

disclose whether the proposed project risks a violation of the ESA. Without formal consultation, there is a risk of violating the ESA. If the Forest Service refuses to disclose impacts to fish from logging during consultation, as they have throughout the DEIS, that consultation will be found illegal by the courts. (35-17)

Response: The project effects will be evaluated with the 2003-2006 Joint Programmatic Biological Assessment. Once an alternative has been selected the project effects will be measured against the project design criteria to determine whether any consultation is required. An alternative will be chosen after the public has provided input to the project.

Comment: We are concerned about negative impacts to Bull trout and Redband trout. The DEIS states that using BMPs and the criteria described in the 2003 Joint Programmatic Biological Assessment will "reduce the effects to bull trout and redband trout rearing and spawning habitat populations within the Metolius River and Lake Billy Chinook". While it is important to follow BMPs and the JPBA criteria, the Forest Service is still mandated to uphold the Endangered Species Act and not engage in management activities that contribute to the overall decline of any species. (38-11)

Response: The current bull trout population is healthy, supporting a harvestable fishery in Lake Billy Chinook. All documented spawning and rearing occur above the project area described on page 122. Page 124 discusses that as the Metolius bull trout population increases, Street Creek could be available for refuge or secondary rearing habitat. Although rearing does occur in Lake Billy Chinook, project effects will not alter this habitat. Redband trout population is healthy in the Upper and Lower Metolius watersheds, explained on page 122. Short-term concerns are noted on redband trout habitat are discussed on pages 128 and 130. Recovery from disturbance is fairly quick from a few months to about three years depending on species, location, and amount of refugia. The current species composition and densities have almost recovered in one season after the retardant spill.

Comment: Bull trout subpopulations in Street Creek, even prior to the kill from retardant spill, were listed as "functioning at risk." (34-91)

Response: Bull trout in Street Creek is not a sub-population but part of the Metolius River sub-population of the Deschutes Recovery group.

Comment: As described *infra*, the record does not support the finding that the proposed sale would not likely adversely affect Bald Eagles, Spotted Owls, Pacific Fisher, Wolverine, Bufflehead, Lynx, Bull Trout, Redband Trout, and other listed species and species of special concern. The proposed sale would significantly exacerbate the degraded habitat conditions for these species that already exists on the Forest. The near absence of any information from surveys or monitoring (including instream sedimentation and water quality monitoring post-fire) for many of these listed species makes a reasonable analysis--of how this project itself, and in combination with other actions within the area, will cumulatively affect these species-- impossible. (34-42)

Response: Monitoring is included in the various specialist reports. Much of the monitoring was occurring during the writing of this document and is now being analyzed which include:

- 1) Physical and biological stream survey of Spring Creek performed during the summer of 2003 and written in Fall of 2003. Biological sampling of Street Creek following the retardant spill Summer of 2003 analyzed in Fall of 2003.
- 2) Water temperature Monitoring of Spring and Street Creeks during spring summer and fall of 2003.
- 3) Fine sediment monitoring by establishment of transects for modified Wolman pebble counts on Street Creek. Analyzed in November of 2003.
- 4) Portland State University Graduate Student project to measure upland soil movement over the winter and spring of 2002-2003. Monitoring taken over by USFS personnel through spring of 2004. Status of the students analysis unknown.
- 5) Storm patrol established by USFS personnel to monitor stream conditions during storm events of 2003 and winter of 2003-2004. Evaluations documented.

Comment: The ESA requires federal agencies to develop recovery plans for listed species. However, the DEIS for the Eyerly project, which has one federally listed aquatic species within the project area, fails to disclose if such a plan exists, if not why not, and how the proposed project may or may not impact future options in developing a recovery plan for this area. As Bull Trout are currently at “functioning at risk” in portions of this area, failure of the agency to take proactive steps to develop a recovery plan is illegal. (34-92)

Response: The USFWS is responsible for the bull trout recovery plan. A draft recovery plan is written and should be finalized during 2004. Page 129 states implementation of the bull trout recovery plan.

Peak Flows

One commenter had multiple concerns about peak flow thresholds, project compliance with standards and guides, and the effectiveness of project-related monitoring within the post-fire landscape.

Comment: Page 36 seems to indicate that the Forest Service uses a 25% ECA as a threshold of concern, but what is the basis for this threshold, especially in a burned landscape? (37-27)

Response: 25% ECA or Equivelant Clearcut Area, is a threshold agreed upon by the USFWS, BLM and USFS in the 2003-2006 Joint Programmatic Biological Assessment. It is a Project Design Criteria worded that if a 6th field watershed is at a calculated 25% do not implement activities that would increases this ECA value. It has no basis for burned landscape. A new current condition ECA was calculated and estimated new ECA calculated for the Eyerly Salvage. Results from these calculations found no change in ECA from removing dead material over 20% of the landscape (See hydrology report).

Comment: The huge number of acres (1203) and log hauling miles (13) with potential sedimentation are cause for serious concern about ACS compliance. How will the Forest Service ensure compliance with the ACS objectives at all scales? It's simply not possible to comply with the ACS after considering the cumulative effects of the fire, fire suppression, salvage logging, activity fuel treatment, site prep, planting, roads, landings, prescribed fire, FMZs, OHVs, etc. We don't have control over the fire, but we can choose not to make the situation worse by salvage logging (37-43)

Response: ACS Objectives are to be addressed at the 5th field watershed scale only. Eyerly Salvage area is almost entirely in the Lower Metolius Watershed with some portions in the Upper Metolius Watershed. Cumulative effects from fire, fire suppression, salvage logging, activity fuel treatment, site prep, planting, roads, landings, prescribed fire, FMZs, OHVs, etc are a concern. The methods used during all of these different site, project and landscape level work is land management. Refugia during disturbance is very important for protection of aquatic populations. The resistance or resilience of a species also allows for rapid recovery after disturbance. Cumulative impacts come as both beneficial and negative. These do not represent long-term cumulative negative effects to fish populations within the project area or the Lower Metolius Watershed. In other words a reduction in or loss of redband trout or bull trout populations is not expected.

Comment: Page 48 appears to assert that BMPs will reduce the effect on bull trout compared to the no action alternative. In fact, BMPs may slightly reduce the effects compared to unmitigated logging but the BMPs will still be grossly inadequate to prevent harm to bull trout and other species. The Forest Service lacks effectiveness monitoring of BMPs in post-fire landscapes. (37-159)

Response: Disagree. Most effected habitat will be in Street Creek. Street Creek provides secondary rearing habitat for bull trout. An occasional juvenile bull trout is observed in Street Creek. It does not support year round rearing and it is not bull trout spawning habitat. Impacts to redband trout habitat is a concern and is defined on page 128 and 130. Best management Practices (BMP's) are tools to select from to achieve water quality standards and reduce or eliminate the introduction of pollutants into receiving waters (USDA-FS 1988). Although this project is within a burned landscape, these tools along with other guidance such as timing of work among many others, provides methods of implementation that reduce the risks of water pollution as a result of implementing the project.

Soils Resource

As mentioned in the Chapter 3 Soil Quality section, multiple comments were received voicing concern that soil disturbance and compaction be kept to a minimum and consistent with standards and guides. Additionally, some comments questioned soil chemical composition following a fire event and fire rehab.

Comment: The forest plan (SL-6, p 4-70, 71) has requirements for ground cover after logging. These requirements will not be met after salvage logging

and/or activity fuel treatment. The EIS does not adequately consider or disclose this issue. (37-13)

Response: The DEIS soils report did not address ground cover specifically as it relates to Forest Plan Standard and Guidelines. Narrative was added in Chapter 3 of the FEIS to address this issue.

Comment: Indicators for site productivity fail to account for the fact that removal of large numbers of large logs is a significant loss of site nutrients that are not replenished for decades or even centuries in many cases (37-16)

Response: Coarse woody debris does not appear to make a significant contribution to N and P cycling in arid east-side conifer forests (Prescott, 2002). The majority of nutrients contained in the biomass of a tree that are available for rapid decomposition and input into the soil system are contained in the crowns and small branches which were already consumed on the majority of trees proposed for removal. The action alternatives provide for level of snags and coarse wood to be left within each plant association following salvage activities (FEIS p.48-50) that are in accordance with site productivity recommendations associated with their role as hosts for mycorrhizal fungal activity (Graham, 1994). Although the removal of bolewood reduces the amount of above-ground site nutrients remaining after the fire (FEIS p.104), the percentage of total site nutrients lost, especially available soil nutrients, is relatively low. The primary replenishment mechanisms for available nutrients on these sites are photosynthetic and atmospheric deposition processes (FEIS table 3.4-12, p.114) that do not utilize bolewood as a storage mechanism before utilization by plants

Prescott, C., and R. Laiho. 2002. The Nutritional Significance of Coarse Woody Debris in Three Rocky Mountain Coniferous Forests. USDA Forest Service, General Technical Report PSW-GTR-181.

Comment: Carbon may in fact be the nutrient of greatest concern because it is replenished so slowly and because the beneficial soil biota in forest soils is still carbon limited. (37-16a)

Response: Carbon removal and replenishment was addressed as a primary nutrient of the chemical component (FEIS p.114). Replenishment of carbon would be relatively equal between alternatives because it primarily depends on photosynthetic processes associated with vegetative re-growth. Bolewood on site is not a primary input of carbon to soil-borne C:N ratios and could divert some microbial activities from nutrient cycling to lignin breakdown if present at elevated levels in these systems.

Comment: Soil indicators focus too much on ratios of Carbon and Nitrogen and not enough on the absolute loss of these nutrients and the time frames for replenishment. (37-158)

Response: The carbon to nitrogen ratio is an important measurement of site activity related to soil biota and nutrient cycling (Busse, personal communication). The absolute, above-ground losses of nutrients from proposed activities were summarized and compared to levels contained in a fully stocked, pre-fire stand (FEIS p.83, Table 3.2-10). The response to comment F2 includes narrative placing the role of bolewood in context in regards to the cycling and availability of nutrients on site.

The loss of above-ground nutrients from bolewood removal would be supplemented by amounts contained in ash produced by the fire and the mineral soil fraction. Levels of carbon and nitrogen measured subsequent to the fire (Hibbard, unpublished), as well as referenced levels of other primary nutrients, are considered to be sufficient to provide for vegetative growth needs over the short-term, while the longer-term site inputs of these nutrients are primarily provided by photosynthetic processes associated with vegetative growth and atmospheric deposition mechanisms.

Comment: [DEIS] Page 35 indicates that pile burning will be allowed within Riparian Reserves. This will cause serious soil effects and likely lead to erosion and sedimentation. (37-22)

Response: The project proposes no piling activities within riparian reserves or RHCA's. Project Design Element #5 under Sediment and Shade (DEIS p. 35) has been removed for the FEIS.

Comment: Logging will disrupt infiltration pathways. For instance, soil disturbance associated with salvage logging mobilizes fine sediment that caps the soil surface and reduces infiltration. (37-29)

Response: The DEIS acknowledged that proposed activities would compact the soil resource on up to 20% of the area within ground-based units and approximately 5% of skyline or helicopter units. Infiltration rates on skid trails and landings totaling up to 856 acres in Alternative 2 and 502 acres in Alternative 3 would be initially reduced as a result of this compaction. A portion of these acres would be subsoiled following harvest and fuels treatments and would have infiltration rates at or below undisturbed levels. Infiltration rates on undisturbed or less disturbed areas are unlikely to change as a result of fine sediment movement and re-accumulation due to the sandy loam surface textures of the soils present on site. Reduction of infiltration via this mechanism has not been observed during monitoring of soil disturbance on the forest.

Comment: [DEIS] Page 39 indicates that logging on slopes over 30% will be allowed. This is a serious problem. The consequences are not disclosed. (37-30)

Response: Project Design Elements for soils in the DEIS stated that proposed activity units on slopes exceeding 30% would have all material hand-felled and yarded with skyline or helicopter operations (FEIS p. 48). Project Design Elements (FEIS p. 49 & 55) are intended to limit machine traffic on areas with slopes exceeding 30% to only necessary passage on existing skid trails. Material removed from these slopes would require hand-felling and end-lining to slopes less than 30%. The consequences of implementing operations on slopes exceeding 30% are discussed under the Cable, Skyline and Helicopter heading of the soils section in Chapter 3 (DEIS p. 86). All units proposed for these yarding operations have slopes exceeding 30% and would not have ground-based harvest or yarding operations within them (FEIS pp.96-97).

Comment: Ground-based logging and unsuspended cable yarding will be very harmful to soils and should be prohibited. (37-31)

Response: The effects of ground-based logging and unsuspended cable yarding are described in Chapter 3 of the FEIS.

Comment: The EIS fails to clearly identify specific stands that are unsuitable for timber production and how removing most of the nutrients and micro-site buffers will not cause long-term harm to three sites in violation of the NFMA regulations at 36 CFR 219. (37-44)

Response: The suitability layer for the Forest is broad scale in nature and was developed to designate a planning level timber base area for the Forest Plan. The DEIS included a discussion of the assessment of suitability for site specific unit areas designated as unsuited on the Forest Plan suitability layer (FEIS p.76). The discussion in the DEIS did not include specific units. The proposed activity units are identified as follows: (Units 48, 49, 79, 83, 84, 85, 95, 97, 98, 99, 100, 107, 108, 109, 110, 111, 112, 116, 117, 120 and 123). These areas were visited by the project silviculturalist and determined to not have physical factors capable of limiting re-forestation and sufficient pre-fire stand density and growth rates to be considered suitable.

Comment: It appears that the Forest Service relied on remote sensing and very limited than field review to assess the condition of soils and vegetation. This is inadequate to support accurate site-specific analysis of the effect of salvage logging. (37-45)

Response: All proposed units were field visited and assessed for a variety of soil conditions and effects to vegetation following the fire, including existing levels of compaction tabulated as the visual extent of skid trails and landings, burn damage, needlefall cover, and suitability for subsoiling (Shank, 2003).

Comment: The EIS shows that virtually all past logging in this area has been conducted in violation of soil compaction standards. (37-46)

Response: The DEIS disclosed that past logging operations have incurred detrimental impacts to the soil resource in excess of 20% in some areas (FEIS p.79). Soil monitoring cited also shows that logging practices in the last ten plus years have reduced the extent of detrimental impacts through prescriptive design, improved methods and sale administration (FEIS p.79). The existing condition of the soil resource within proposed activity units is summarized in the FEIS, showing that only 2% of the Alt 2 units and none of the Alt 3 units currently exceed the 20% Standard, while 39% of Alt 2 and 46% of Alt 3 units have less than 5% existing detrimental disturbance (FEIS p.80 Table 3.3-3). The cumulative amount of detrimental acres on a subwatershed scale following the implementation of proposed activities can be summarized by combining numbers found in tables describing Past Harvest Activities and Proposed Harvest activities (FEIS p. 79 Table 3.3-2 and FEIS p. 89). Summary estimates of detrimental disturbance within the primary 6th field subwatersheds have been added in the FEIS for the Alternatives 2 and 3 (FEIS p.79, table 3.3-2)

Comment: [DEIS] Pages 62 and 63 have conflicting information on soils. Claiming that past harvest currently meets and violates standards. (37-47)

Response: The narrative statement on p.62 of the DEIS and the table summary on p.63 describe detrimental disturbance at two different scales. The narrative on p.62 (FEIS p. 79) describes detrimental disturbance exceeding the 20% standard within activity unit boundaries, while the summary in the table on p.63 (FEIS p. 80) describes detrimental disturbance across the entire subwatershed. LRMP Standards for soil productivity only require an assessment within individual proposed activity units.

Comment: The DEIS failed to accurately account for the effects of the fire on soil. The EIS only counts detrimental soil conditions if area was very severely burned and failed to account for less severe effects of burning that are nonetheless significant. Just because the soil was not discolored does not mean that the soils were not adversely affected. The Forest Service cannot assume zero effects on these less severely burned sites, but this is what they have done. (37-49)

Response: The analysis discusses effects of the fire on the chemical and biotic components of the soil resource and summarizes the loss of below ground nutrients in the system as a result of volatilization, the effects to soil biota, and the transformation of nutrients during the combustion of forest floor and mineral soil organics (FEIS p.85). Field observations of vegetative recovery and measurements of soil carbon and nitrogen on site appear to show a very limited effect to the productivity of the soil resource in areas that did not experience mineral soil discoloration as a result of this wildfire. Anecdotal observations of vegetative recovery within areas of discoloration where extended durations of elevated temperatures likely occurred showed slightly less cover but were not devoid of vegetation (Dewey, personal communication), indicating that even these areas has nutrient levels sufficient to some level of short-term re-growth on site.

Comment: The BAER team was supposed to use criteria that captured the Forest Service concerns about soil but then the Forest Service arbitrarily adjusts their BAER team's numbers from 32% high soil severity to only 1% high severity. This is unacceptable and fails to account for the complete range of effects on soil (p 66). (37-50)

Response: The BAER methodology for determining severity as a result of wildfire attempts to combine multiple resource conditions in the rating and can inadvertently dilute or accentuate the rating on an individual component of a resource. The FEIS discusses how this process was modified to separate severity ratings to more accurately describe the effect of the fire on vegetative conditions, erosion/hydrologic response, and soil productivity (FEIS p.82-83). The Forest Service did not arbitrarily adjust the BAER team numbers for severity, but rather maintained them to describe severity as it relates to erosion/hydrologic response. The layer describing severity as it relates to soil productivity was developed from field observations and measurements of detrimental burn conditions based on the specific criteria included on the BAER website. Field transects taken following the fire measured an average of 4% detrimental burn damage within areas mapped as high severity by the BAER team. The total of 1% high burn severity for the layer describing effects to soil productivity is calculated as 4% of the high burn severity acres mapped by the BAER team.

Comment: The EIS adjustment showing that 73% of the fire area at high risk of erosion is more likely accurate. Why is erosion not a concern for site productivity? Soil that leaves the site is not available for growing medium, nutrient storage, water retention, etc. These are serious site productivity issues. (37-51)

Response: The severity layer describing effects to erosion/hydrologic response does show 73% of the fire as high severity. This primarily describes the complete consumption of surface litter and duff and live vegetative cover on these sites, although very little hydrophobicity was observed on these areas. Elevated erosion rates are predicted in the first few years following the fire as a result of these conditions during rainfalls of sufficient intensity to create overland flows. Rates of loss would decrease steadily as vegetative and other effective ground cover re-establishes on the soil surface. Erosive losses of soil are a concern for site productivity and were measured to be within allowable tolerance values for the soil types present under moderate intensity, 2yr recurrence interval storms. Tolerance levels would be exceeded in short-term in the event of a high intensity, 100yr recurrence interval storm until sufficient effective ground cover returns in three to five years (FEIS p.83).

Comment: [DEIS] Page 79 indicates that under the no action alternative down wood helps retain moisture, but under the analysis of the action alternatives, the EIS fails to disclose the consequences of losing this ecological function in salvage logging areas. (37-52)

Response: The ecological function of down wood would not be lost in salvaged areas. No wood currently on the ground would be removed and approximately 10 to 15 tons/acre of coarse wood would be left on the ground within proposed activity acres to meet wildlife and soil productivity needs. Additional amounts would be contained within snags left standing within proposed activity units.

Comment: In fact, this same complaint can be made concerning soil biota, coarse wood, long-term site productivity, erosion risks, and other issues. The EIS discusses them in the no action but does not disclose them in the analysis of the action alternatives. (37-52a)

Response: Narrative discussion in the action alternatives has been improved to clarify this discrepancy (FEIS Chapter 3, Alternatives 2 and 3 Effects).

Comment: The EIS does not honestly compare the action and no action alternatives. The EIS discusses the no action and then compares to the two action alternatives to each other but not to the no action alternative. (p 83) This fails to highlight the serious consequences of the action alternatives compared to the no action alternative. (37-53)

Response: The action alternatives and the no action alternative can be compared by reading attributes included in tables 3.2-8 and 3.2-2 (DEIS p.63 and p.83; FEIS p.99 Table 3.3-8 and p.79 Table 3.3-2). The first two rows of table 3.3-9 are the existing condition of units and represent conditions under the No Action alternative. Table 3.3-8 has had the existing % subwatershed of detrimental acres from table 3.3-2 included in the FEIS.

Comment: You can tell us with a straight face that the soil standards & guidelines was meant to allow 56 units totally 44% of the area to violate the soil standard and then be mitigated. This is ridiculous. Mitigation is imperfect, may not be funded; ripped soil is not healthy soil or fully restored soil. The Forest Service must emphasize prevention not mitigation. (37-54)

Similar Comment (35-12b)

Comment: According to the regional guidelines soils in 80% of an activity area must be maintained in a non-detrimental condition (i.e., non-compacted, non-displaced, non-burned, and non-puddled). Soils must be “maintained,” not “mitigated” or “restored” to attain that objective. Mitigation should not be used as an excuse for violation of the regional soil guidelines. (37-143)

Response: The use of mitigation is defined by NEPA policy included in the Council of Environmental Quality 40 CFR 1508.02. This clause states that mitigation measures are specific actions that could be taken to minimize, avoid or eliminate potentially significant impacts on the resources that would be affected by the alternatives, or rectifying the impact by restoring the affected environment (bold type added). The use of subsoiling is a mitigation used to rectify detrimental compaction incurred on the soil resource as a result of proposed activities.

Comment: The EIS has inconsistent info on whole tree yarding. Page 84 says it will occur and page 114 says it will not occur. Which is it? The EIS fails to disclose that WTY has serious adverse soil impacts in terms of plowing the soil surface layers with the broken stubs of branches. (37-56)

Response: The DEIS is mistaken on p.114 under the soil erosion, stability and sedimentation heading of the hydrology section. Whole tree yarding would occur within mechanical ground-based harvest and yarding units of alternatives 2 and 3. Trees yarded in this manner would be accumulated and bunched on designated skid trails and taken to landings by a grapple skidder with their butt ends lifted in the air. The lack of green branches and crown would create some gouging of the soil on skid trails as they were yarded to the landing. At the same time, some branches and tops would break off before reaching the landings and provide areas of cover and cushion on the skid trails. The extent of yarding disturbance would be limited to designated skid trails and landings that comprise approximately 16% of the activity area acreage and would incur detrimental compaction as a result of multiple machine trips. Many of these areas would be subsoiled following the implementation of proposed harvest and fuels activities.

Comment: The EIS relies on evidence of logging impacts on similar operations on the Deschutes NF (p 84, 85, ...). Were these post-fire salvage logging operations? If not, they are not comparable and the EIS may not rely on them. (37-57)

Comment: And these figures are based on monitoring of unburned logging sites. The Forest Service lacks adequate monitoring of post fire logging impacts to justify this project. (37-58a)

Response: The soils analysis uses monitoring of past harvest activities to help predict the extent of impact from commercial salvage proposed under this EIS. Sales used to compare the proposed activities include fire salvage operations which utilized feller/ buncher shears

and grapple skidder systems similar to those proposed for the ground-based activity units (Evans West and Surveyor's Fire, Deschutes National Forest). Monitoring of other operations removing bug-killed salvage and green thinning which utilized feller buncher/grapple skidder ground-based systems were also used to show a range of impacts incurred from the removal of similar volumes per acre (Santiam Corridor and Santiam Corridor Followup, Deschutes National Forest).

Comment: [DEIS] Pages 85-87 indicates that a typical dendritic system of yarding corridors (14%), plus compaction from off-trail travel (5%), and burning fuel piles (2%, just the piles, not including machine use) add up to OVER 21% detrimental soil conditions, and this is WITHOUT considering roads, landings (5%), "additional" fuel treatment (5%, p 93), the machines used in fuel treatments, and the fire itself. This is simply illegal and irresponsible. (37-58)

Response: The DEIS acknowledged that 54 out of 80 proposed ground-based units are predicted to exceed the 20% Standard for detrimental disturbance prior to subsoiling (DEIS p.304-307; FEIS p.362). Past monitoring shows that ground-based systems utilized within activity areas having less than 5% impact from previous entries can logistically meet the 20% Standard through the implementation of designated skid trails spaced greater than 100 ft for the majority of their length, careful administration of off-trail travel of feller bunchers and reduced impact fuels treatments restricting machine traffic to existing areas of impact. The potential extent of detrimental impacts identified in the effects analysis allows for comparisons between alternatives, specifically the amount of acres in excess of the 20% Standard that would utilize subsoiling as a mitigation measure to rectify impacts incurred by proposed activities (DEIS p.32; FEIS p.48).

Comment: Disturbance levels following operations within activity units are not predicted to be extensive enough..." (page 334, italics emphasis added herein). The agency fails to disclose or analyze several studies regarding logging's known detrimental impacts to soils—including a study by David Perry in which he concludes that logging damage to forest soils, which have taken thousands of years to form, may take three centuries or more to fully recover. Other studies such as those by Elaine Ingham address the damage to forest soils by both logging and grass seeding, adversely impacting the ability of tree seedlings to survive. Numerous irrefutable evidentiary studies exist spanning centuries and continents showing the long-term harmful impacts to soils and forest health by logging. Some of these studies are by agency scientists as well, including reports based upon Ponderosa Pine forest ecosystems similar to Eyerly, and by authors including Scott, addressing detrimental impacts to forest health and seedling survival by logging disruption of forest soil microbial communities. Yet the agency has failed to disclose or incorporate any of these pertinent studies, choosing instead to simply dismiss such credible scientific research. (34-33) See ONRC letter 37, comment #59A (following this response) for effects of bolewood removal on soil productivity.

Proposed activities, especially commercial log removal, will violate requirements to maintain long-term soil productivity. Soil compaction and erosion, loss of coarse woody debris, and erosion all adversely affect long-

term productivity. Removal of a major fraction of the available organic matter through salvage of large trees will adversely affect soil productivity for decades or centuries. (34-53)

Response: The soils analysis acknowledges that proposed activities would incur detrimental impacts to the soil resource (DEIS p. 84-86; FEIS 96-97). These impacts would be incurred on less than 20% of a proposed activity unit following the implementation of salvage operations, fuels treatments and mitigation measures and would meet Standards and Guidelines for maintaining soil productivity (FEIS p. 100, Table 3.3-9). The studies mentioned, but not cited, in the comment do show that logging has direct effects on soil components such as soil strength, microbial communities and vegetative growth and survival. The extent of these effects on various soil components and associated productivity were analyzed in the draft (DEIS, Chapter 3, Soils) and clarified in the FEIS in response to public comments.

Comment: Table 3.2-10 (page 83) shows that salvage logging will cause a 44 year delay in the recovery of carbon and a 4 year delay in the recovery of nitrogen. Page 84 then makes an unsupported conclusion that the remaining post-harvest levels of nutrients are “sufficient.” The EIS fails to address whether the site recovery rate will be retarded or whether long-term site productivity may be affected. (37-55)

Response: Table 3.2-10 of the DEIS (FEIS p.106; Table 3.3-10) compares the site budgets of the primary nutrients contained only in above-ground tree components. The action alternatives propose to remove approximately 50% to 65% of the standing merchantable dead on site, which would immediately lower the site budget of these nutrients contained only in bolewood, partially consumed bark and branches of dead trees on site (Table 3.2-10, footnote **). However, overall input of nitrogen into the soil system from the decay of coarse wood is negligible when compared to atmospheric deposition and fixation pathways on site. Calculating a delay in the recovery of these nutrients on site in the manner in which the comment suggests accounts only for the recovery of these nutrients contained in tree bole material. Measurable amounts of these nutrients remain within the mineral soil following the fire (Hibbard, unpublished), which are available for plant uptake or microbial use in the short-term. Additional inputs of organic litter to the soil surface containing both of these nutrients would increase steadily in successive years from photosynthesized vegetative growth on site.

The DEIS did not calculate or compare recovery rates of carbon and nitrogen site budgets between alternatives because the return of carbon and nitrogen via photosynthetic processes is not expected to be significantly different between the alternatives over the course of an entire rotation. Additionally, the replenishment of nutrients contained in live tree components following the fire depends on the density and growth rates of natural and re-planted conifer seedlings. Measurement of the growth rates and cover of conifer seedlings and herbaceous vegetation on the Lone Pine fire shows little statistical difference between salvaged and control sites five years after treatment (Malaby, 2000).

The effect of bolewood removal on long-term site productivity was partially discussed under the cumulative effects section of the draft (DEIS p.93) and has been expanded for the final analysis. The DEIS partially addressed the direct effects of bolewood removal by comparing the loss of nutrients by alternative with annual environmental inputs (FEIS p.112-115, Table 3.3-12). The discussion of coarse woody debris in the analysis also partially addresses the issue of productivity by placing the estimated fuel loads of material

greater than 3" per acre within activity units in perspective with site needs (DEIS p.94; FEIS p.112). The DEIS did not bring forward cited references of coarse wood levels and their relation to site productivity in western coniferous forests that were included in the soils specialist report (Graham, 1994; Brown, et al, 2003) which are included in the FEIS.

The cited references state that coarse wood levels above 7 tons/acre in Douglas fir/Ponderosa pine forests provided sufficient levels of mycorrhizal root tip interactions for adequate soil productivity. Large snags and downed logs would be left on site at levels meeting the Metolius LSRA Standard and Guidelines for coarse woody debris and snag retention for each Plant Association Group (PAG). These levels range from 25 tons/acre in the Mixed Conifer wet PAG to 8 tons/acre in Ponderosa pine dry PAG (FEIS p.40). Unmerchantable standing trees and broken branches from felled and yarded boles would provide additional levels of coarse wood within salvaged areas. As a result, levels of coarse wood on these sites are likely to meet or exceed recommended levels for soil productivity, maintaining the role of this material in providing functional microbial habitat and moisture retention on site. Long-term site productivity would also be maintained as a result of biomass production from successional pathways, nutrient input from environmental pathways and nutrient cycling associated with biotic and woody decay processes.

Hibbard, K., Research post-doctorate, Oregon State University.

Comment: The EIS states repeatedly states that the proposed activities are consistent with existing Forest Plan direction and simultaneously gives many examples where it is made clear that the Proposed Action will ignore Forest Plan guidelines. Take soils, for example. The DEIS states "The proposed salvage activity may reduce overall soils productivity..." (Eyerly DEIS p. S-9) The PROWL Project finds the word "may" in in this sentence perplexing. As there are many areas in the project area where soils already exceed or are close to exceeding Deschutes National Forest Plan Standards for soil impacts, implementing the proposed action WILL reduce overall soils productivity. (38-22) See also response to Letter 37, comment #59.

Response: Compaction of the soil resource from proposed harvest activities would have documented effects on populations of soil biota in skid trails and landings. Shifts in ratios of fungal and bacterial populations were shown to swing back towards pre-impact conditions following subsoiling in the Metolius Basin (Moldenke, 1998). Subsoiling with a self-drafting winged implement is designed to shatter compaction in the soil profile with a minimal amount of mixing of horizons and exposure of subsurface material. Although variable operating conditions in the field can cause soil horizons to be mixed, operator diligence and clauses included in subsoiling operating contracts minimize this from occurring.

Comment: [DEIS] Page 87 makes an unsupported conclusion that these soil impacts will not be detrimental to site productivity or overall populations of soil biota. (37-59)

Response: Support for the conclusion on page 87 has been added to the FEIS. Compaction of the soil resource from proposed harvest activities would have documented effects on populations of soil biota in skid trails and landings (Moldenke, 1998). Effects from compaction, however, would be confined to approximately 20% of the area within a

proposed activity unit, while approximately 80% of the areas would not have detrimental disturbance and little effect on the soil biota or associated site productivity (FEIS p.112). In addition, subsoiling rehabilitation of compacted skid trails in the same study was shown to move shifts in soil biota as a result of compaction back towards pre-impact conditions (Moldenke, 1998).

Narrative summarizing effects of compaction on soil biota was added to the FEIS, including the loss of 1/3 of the pre-impact fungal biomass, a 1.5 to 2 fold increase in bacterial activity, and an 8 to 9 fold increase in bacterial feeding nematodes. Total arthropod densities remained constant in these areas, although the species composition shifted from a community dominated by fungivorous mites to one with a large component of bacterivores and predators of bacteria-feeding nematodes (Moldenke, 1998).

Comment: In unrelated paragraphs on pages 87 and 89, the EIS says that removal of large material will leave “substantial amounts” of nutrients but that the small material (3-12”) leaves provides only short-term sources. Adding up these facts, leads to conclusions different than offered by the Forest Service. (37-59a)

Response: Large snags and downed logs greater than 10” in diameter would be left on site at levels intended to meet the Metolius LSRA Standard and Guidelines for coarse woody debris and snag retention range for each Plant Association Group (PAG). These levels would range from 25 tons/acre in the Mixed Conifer Wet PAG to 8 tons/acre in Ponderosa Pine Dry PAG (FEIS p.40). Fuels activities would treat a portion of unmerchantable material in the 3 to 12” size class (1,000 hr fuels) within activity units but are predicted to leave approximately 3 to 8 tons/acre in this size class on site.

The soils section of the DEIS did not address the length of time that coarse wood would remain on site and provide functional habitat or nutrient input to the soil system. Decay rates of 1,000 hr fuels are not necessarily faster than that of larger diameter size classes exceeding 10”, especially in dry climates and low wood moisture settings, and are likely to remain on site for a number of decades in the absence of fire. Lodgepole pine boles averaging >15 cm at the base took an average of 38 years to reach Decay class V status in dry, east-side forest settings on the Deschutes similar in seasonal precipitation patterns and amounts as the Eyerly project area (Busse, 1994). Ponderosa pine and Douglas fir in the mid and lower elevation settings of the Eyerly fire may be expected to decay at similar rates (Busse, personal communication), providing microbial habitat and surface cover well into a third or fourth decade following the initial fire event. Detrital input to the soil surface from conifer and herbaceous vegetative growth, as well as atmospheric deposition and microbial fixation mechanisms on site, are expected to sustain the nutrient system throughout the latter part of short-term coarse wood decay.

The lodgepole decay study also measured the nutrient budget provided by down boles levels at loadings of 17 tons/acre to be less than 3% of the combined mineral soil, O horizons, and downed wood nutrient pools on site, indicating the greater importance of this component as microbial habitat than a direct storage and release bank of plant available nutrients over time. Other studies also indicate that coarse woody debris does not make a significant contribution to N and P cycling in arid, east-side or inter-mountain coniferous forests (Prescott, 2002).

Comment: [DEIS] Page 90 indicates that salvage logging will slow vegetation recovery. This fact is not fully accounted for or factored into the EIS analysis. Fuel treatments will slow it even more. This has serious consequences for soil biota, erosion, current and future habitat. (37-60)

Response: The analysis states that recovery of vegetation on “skid trails and landings that were not subsoiled” would be “very slow” (DEIS p.90; FEIS pp.96-97). Field observations of the McKay and Pringle fire salvages on the Deschutes National Forest were used as anecdotal citations of the extent and rate of return of vegetation following fire and salvage operations. Re-measurement of Sexton’s study on the Lone Pine fire after five years shows no statistically significant difference in vegetative cover between controls and logged sites (Malaby, 2000). Fuels treatments would operate under mitigations limiting machine traffic to existing areas of impact, with hand lopping and piling in areas of accumulation between skid trails that are out of reach of a grapple piler (FEIS p.59).

The contribution of woody material to skid trails and landings as a result of yarding activities would provide surface roughness and effective cover capable of off-setting to varying degrees any reductions in the short-term return of vegetation on these areas (DEIS p.90, FEIS pp.96-97). Many skid trail and landing areas would also be subsoiled to return hydrologic function and reduce compaction capable of inhibiting vegetative growth following harvest and fuels treatment activities (FEIS pp.97-98). Effects of salvage logging on vegetative re-growth, along with any associated effects on soil biota, habitat and erosion processes are discussed in the analysis (DEIS pp.82-92; FEIS pp.103-116).

Comment: [DIES] Page 93 asserts that planting will jump start the return of fine organics. But this is belied by the fact that overall vegetative recovery will be delayed by salvage logging and other activities, and some green trees will be removed, and it’s not just planted conifers provide fine litter. (37-61)

Response: The analysis states that “planting of stand replacement acres proposed for salvage would jump start the return of fine organic litter inputs from *trees*” (*bold and italics added*) only (DEIS p.93; FEIS p. 115). Although vegetative recovery would be slowed to varying degrees on skid trails and landings in the first few years as a result of disturbance from proposed activities it would not be prevented from returning on these areas (see response to comment f26) and effective cover would also increase within the proposed activity units between skid trails in each subsequent year at similar rates compared to unsalvaged areas (see response to comment f1). As a result, the recovery of herbaceous vegetation on salvaged sites would contribute fine litter at similar rates compared to unsalvaged areas. Only dead or severely damaged trees are proposed for removal (DEIS p.24; FEIS p.42).

Comment: The cumulative soil analysis on page 92-93 fails to integrate chemical and physical effects on soil, and the cumulative erosion analysis is very poorly done. (37-62)

Response: The cumulative effects analysis for the soil resource in the DEIS did not clearly state the combination of effects on the chemical and physical components. The primary areas of disturbance where effects to these components are cumulative would be on areas of pre-existing disturbance where additional machine traffic may occur off of skid trails and on areas of multiple machine trips such as skid trails and landings within

the proposed activity areas. The effects analysis for the action alternatives focuses on the compaction of the soil resource in order to quantify the extent of detrimental disturbance that may need to be rectified with subsoiling. The cumulative effects analysis has been rewritten to clarify the analysis.

The cumulative erosion analysis summarizes the changes in detrimentally compacted acres within the Street and Spring Creek subwatersheds as a result of implementing proposed activities under the action alternatives (DEIS p.92; FEIS 101-104). The analysis narrative has been updated to include estimates of existing disturbance and road miles within these subwatersheds to show the cumulative area having elevated erosion risks.

Comment: [DEIS] Page 102 says that as standing dead trees begin to fall, they add to the surface roughness and help trap sediment. The EIS fails to recognize that removal of standing dead via salvage logging will significantly reduce this effect. (37-65)

Response: The removal of standing dead via salvage logging would leave an estimated 25, 12, 10 and 8 tons/acre of coarse wood greater than 10" dbh on site within the MCW, MCD, PPW and PPD PAG's, respectively, primarily as standing snags (DEIS p.38, Table 2.8-2; FEIS p.46, Table 2.8-7). Additional material in the 5 to 12" unmerchantable size class is also present in the proposed activity units averaging 35 trees per acre for the 5 to 9" dbh class. Snag fall rates from the Lone Pine fire measured 50% of snags over 14" and 90% of snags between 3 and 14" on the ground in 10 years, indicating that material left standing in activity units would contribute a steady supply of down wood over the next two decades. Material in the 3 to 14" size class would reach the ground sooner in units proposed for salvage, primarily as a result of machine disturbance in ground-based units and the clearing of yarding corridors within skyline units.

Although a portion of activity fuels would be piled, material that was not piled and burned or that fell after harvest and activity fuels treatments were completed would provide additional surface roughness capable of reducing overland flow energies and trapping sediment. Although unlogged areas would have a higher supply of coarse wood for contribution to the ground, much of it would be jack-strawed and not actually in contact with the ground, even at high fuel loads (Brown, et. al., 2003). The role of coarse wood in this condition is likely greater as effective ground cover functioning to intercept raindrop impacts and the relative difference between the alternatives in terms of sediment trapping capabilities is lessened. The return of conifer, herbaceous and shrub cover within activity areas would supplement whatever levels of coarse wood are present as effective ground cover in the short-term and would likely cover much of the coarse wood reaching the ground in the long-term.

Comment: [DEIS] Page 102 says that the nutrients of concern are phosphorus and nitrogen but the EIS must disclose that soil organisms are Carbon limited and salvage logging will remove tons of Carbon and significantly delay the replenishment of C. (37-66)

Response: See response to Letter 37, comment #55 for a discussion on the role of carbon contained in coarse wood, as well as effects of the proposed removal levels and relative replenishment rates. Soil carbon measured in samples from the Eyerly fire area, as well as the Hinman fire in Colorado, show measurable levels and only slightly reduced C:N ratios that would not impede microbial utilization on these sites (Hibbard, unpublished;

Rumbaitis del-Rio, unpublished). Additional host material would be provided by down wood derived from windthrown trees over the next twenty years.

Comment: [DEIS] Page 111 falsely claims that soil recovery will occur at the same rate under the action and no action alternatives. In fact, soil recovery will be much faster under the no action alternative because under no action the soils will not be salvage logged, activity fuel treated, site prepped, planted, brush controlled, etc. Soil recovery will also closely follow the recovery of soil organisms which will closely follow the recovery of vegetation. And vegetation will recovery much faster under no action because it won't be chopped, mutilated, and spindles as in the action alternatives. (37-73)

Response: The analysis states that “the recovery of soil *stability* (*italic's added*) would occur at the same rate as the action alternatives” (DEIS p.11; FEIS p.26). This statement refers to erosion susceptibility as it relates to the return of effective ground-cover on the sites. The relative comparison of effective ground-cover for proposed activity acres factors in the disturbance of soil and re-established vegetation with the addition of organic ground-cover from activity fuels and trees planted after harvest and fuels treatment activities were completed. Effective ground cover is likely to be very similar between the action and no action alternatives as a result of these factors.

Comment: Page 115 says that activity fuel burning will not increase erosion. This is false. Burning piles will involve heavy machinery that will compact soils. Burning the piles themselves will seriously heat soil far beyond the effects of the fire itself and destroy the soil structure and cohesion. Much of this burning will occur on steep slopes. I have often observed burn piles as initiation points for soil mobilization and sedimentation. (37-155)

Response: Piling of activity fuels would primarily utilize machine grapples limited to existing skid trails and landings (FEIS p.59). Piles would generally occur on or adjacent to existing areas of impact such as skid trails. Activity fuels out of reach of grapples from the skid trails would be hand lopped and scattered or piled. Hand piles are likely to occur on less disturbed and uncompacted areas between skid trails and could cover up to 5% of the unit area. The density and size of hand piled burn piles are less than machine piles and generally generate lower temperatures and associated burn effects when compared to machine piles (Metzger, personal communication). While all piles would create ash deposits on exposed mineral soil with the potential to erode during rain events, the extent of this erosion would be limited due to the surface roughness and cover of areas adjacent to the piles themselves.

Comment: Burned soils are highly susceptible to disturbance degradation, including erosion and compaction. Recovery of native vegetation is significantly set-back and impaired by logging in these areas. (34-77) See also response to ONRC Letter 37, comment #13 and comment #109.

Response: The direct effect of proposed salvage operations on native herbaceous cover values includes the crushing or uprooting of established plants on implemented skid trails and landings, as well as areas of off-trail, out and back passes of a harvest excavator, the extent of which would be approximately 20% of an activity area. At the same time, the

felling and yarding of material would move organic woody branches and smaller boles to the ground. The continued growth of the root systems of crushed plants and the new growth of vegetation after logging disturbances would be variable and primarily dependent upon overall site conditions, seed sources and small mammal populations.

Disturbance resulting from logging operations is not expected to slow the continued growth of vegetation established on the site. Cover values of shrubs (PUTR = 25%) and biomass production (herbaceous species = 387 kg/ha) on salvaged areas in the Lone Pine fire after five years were not statistically different than un-salvaged controls and had additional live vegetative cover provided by planted and naturally regenerated conifers (Malaby, 2002). Although tree heights in 1994 were measured to be statistically greater in unplanted control plots compared to unplanted salvage plots (Sexton, 1998), this was preliminary data of only 1 to 2 seasons of re-growth and has a p-value of 0.2, too high to provide enough evidence to reject the null hypothesis (Triola 1997) and should not be considered statistically significant.

Continued research measured tree height on the Sexton plots 6 to 7 years after the salvage and show no statistical difference between control plots or treatment plots regardless of planting (Malaby 2002). Tree density, height, and diameter were, however, measured to be significantly greater (p of 0.01 for diameter, p of 0.1 for density and height) in natural and planted salvage plots compared to natural and planted control plots. The combination of herbaceous and coniferous cover within proposed activity units of this project is not expected to be significantly set-back as a result of logging.

Comment: Salvage logging will also reduce the rate of survival and rate of growth of vegetation compared to not logging (Sexton 1998). (37-13, 37-109)

Response: Five and ten year updates of Sexton's work have been completed on the Lone Pine fire. Five year data showed a narrowing trend of cover values, survival and rates of growth between treated and untreated areas with little or no statistically significant differences in the vegetation recovery data (Malaby, 2000). Although ten year data has not been completely analyzed, initial assessment appears to show these trends continuing to narrow (Riegel, personal communication).

Comment: The watershed analysis indicates that soil is a "red" issue of concern throughout almost the entire watershed. The EIS just makes it worse. 37-129

Response: The soil resource was identified in the Metolius Watersheds Analysis as a "red" issue of concern at the 5th field watershed scale, primarily within past harvest activities areas with prescriptions that had incurred high levels of detrimental disturbance. Research documentation does not exist to show productivity losses in these areas, but levels of detrimental disturbance are likely to exceed the 20% Standard in many areas harvested under heavy volume removals of the 1970's and 80's. The Street Creek and Spring Creek subwatersheds were identified in this analysis as having approximately 13% and 17% of their aerial extent in a detrimental condition or as dedicated roads using an average of 25% detrimental disturbance within past activity units (DEIS p.63, Table 3.2-2; FEIS p.79 Table 3.3-2). The analysis shows that proposed activities could incur detrimental impacts on an additional 2% of the soil resource in Street Creek and 5% in Spring Creek under Alternative 2; and 1% and 3% additional impact, respectively, under Alternative 3 (DEIS p.82, Table 3.2-8; FEIS p.99, Table 3.3-8). Although the Spring

Creek subwatershed could have detrimental impacts over 22% of the total area following the implementation of Alternative 2, none of the individual proposed activity units would exceed the 20% Standard following the implementation of salvage, fuels treatment and mitigation measures.

Comment: Nutrient Cycling and Soil Fertility. Soil is the foundation of the forest ecosystem.68, 348 ... On the H. J. Andrews Experimental Forest of western Oregon, 20-30% of the soil volume consists of decaying wood dispersed throughout a matrix of litter and duff. Because wood is a relatively inert substance, it may help to stabilize pools of organic matter in forests by slowing soil processes and buffering against rapid changes in soil chemistry.... Numerous studies have demonstrated that losses in soil productivity often are closely linked to losses in soil organic matter - Decaying Wood in Pacific Northwest Forests: Concepts and Tools for Habitat Management, Chapter 24 in Wildlife-Habitat Relationships in Oregon and Washington (Johnson, D. H. and T. A. O'Neil. OSU Press. 2001).

Nutrient Cycling and Soil Fertility. Decaying wood has been likened to a savings account for nutrients and organic matter, and has also been described as a short-term sink, but a long-term source of nutrients in forest ecosystems. ... Substantial amounts of nitrogen are returned to the soil from coarse wood inputs, yet even where annual rates of wood input are high, 4 to 15 times more nitrogen is returned to the forest floor from foliage than from large wood... The low nutrient content in wood, small mass of tree boles relative to foliar litterfall, and slow rates of wood decay suggest that large wood plays a minor role in forest nutrition. After large scale disturbance such as fire and blowdown, however, the large nutrient pool stored in woody structures of trees (bole, branches, twigs, roots) becomes available to the regrowing forest. Large down wood may thus be an ample source of nutrients throughout secondary succession...Recent studies indicate that wood may release nutrients more rapidly than previously thought through a variety of decay mechanisms mediated by means other than microbial decomposers, i.e. fungal sporocarps, mycorrhizae and roots, leaching, fragmentation, and insects-

Decaying Wood in Pacific Northwest Forests: Concepts and Tools for Habitat Management, Chapter 24 in Wildlife-Habitat Relationships in Oregon and Washington (Johnson, D. H. and T. A. O'Neil. OSU Press. 2001).

Processes that sustain the long- term productivity of ecosystems have become the centerpiece of new directives in ecosystem management and sustainable forestry. Given the key role of decaying wood in long-term productivity of forest ecosystems in the Pacific Northwest, the topic should remain of keen interest to scientists and managers during the coming decade. ... functions of decaying wood directly linked to long-term productivity, include[e] influences on the frequency and severity of disturbances such as fire, disease, and insect outbreaks. - Decaying Wood in Pacific Northwest Forests: Concepts and Tools for Habitat Management, Chapter 24 in Wildlife-Habitat Relationships in Oregon and Washington (Johnson, D. H. and T. A. O'Neil. OSU Press. 2001). (37-131, 37-132, 37-133)

Response: Analysis of coarse wood in the post-fire environment was included in the draft (DEIS p.79) but not well clarified for the post-harvest scenario (DEIS p.88-89). Narrative

as to the role and effects of coarse wood levels within proposed activity units following implementation of the action alternatives has been added to the final analysis (FEIS pp.105-106). See also response to Letter 37, comment #'s 16, 55 and 59A.

Comment: The Forest Service policy to ignore detrimental effects to soil areas less than 5 feet wide and less than 100 square feet is arbitrary and capricious. Under this senseless policy many small areas could add up to significant detrimental soil conditions, yet not trigger any management concern whatsoever. This violates NFMA, and failure to disclose the true extent of DSC violates NEPA. (37-144)

Response: The Region Standards and Guidelines for detrimental displacement are defined in the document (FEIS pp. 77-78). Displacement is the only detrimental soil condition in which a minimum surface area is included in the definition in order to allow for activities such as scalping around planted trees and the operation of machinery in a controlled manner on the soil resource. Areas smaller than 100 square feet are not considered to be large enough to prevent revegetation of herbaceous species or limit soil productivity. Multiple areas of displaced soil not meeting the detrimental definition can be qualitatively addressed in on-site monitoring and considered detrimental as a whole if conditions merit. Detrimental conditions for compaction, puddling and burn damage are generally tallied on a percentage basis regardless of size.

Comment: Without an adequate discussion of the impacts to soil mycorrhizae, the public and the decisionmaker are precluded from making an informed decision regarding the proposed project, and the USFS cannot assert that there will be no permanent impairment of the soil. 30 C.F.R. §§ 219.27(a)(1), 219.14(a)(2) (prohibiting activities unless technology is available to prevent impairment of soil or water resources. (34-75)

Response: See response to ONRC comments [f24]. The FEIS discusses effects of wildfire on soil biota under the No Action Alternative (DEIS p.78; FEIS p. 103), but effects to soil biota by proposed activities were not carried forth into the analysis. The following narrative has been added to the FEIS:

Compaction of the soil resource from proposed harvest activities would have documented effects on populations of soil biota in skid trails and landings (Moldenke, 1998). In general, compacted skid trails were shown to have lost 1/3 the pre-impact fungal biomass, a 1.5 to 2 fold increase in bacterial activity, and an 8 to 9 fold increase in bacterial feeding nematodes. Total arthropod densities remained constant, but the species composition shifted from a community dominated by fungivorous mites to one with a large component of bacterivores and predators of bacteria-feeding nematodes. This shift was further shown to be swung back towards pre-impact conditions through subsoiling (Moldenke, 1998).

Although proposed activities would alter biotic populations as a result of compaction, impacted areas would still contain functional soil biota. These changes would occur on less than 20% of the area in many units and would be returned toward pre-impact conditions in areas where compaction was relieved through subsoiling. Soil biota throughout the unit areas where skid trails and landings were not created would not be expected to be altered from the proposed activities.

Comment: Scarification, ripping, and subsoiling does not alleviate the following negative impacts, therefore not completely mitigating: compaction of soil and alteration of the soil ecosystem; alteration of hydrology, water storage, flow, timing, from soil compaction; alteration or loss of native plant communities, and tendency to create conditions which favor noxious weeds or other non-native plants; disruption of soil foodweb and biotic communities that serve important soil functions and processes such as aeration, nutrient cycling. (37-145)

Response: The DEIS discussed the effectiveness of implementing a self-drafting winged subsoiler on alleviating compaction (FEIS p. 102). Ripping with fixed tines is not proposed under this EIS. Bulk densities following subsoiling would be similar to undisturbed conditions, allowing water to infiltrate into the soil profile and be stored, while maintaining contributions and timing of overland flows at similar levels to undisturbed conditions. Information on the changes in soil strength following subsoiling is summarized in a monitoring report from the Forest files (Craig, 2001).

Vegetation on skid trails prior to subsoiling is generally limited in size and extent due to physical trampling and compacted rooting zones incurred by harvest and fuels treatment machinery. Non-native noxious weeds and native annuals alike are known colonizers of these conditions (Pajutee, personal communication). Although subsoiling of skid trails can disturb surface vegetation by physical means, it creates an uncompacted profile more conducive to vegetative re-establishment and growth. Native perennials and shrubs are more likely to be able to colonize and grow to a normal size under these conditions.

The effects of subsoiling on soil biota was summarized in response to comment [f 24]. The composition of soil biota in a compacted soil profile was shown to swing back towards pre-impact conditions after subsoiling an area in the Metolius Basin (Moldenke, 1998). Scarification of approximately 2 square meters could occur around trees planted following harvest and fuels treatment activities, but this activity is intended to reduce herbaceous vegetative competition and is not proposed as a mitigation.

Comment: The existing level of soil disturbance has not been measured and disclosed in the NEPA document so the Agency cannot say with any factual basis whether forest plan standards will be met. (37-156)

Response: Existing impacts were measured in the field for all or portions of all units included in the proposed activities (Shank, 2003). Some units that had partial coverage from field surveys utilized past harvest activity records to help refine existing levels of disturbance. Appendix B Table B-5 includes site-specific measurements of the majority of proposed activity units from field surveys conducted during the fall of 2002 (DEIS p. 304; FEIS p.418). Estimations of impacts following proposed harvest and fuels treatment operations were made based on monitoring of soil disturbance in past harvest activities in other fire salvage sales with similar logging systems and volume removals.

Comment: Logging will kill trees and cut off the supply of photosynthate which forms the basis of this food web, so the tightly coupled nutrient retention systems will be disrupted, allowing nutrients to “leak” from the system. Burning slash piles also kills the below ground ecosystem and soil compaction from road building and other heavy equipment kills or destroys habitat for many soil dwelling species and shifts the below ground ecosystem from

aerobic to anaerobic. The NEPA document fails to consider these significant effects. (37-157)

Response: The FEIS proposes to cut only trees killed or severely damaged by the fire (FEIS p.36). Few, if any, of these trees that supply photosynthates to the soil food web in their current condition.

The effects associated with burn piles are discussed in the effects analysis under Alternative 2 (FEIS p.97-98). Detrimental effects from this process would primarily be confined to areas already detrimentally impacted by compaction where fuels were machine or handpiled on skid trails. Some additional areas of detrimental disturbance would occur where fuels were hand piled between skid trails, although the size and density of material within these piles would reduce the range and residence time of temperatures generated during the burn period.

Although no new roads are proposed for construction, skid trails, landings and temporary roads would incur compaction capable of affecting soil biota (Moldenke, 1998). Despite increases in soil strength, the soil profile would not be entirely converted to an anaerobic condition. Many of the skid trails and landings, and all of the temporary roads would be subsoiled following the completion of harvest and fuels treatment and would re-establish pore spaces within the soil profile similar to pre-disturbance conditions. Soil biota populations and distributions were also shown to move back toward pre-disturbance conditions following subsoiling (Moldenke, 1998).

Comment: Compound disturbances have the potential to fundamentally alter an ecosystem structure and function. This study examines the effects of a natural disturbance and a compounded natural and anthropogenic disturbance on soil properties, biogeochemical cycles, and ecosystem reorganization in a windblown and salvage-logged ecosystem in northwestern Colorado. Areas of intact forest are used as a control to compare the disturbance effects. Results indicate that soils in the salvage-logged areas are drier, significantly warmer, denser, and contain less organic matter than soils in blowdown or control areas. Significant amounts of erosion occurred in the salvage-logged areas to produce these results. Furthermore, net nitrogen mineralization rates are lower in soils from salvage-logged areas than in blowdown areas. By contrast, net nitrogen mineralization rates are twice as high in blowdown areas than in control areas. Seedling density, herbaceous cover, and plant species diversity are greatest in blowdown areas, and least in salvaged-logged areas. The results of this four-year study indicate that the mitigation effects of salvage logging significantly alter ecosystem functions and retard the rate of recovery when compared to unlogged blowdown areas.

Cristina M. Rumbaitis-Del Rio and Carol A. Wessman. Impact of compound disturbances on N-cycling and forest reorganization in a wind-disturbed and logged forest. (37-146)

Response: The study referenced in the comment occurs in high elevation lodgepole pine or engelmann spruce/subalpine fir plant associations in the mountains near Steamboat Springs, Colorado that are not directly comparable to Ponderosa Pine or Mixed Conifer plant associations groups present in the Eyerly area. The study area also contains granitic, skeletal soil types that are not similar to the volcanic ash soils located in the Eyerly project area (John, personal communication). Furthermore, the study results that are referenced in the comment were measured in areas of live blowdown in unburned forest areas.

Ironically, the study site burned during the summer of 2002 and the study has been re-configured to measure and compare effects of the fire on the soil resource between control, unlogged blowdown and blowdown areas that were salvage logged. These areas have subsequently been measured for nitrogen availability, net nitrogen mineralization rates, seedling establishment, seedling density and understory vegetation cover.

Preliminary findings from measurements the first year after the fire show that the variance in fuel loads between the three burned plot replicates had little effect on available ammonium in the soil profile. Lower fuel load areas that had been salvage-logged did have significantly greater nitrate and nitrite availability than control and unsalvaged areas in both burned and unburned conditions. Net nitrogen mineralization rates were extremely variable, but did not differ significantly between any of the treatment areas (Rumbaitis-del Rio, unpublished).

The carbon concentration in the top 10 cm of soil in the burned unsalvaged blowdown areas was measured to be significantly lower than in the burned control areas or burned salvage-logged areas. The burned blowdown areas had the lowest total carbon and nitrogen concentrations, and the lowest carbon to nitrogen ratios in the top 10 cm of soil when compared to the burned salvaged and burned control plots. The carbon to nitrogen ratio of the top 10 cm of soil was measured to be lowered from 25:1 in unburned areas to 18:1 in burned areas when averaged across all treatment replicates (Rumbaitis-del Rio, unpublished).

The return of seedlings, herbaceous cover, and plant species diversity have been measured on the Lone Pine fire and show little difference between salvaged and control areas five years after activities (Malaby, 2000). Although the burned Colorado study observed first year seedling establishment in only in burned control stands, the Lone Pine fire showed the establishment of seedlings in all areas within the first two years following the fire and salvage activities (Sexton, 1998).

Comment: Salvage: Importance of Mycorrhiza Formation after Fire.

Rapid mycorrhiza formation is important to establishment and survival of vegetation after a fire. The quantity, quality and rate of revegetation is in turn important for many hydrologic, soil, and habitat qualities.

From Long-Term Forest Productivity and the Living Soil by M. P. Amaranthus, J. M. Trappe, and R. J. Molina— (37-149)

Response: The analysis acknowledges the importance of mycorrhizae in east-side forest systems by managing for coarse woody debris in proposed activity units at levels considered to be sufficient for soil productivity (FEIS Chapter 3, Alternative 2 and 3 coarse woody debris). Effects to fungal and biotic populations as a result of the fire (DEIS p.69) and Alternative 1 (DEIS p.78) were included in the draft analysis. Effects to these populations under the action alternatives were added to the narrative of the final analysis.

Comment: The DEIS violates Forest Plan direction on soil compaction:

75% of proposed logging will be done using ground-based systems (DEIS p. 6). Three miles of temporary road would be constructed (DEIS p. 26) as part of the Eyerly Project. (35-12)

Response: The EIS does not violate Forest Plan direction on soil compaction. Specifically, the DEIS outlines Forest Plan direction for defining detrimental disturbance and maintaining productivity of the soil resource within the document (DEIS pp. 59-60). The FEIS estimates that detrimental impacts exceeding the 20% Standard and Guideline (SL-3) will temporarily occur in some units as a result of proposed activities before subsoiling mitigations (Appendix B. Table B-5). The FEIS states that units exceeding the 20% Standard for detrimental compaction will have compacted areas subsoiled (FEIS p. 96).

Mitigation measures are specific actions that could be taken to minimize, avoid or eliminate potentially significant impacts on the resources that would be affected by the alternatives, or rectifying the impact by restoring the affected environment (40 CFR 1508.02). The use of subsoiling to rectify impacts incurred by proposed activities by restoring compacted areas to a more natural condition of soil strength throughout the profile is described in the document (FEIS p.96).

Comment: These silvicultural methods, along with helicopter and skyline yarding will compact soils in planning subdrainages by more than the 20% detrimentally impacted soil condition allowed by Deschutes National Forest Plan Standard and Guideline SL-3. For instance, proposed logging in Spring Creek will exceed detrimental soil condition thresholds (22% in Alt. 2, 20% in Alt. 3) (DEIS p. 82). (35-12a)

Response: The EIS has been misinterpreted in order to come to this conclusion. The DEIS stated that 24% and 14% of the Spring Creek subwatershed is proposed for ground-based harvest activities under Alternatives 2 and 3, respectively. Predicted detrimental acres from proposed ground-based activities are 5% and 3% of the Spring Creek subwatershed under Alternatives 2 and 3, respectively (FEIS p.99, Table 3.3-8). An additional 11% and 5% of the Spring Creek subwatershed is proposed for skyline, helicopter or cable yarding under Alternatives 2 and 3, respectively. A maximum of 10% of these unit areas would have detrimental disturbance from the implementation of landings to process yarded material or yarding corridors to move material to the landings. These activities would incur impacts to less than 1% of the Spring Creek subwatershed.

Comment: Forest Service policy, including direction in the Northwest Forest Plan Record of Decision (ROD) prohibits using mitigation measures to comply with these standards. The Forest Plan standards are there for a reason: Violating these standards risks unacceptable levels of decreased water filtration, run-off, sedimentation, increased peak flows, mass wasting and other detrimental hydrologic events. (35-12b)

Response: The NWFP ROD does not include policy preventing the use of mitigations to meet LRMP Standards and Guidelines. The use of mitigation is defined by NEPA policy included in the Council of Environmental Quality 40 CFR 1508.02. This clause states that mitigation measures are specific actions that could be taken to minimize, avoid or eliminate potentially significant impacts on the resources that would be affected by the alternatives, or rectifying the impact by restoring the affected environment. The use of subsoiling is a mitigation to rectify detrimental compaction incurred as a result of proposed activities.

Comment: Mitigation and best management practices are described on pp. 32-44. “Project design elements” soils report on the effectiveness of these mitigation measures, e.g., “moderate effectiveness,” “high effectiveness,” etc (DEIS pp. 32-33). This is not an adequate description. Furthermore, if a practice or measure is only of “moderate effectiveness,” than those impacts that are assumed to entirely mitigated will not, in fact, be mitigated, but only “moderately” mitigated. The precise nature of impacts remains unknown. (35-24)

Response: Effectiveness Ratings provide a qualitative assessment of expected effectiveness for an implemented practice on preventing or reducing impacts on soil and water resources. The following ratings for mitigation measures are derived from monitoring by research or resource professionals and are included in the FEIS:

- High: The mitigation is highly effective (estimated at greater than 90 percent) at meeting the objective, and one or more of the following types of documentation is available:
 - Research or literature
 - Administrative studies
 - Experience: professional judgment of an expert
 - Fact: Evident by logic or reason
- Moderate: The mitigation is moderately effective (estimated at 60 to 90 percent), and its effectiveness is supported either by evidence (documentation) or logic that the mitigation is highly effective but documentation is lacking. Implementation of this mitigation needs to be monitored, and the mitigation may be modified if needed to achieve its objective.
- Low: The mitigation is somewhat effective (estimated at less than 60 percent), but its effectiveness is not supported by substantial evidence; or professional judgment indicates limited success in implementation or meeting objectives. Implementation of this mitigation needs to be monitored, and the mitigation may be modified if necessary to achieve its objective.

The use of mitigations to minimize, avoid or rectify is defined by CFR regulations and proposed in this FEIS. The effectiveness of subsoiling to relieve compaction is described in the document (FEIS p.102)

Comment: Insects may be so important to soil fertility that they may be a better barometer of forest ecosystem health than the larger trees or animals which live there, researchers say. In natural forest communities there are more than 200 species of arthropods and more than 200,000 individuals in a square meter of soil, and the numbers of these arthropods can tell more than chemical tests about soil concerns such as compaction and nutrient cycling. A study by another OSU researcher showed residual impacts on soil invertebrate populations from a site that had been clearcut and slash burned 40 years earlier. (35-33)

Response: The effects of the fire and proposed management activities on soil biota were minimally discussed in the DEIS and have been addressed in more detail in the final analysis. Impacts on soil invertebrates from compaction are primarily changes to the ratio,

but not the removal, of fungal and bacterial populations in the soil profile. Subsoiling subsequent to the compaction impacts was shown to move these ratios back towards pre-impact levels (Moldenke, 1998).

Comment: Many of the green proposed units already have extensive natural regeneration process ongoing, with many new plants, tree-seedlings, and shrubs helping to hold and stabilize the soils. Logging in these recovering areas would destroy these ongoing processes and exacerbate the adverse impacts of the fire. (34-5)

Response: The proposed activities within units of mixed severity mortality would remove a small percentage of existing trees and the implementation of a less extensive logging system infrastructure than proposed units located in stand replacement mortality. Estimated disturbance levels for proposed units are included in Appendix B of the document (FEIS, p.418, table B-5). Effects to herbaceous and conifer vegetation on site were not well documented in Chapter 3 of the FEIS. Measurements from the Lone Pine fire on the Winema National Forest shows the return and continued growth of naturally regenerated seedlings five years following salvage operations at levels comparable to unlogged controls (Malaby, 2002).

Comment: Logging on steep slopes would further imperil area water quality and fish populations--in and downstream from project area creeks and riparian areas--where sediment loads are already being washed towards, and into, area creeks. These units, and/or portions of units, located on steep slopes need to be dropped from any proposed commercial logging. (34-6)

Response: The EIS proposes hand-felling and helicopter or skyline yarding within all activity units with slopes exceeding 30% in order to minimize disturbance to the soil resource (FEIS p. 136). Landings for these units would be located along roads located at the upper end of skyline units or in existing areas of disturbance on ground with slopes less than 20%, usually within 1 mile of the harvest unit. Undisturbed riparian buffer boundaries are located between any proposed activity units and stream channels within the project boundary. These buffers function to decrease the amount of eroded soil from any areas of disturbed ground within proposed activity units from becoming sediment transported or deposited in the stream channels (FEIS p.137).

Comment: Indeed, the severity and extent of the Eyerly fire was largely due to the synergistic cumulative impacts of these multiple (and ongoing) agency--as well as private lands--actions—including loss of soil moisture retention due to compaction from past logging and livestock grazing, loss of closed overstory canopy—and consequent unnatural solar exposure to the area's forests—drying out area soils, forest duffs, and understory trees, and the loss of significant amounts of once abundant fire-resistant old growth trees throughout the area. (34-14)

Response: Cumulative effects of past management activities in the Eyerly Project area are accounted for in the existing detrimental disturbance within each proposed activity unit (*Appendix B, Table B-5*). Soil moistures on site have not been monitored in relation to past disturbances but have been sufficient to support vegetative growth at levels above those estimated for the Mixed Conifer and Ponderosa Pine plant associations under a regular fire regime.

Comment: Slopes in the burned area are already evidencing erosion (34-24)

Response: Monitoring data of silt fences installed as a part of BAER erosion treatments following the Eyerly fire shows minimal accumulations of eroded sediment on both control and treated slopes (BAER Monitoring, 2004). This is qualified with the lack of significant precipitation events since the fire, although the measurements of accumulations during the spring of 2004 will capture results of a rainfall event that occurred at the end of January, 2004. The FEIS analysis predicts increased erosion rates and runoff flows during storm events in the first year following the fire due to the loss of effective ground cover (FEIS p.75, Table 3.3-5). Total effective cover provided by vegetative re-growth and coarse woody debris reaching the ground within proposed activity unit areas would not be significantly inhibited by harvest and fuels treatments. Erosion rates and runoff flows are expected to decrease in subsequent years as effective ground cover continues to increase.

Comment: Area watershed conditions and quality, and soil conditions and quality, including the potential for erosion and compaction, must be disclosed within the EIS for this project. These disclosures should include area cumulative impacts from past and ongoing management activities, including historic livestock grazing. (34-76)

Response: The EIS discloses existing soil conditions on a subwatershed scale (FEIS p.79, table 3.3-2) and within each proposed activity unit (FEIS p. 418, Appendix B, table B-5). Potential erosion rates were calculated for pre and post-fire conditions. Erosion Hazard and susceptibility to compaction for the soil types found in the project area can be found in the Soil Resource Inventory for the Deschutes National Forest (Larsen, 1976). Impacts from past management activities and natural events were used to summarize existing conditions for each proposed activity unit.

Comment: As was addressed earlier, it is not acceptable for the Forest Service to exceed Forest Plan Standards for soil impacts and hope to mitigate the damage later. Do the detrimental soil condition percentages shown in table S-1 of the DEIS account for the planned mitigation measures? We question the ability of the Forest Service to adequately mitigate soil impacts from logging, roadbuilding and reconstruction, and other planned management activities in the area.

We oppose the use of subsoiling as a means to adequately mitigate soil damage since it disturbs the mychorizal balance and brings infertile soil to the top. (38-6)

Response: No detrimental soil conditions are included in table S-1 of the DEIS. Table S-2 of the DEIS is in error in that it uses acres as the unit of measure for detrimental soil conditions in each Alternative column. The table should use number of units (proposed activity units) as the measure under each column. Another version of this table is shown on page 47 of the DEIS. Each of these tables have been revised for the FEIS and are intended to show the number of proposed activity units within each range of detrimental condition classes before (No Action) and after (Alternatives 2 and 3) the implementation of salvage, fuels treatments and mitigation measures.

Footnote *** of Table 3.2-14 - DEIS p. 90 (Table 3.3-8 – FEIS p.99) includes reference that summary calculations of detrimental conditions were made following the implementation all proposed activities, including subsoiling, for this analysis. A summary of detrimental conditions within individual proposed activity units is listed in Appendix B of the draft (Table B-5) which includes existing levels of detrimental disturbance, levels estimated immediately after post-harvest/fuels treatments for each unit and predicted number of acres for subsoiling to meet the 20% Standard.

Comment: Erosion and sedimentation is already taking place in the areas of the fire. The USFS must quantify these variables and make scientifically-based predictions for future increases or decreases, based on all past, present and reasonably foreseeable future actions. In order to meet the requirements of the NFMA and the Deschutes LRMP, the forest service will need site-specific measurements of soil and water quality conditions from the proposed planning area. (30-8)

Response: The assessment of burn severity as it relates to the soil resource needs to distinguish between effects to the hydrologic response and the productivity of the resource (DEIS pp.65-66; FEIS pp.79-80). Although many acres of the soil resource within stand replacement mortality had complete consumption of litter and duff affecting the short-term hydrologic response, they did not experience burn conditions that caused detrimental damage to the productivity of the resource. The burn severity of the majority of stand replacement acres is considered to be moderate when describing effects to soil productivity, primarily as a result of erosional losses of surface mineral soil in the short-term until live vegetative and organic cover returns. Detrimental impacts resulting from proposed activities are predicted in the document and will be mitigated in some units with subsoiling to meet Forest Plan Standards and Guidelines.

Comment: Erosion and sedimentation is already taking place in the areas of the fire. The USFS must quantify these variables and make scientifically based predictions for future increases or decreases, based on all past, present and reasonably foreseeable future actions. In order to meet the requirements of the NFMA and the Deschutes LRMP, the forest service will need site-specific measurements of soil and water quality conditions from the proposed planning area. (30-8)

Response: The EIS quantifies erosion and sedimentation rates in the post fire environment for each of the three burn severities (FEIS p.92. Table 3.3-5). Proposed activities could alter erosion rates on up to 5% of Spring Creek, 3% of Street Creek, 1.5% of Metolius and <1% of Lower Fly Creek subwatersheds by creating compacted skid trails and landings. Although approximately 13% of the Spring Creek subwatershed is estimated to be detrimentally compacted from past harvest activities, a portion of the 5% predicted to be impacted under implementation of Alternative 2 would overlay areas of existing detrimental disturbance. Maximum total detrimental disturbance following the implementation of Alternative 2 could cumulatively be 21% of the Spring Creek subwatershed, but is likely to be slightly less than this figure.

Snags, large woody material

Comment: The DEIS completely fails to take a hard look at the serious environmental consequences of salvage logging in terms of snags, large woody material, and wildlife habitat. (34-35, 34-44, 35-36, 35-122, 37-92, 37-98, 37-125)

Response: Information on snags, large woody debris, and wildlife habitat can be found on pages 132-208 of the DEIS (FEIS pp.219-293).

Snag and Down Woody Material Retention/Levels:

Comment: Meeting minimum wildlife habitat levels in the aftermath of logging is not good enough. Need to relate how the fire limits future snag recruitment and the difficulty of meeting snag and down wood levels in the critical periods several decades out. (37-97)

Similar Comment (34-44)

Response: Page 37 of the Wildlife Report addresses fall rates of snags within the area.

Comment: Meeting Forest Plan requirements and species needs will require retaining virtually all snags but the DEIS avoids this issue. (34-9)

Response: Snags are being left in accordance with the Metolius LSRA. That means snag retention will be consistent with LSR standards across the entire project area, just not in the LSR. Snag retention levels for alternative 2 can be found on page 27 of the DEIS (FEIS p.40).

Comment: Snags and green trees for replacing snags are left in harvest areas not met, snag gaps are exacerbated by salvage logging. (2-1, 2-2, 34-8, 35-10, 35-23, 37-18, 37-137)

Response: There will be no harvest of trees expected to live for an extended period of time. The only trees that will be removed are trees that are dead or severely damaged. Within the LSR only dead trees will be removed. Therefore, trees expected to live for an extended period of time will be left in the units and will supply the area with snags in the future as they die. Also, snags are being left in accordance with the Metolius LSRA. That means snag retention will be consistent with LSR standards across the entire project area, just not in the LSR. Snag retention levels for alternative 2 can be found on page 27 of the DEIS (FEIS p.40). The FEIS has been updated to include projections of snags and down wood over time. These area located in chapter 3.6.

Comment: Wildlife indicators must account for snag habitat gap that will occur after most snags fall down and new stands begin. We can affect timing of both the beginning and end of snag gap and determine the duration of the gap. Salvage will cause species to leave early and return late. (34-35, 34-63)

Response: Information on snags and wildlife habitat can be found on pages 217-293 of the FEIS. In addition studies of snag fall rates show that about half of the snags created

by a disturbance event are on the ground within ten years. Miller and Keen (1960) reported on studies of snag longevity in large-diameter beetle-killed ponderosa pine. They found that 85% of the snags were still standing after five years, but that between 5 and 12 years, the rate of fall increased rapidly. At the end of 10 years, about 40% of the snags remained (50% of the snags had fallen by the eighth year after death). About 10% of the snags were still standing after 32 years. Projecting these numbers further would lead to the conclusion that there are probably very few snags that stand for 100 years. Figures 3.6-7 through 3.6-10 of the FEIS predict snag retention and fall down rates over a 100 year period. The reader is allowed to compare alternatives and even when looking at the no action alternative a very small percentage of the landscape will have high snag densities of snags over 21 inches dbh.

Comment: Wildlife indicators must consider optimal levels of snags over time not just minimum levels after logging. (37-135)

Response: Snag retention levels are located in the REIS on pages 40 and 45, and are consistent with the Metolius LSRA. The LSRA numbers were used across the landscape within the harvest units. There is also approximately 12,000 acres of national forest within the fire that will be left as snag habitat, unless along a main road and identified as a hazard tree.

Comment: How will long-term snag levels be met where green trees aren't available? All largest snags must be retained. (37-117b)

Response: Snag retention levels are described on page 45 of the FEIS. FEIS p.235-237 in the cumulative effects section explains the future snag recruitment in areas that suffered stand replacement fire will be extremely low until green trees large enough can be recruited. The FEIS Figures 3.6-7 through 3.6-10 (pp. 203-205) predict snag densities over the landscape for the next 100 years. The reader is allowed to compare alternatives, and even with the no action alternative a small percentage of the landscape will have high snag densities of snags greater than 21 inches in the next 100 years.

Comment: Agency must avoid any reduction of existing or future large snags and logs. (37-88)

Response: There is approximately 12,000 acres where there will be no harvest of snags unless they are identified as a hazard tree along main roads. Within the harvest units snags will be retained in accordance with the Metolius LSRA for all units, not just units within the LSR. Page 40 of the FEIS outlines snag retention levels.

Comment: Additional snags should be left because future fires and illegal firewood cutting is almost certain to take a heavy toll on snags over the next several decades. (37-95)

Response: Outside of the harvest units all snags that are not identified as hazard trees along main roads will be left. Within the units snags will be at specified retention levels outlined on page 40 of the FEIS.

Comment: The DEIS does not address the fact that the DecAID advisor is not time dynamic simulator and the Forest Service must incorporate snag fall rates and snag recruitment rates into the analysis in order to use this tool appropriately. (37-90)

Response: All large snags identified for retention will be protected during harvest and post harvest activities (see page 8 and page 42 of the Draft Wildlife Report).

Comment: Salvage removes largest trees and will harm wildlife because larger snags persist longer and provide valuable ecosystem services longer and then serve longer as down wood. (34-18)

Response: Snag retention guidelines for alternative 2 can be found on page 40 of the FEIS. In areas treated within the mixed-conifer wet plant association group, 85% of the snags retained are over 15" dbh and within the mixed-conifer dry plant association 83% are over 15" dbh. In the ponderosa pine wet 78% are over 15" dbh and in the ponderosa pine dry 100% of the snags retained are over 15" dbh.

Comment: DO NOT simplify or homogenize ecosystems. Disruption of historical patterns of disturbance together with management that simplified the ecosystems (1) made ecosystems more homogeneous, (2) removed small-to intermediate-scale disturbance that creates heterogeneity (patchiness), (3) opened the way to invasion by exotics, and (4) led to the development of novel alternative stable states of low diversity and productivity, and decreased sustainability of the goods, services, and amenities we rely on our natural and semi-natural systems to provide. Thus, diversity, invasibility, and biocomplexity are linked ... (37-140)

Response: The proposed action is not simplifying or homogenizing the Eyerly Fire landscape. Much of the existing diversity would be retained since over 70% of the fire area would not be impacted. Treatment units selected would meet management direction to provide a mosaic of conditions. A purpose of the proposed action is to restore forest vegetation and fuels conditions on a portion of the area that would support the use fire as a disturbance process. Other design elements of the action alternatives are included to retain and enhance diversity across the landscape such as: snags will be left individually and in clumps, no activity within RHCA/RRs, and avoidance of existing noxious weed populations.

Comment: Leaving ample densities of snags following fire can help maintain a minimal snag resource during the 20 to 40 year postfire period when many snags have fallen. (37-179)

Response: Outside of harvest units all snags that are not identified as hazard trees along main road will be left. Within the units snag densities will be left that will meet the Metolius LSRA requirements. Within the FEIS Figures 3.6-7 through 3.6-10 show a prediction of snags overtime that allows the reader to compare alternatives. Even in the no action alternative there is an very limited percentage of the landscape that will have high densities of snags over 21 inches.

Cumulative Effects of the Metolius Basin project:

Comment: Cumulative effects analysis for the Metolius Basin project must include the Eyerly fire effects. (37-180)

Response: Cumulative effects analysis for the Metolius Basin project is outside the scope of the Eyerly Fire Salvage ID Team. However the actions proposed in the Metolius Basin Project and other past (including recent wildfires) and reasonably foreseeable future actions are considered in the description of cumulative effects for the Eyerly Fire Salvage FEIS.

Project Design: Down Wood

Several comments identified the value of maintaining down wood across the landscape for hydrologic and soil function, as well as to benefit sustainable wildlife habitat.

Comment: Page 147 describes the down wood component of pine marten habitat as requiring 8-20 pieces of down wood >30 inches dbh. The Forest Service must meet this requirement in mixed conifer sites unless they have effectiveness monitoring data to show that viable populations can be maintained with less, but page 191 indicates that presence/absence surveys have not been done, let alone effectiveness monitoring surveys. The Forest Service must look not just in the immediate aftermath of the fire and salvage logging, but decades in the future when the forest grows over the fallen snags and down logs. (37-97)

Recognize that dead and down wood are key elements of the forest ecosystem. (37-147)

Response. Maintaining down wood across the landscape will benefit certain species of wildlife. Outside the identified harvest units all snags that are not identified as hazard trees along main roads will be left and eventually will contribute to down wood. Within the harvest units snags retention guidelines outlined on page 40 of the FEIS will eventually contribute to down wood as snags fall. The down wood in all units will represent the species composition of the stand. In the harvest units down wood that survived the fire should be retained and protected to the greatest extent possible from disturbance during treatment (e.g. fuels treatments and yarding) which might otherwise destroy the integrity of the substrate (ROD C-40). For all units outside the LSR, leave a minimum of 120 linear feet of logs per acre greater than or equal to 16" in diameter and 16 feet long. Decay class 1 and 2 logs can be counted toward this total (ROD C-40). In the units that are within the LSR tons per acre by Plant Association Group from the Metolius LSRA will be used as what to leave as down wood. The table outlining tons per acre to be left in the LSR can be located in Chapter 2 of the FEIS.

Metolius Wildlife Primitive

Project consistency with Metolius Wildlife Primitive (MWP) was a concern of many commenters.

Comment: Salvage logging will violate management objectives for the Metolius Wildlife Primitive (MWP) area that includes maintaining ecological processes largely unmanaged. (37-11)

Economics reasons for salvage is improper for the MWP considering timber harvest is not scheduled in this area. The goal is to protect and perpetuate an predominately unmodified natural environment to provide habitat for a wide variety of species and to specifically enhance habitat for bald eagles. (37-8)

Salvage proposed does not protect or create habitat only degrades habitat now and in the future. (37-10)

Inconsistencies between salvage logging and meeting goals and objectives for Metolius Wildlife Primitive. Salvage cannot be allowed to interfere with natural ecological processes. (37-4, 35-20)

Fuels treatments must be consistent with Metolius Wildlife Primitive objectives. (40-3)

The MWP states that the area will provide adequate habitat for wildlife species and the design of the project will not meet the needs of wildlife. (37-181)

Need to discuss short and long term wildlife function of the MWP. (37-209)

Salvage logging disrupts post-fire ecological processes. (37-210)

The Forest Service must have monitoring data to show that salvage logging will meet the goals and objectives of the MWP. (34-99)

Response: Information regarding the Metolius Wildlife Primitive LRMP land allocation can be located in the DEIS on pgs 11, 15, 25, 29, and 149 and within the Draft BE on pg 17. The goal of the Metolius Wildlife Primitive allocation is to protect and perpetuate a predominantly unmodified environment where natural ecological processes can continue. The goal is to provide habitat for a wide variety of wildlife species and manage for bald eagles. However, within the general theme and objectives, the LRMP states that bald eagles are known to inhabit a portion of this management area.

The project design to salvage within the Metolius Wildlife Primitive is consistent with the LRMP based on the following:

- The intent of the allocation is to protect and perpetuate a predominately unmodified environment the Eyerly fire modified the environment.
- M 20-7 states there will be no scheduled timber harvest within the allocation.
- M 20-8 states timber harvest will be allowed in catastrophic situations and efforts will be made to protect or create suitable wildlife habitat during activities. Of the approximately 4,800 acres of this allocation within the project area, 690 acres (14%) are proposed for treatment. Therefore, 76% of the land allocation within the project will not be treated. The 690 acres proposed for treatment will provide habitat for a variety of wildlife species associated with open post-fire environments.
- M 20-30 states that natural fuel loading is the standard and fuel reduction will be achieved through intensive utilization to the extent possible. Therefore, fuel treatments in order to reduce fuels with the goal of returning fire to the landscape are within the intent of the Metolius Wildlife Primitive area.

Bald Eagle Effects

Comment: Project removes too many large trees suitable for bald eagles. Science indicates that eagles use trees greater than 14 inches dbh. The Forest Service must retain all large snags within 3 miles of the Metolius River and Lake Billy Chinook for bald eagles. (37-98)

Similar Comments (37-9, 40-5)

Response: Information regarding bald eagles can be found in the FEIS on pages 195-196:239: & 242-245, DEIS on pages 149-151 and the Draft Biological Evaluation (BE) on pages 17-23. The FEIS, DEIS and draft BE all discuss habitat preferences and define suitable habitat. In addition, suitable habitat is defined in the Deschutes LRMP (p. 4-170): suitable nest and perch trees should exceed 110 feet and 40" dbh. There are no proposed harvest units within suitable bald eagle habitat. The only activity occurring within suitable habitat is the removal of identified hazard trees. This will occur along County Road 64 (approximately a 4 mile stretch) and within campgrounds. Most hazard trees proposed for removal occur some distance away from the shoreline of Lake Billy Chinook and the Metolius River and outside known nest groves. These are less likely to be utilized by eagles due to their proximity away from existing waterbodies. An area approximately 1.5 miles from the Metolius River and Lake Billy Chinook has been identified as the area of use by bald eagles. Anthony et al. (1995) found that nests are usually constructed within 1 mile of foraging habitat, which includes large rivers, large lakes, and reservoirs. A buffer was incorporated into the 1-mile recommendation in order to include known roost sites. In addition, the 1.5-mile area approximately follows the topographic break along the Metolius River and Lake Billy Chinook.

Comment: Salvage will severely degrade the value of the AWA as habitat for late-successional species. (Eliminate habitat for some species and delay return of some species). (34-54, 35-121, 37-10)

Response: Information on late-successional forests can be found in the Draft Wildlife Report on pages 18-21. There will be no harvest of any late-successional habitat throughout the entire project area. Also, snag retention levels for the AWA and all land allocations are snag numbers that are taken from the Metolius LSRA and can be found on page 27 of the DEIS.

Comment: Among these concerns are the agency's continuing use of the archaically outdated Forest Plan, which was adopted in 1990, and has only been peripherally amended to include the barest, inadequate pieces of numerous scientific research reports, conservation science, ecological, wildlife, watershed, and fisheries needs, goals, and objectives. Federal environmental policy laws and federal judicial case-law clearly require that agency Forest Plans be periodically updated, and be amended to incorporate new scientific research, ecological needs, and conservation goals. Use of this Forest Plan could be perhaps be partially justified if the agency disclosed the Forest Plan's legal and scientific failings through the NEPA process in this DEIS, which it has failed to do, as well as disclosed the relevant scientific research, and changes in conservation goals (including the compiled science and guidance of the ICBEMP), and identified the inadequacies of the amendments to date of the Forest Plan. (34-12)

Response: LRMP requirements are out of the scope of the Eyerly Fire Salvage ID Team.

Big Game Effects

Comment: Salvage is not required to develop cover for big game and may delay regeneration of big game cover. (37-182)

Response: Salvage is not required to develop cover for big game, however it will not delay regeneration for big game. In Sexton's thesis (1998) only tree height in 1994 was statistically greater in unplanted control plots compared to unplanted salvage plots. However, this had a p-value of 0.2, which does not provide enough evidence to reject the null hypothesis (Triola 1997) and should not be considered statistically significant. In addition, this data was preliminary because it only included 1 to 2 seasons of re-growth. Continued research on these same plots 6 to 7 years after the salvage show no statistical difference between control plots or treatment plots regardless of planting (Malaby 2002).

Comment: Removal of post-fire vegetation (dead trees) will remove cover. (34-84)

Response: The LRMP defines thermal cover for deer as an area of at least 6 acres that has trees at least 30 ft tall and a canopy closure of at least 40%. While the elk thermal definition is similar with at least 10 acres of trees that are at least 40 ft tall and a canopy closure of 40%. Areas that meet the definition of thermal cover for big game (deer and elk) are not areas that are identified for proposed treatments. The DEIS and the draft wildlife report both state that thermal cover is virtually non-existent in areas that have been identified for treatments. It is also important to note that the definition of thermal cover is based on canopy cover and the project is designed to only remove dead or severely damaged trees, which do not add to canopy cover. The LRMP identifies deer and elk hiding cover as areas at least 6 acres in size that are capable of hiding 90% of an adult animal from human view at a distance of 200 ft (Thomas 1979). The DEIS and draft wildlife report both state that hiding cover is virtually non-existent in the areas identified to be salvaged, however standing snags can provide minimal hiding cover. However, the minimal hiding cover that snags and severely damaged trees does not meet the definition of hiding cover.

Comment: EIS is inconsistent when analyzing big game habitat. First states snags and down wood provide some thermal and hiding cover, then fire reduced cover and area doesn't meet S&Gs, and then salvage won't impact big game habitat. (34-96)

Response: The LRMP defines thermal cover for deer as an area of at least 6 acres that has trees at least 30 ft tall and a canopy closure of at least 40%. While the elk thermal definition is similar with at least 10 acres of trees that are at least 40 ft tall and a canopy closure of 40%. Areas that meet the definition of thermal cover for big game (deer and elk) are not areas that are identified for proposed treatments. The DEIS and the draft wildlife report both state that thermal cover is virtually non-existent in areas that have been identified for treatments. It is also important to note that the definition of thermal cover is based on canopy cover and the project is designed to only remove dead or severely damaged trees, which do not add to canopy cover.

Comment: Limited snag retention will reduce cover values but does not disclose actual effect on big game (p.172). (34-97)

Retaining large quantities of snags will help provide some hiding cover for mule deer and elk. (34-98)

Response: The LRMP defines thermal cover for deer as an area of at least 6 acres that has trees at least 30 ft tall and a canopy closure of at least 40%. While the elk thermal definition is similar with at least 10 acres of trees that are at least 40 ft tall and a canopy closure of 40%. Areas that meet the definition of thermal cover for big game (deer and elk) are not areas that are identified for proposed treatments. The DEIS and the draft wildlife report both state that thermal cover is virtually non-existent in areas that have been identified for treatments. It is also important to note that the definition of thermal cover is based on canopy cover and the project is designed to only remove dead or severely damaged trees, which do not add to canopy cover. The LRMP identifies deer and elk hiding cover as areas at least 6 acres in size that are capable of hiding 90% of an adult animal from human view at a distance of 200 ft (Thomas 1979). The DEIS and draft wildlife report both state that hiding cover is virtually non-existent in the areas identified to be salvaged, however standing snags can provide minimal hiding cover. However, the minimal hiding cover that snags and severely damaged trees does not meet the definition of hiding cover.

Comment: Better to retain what little cover we have left.

Cite reference related to easing movement with salvage harvest for big game. (32-5)

Response: See above response for cover. Big game movement through the fire area may be impeded by dead and down wood. In fact Lyon and Jenson (1980) state that in uncut forests with substantial amounts of dead and down materials create barriers to movement of elk. Lyon and Jenson (1980) then go on to say that elk apparently avoid areas with large accumulations of dead and down wood, however they note they are not excluded.

Late-Successional Reserve (LSR)

Comment: Consider all negative effect of logging on LSR objectives (LSRA consistency). (37-211)

Retention of large snags and logs is essential to natural recovery and none of this material can be viewed as in excess of ecological needs. (37-183)

LSR indicators fail to consider forest complexity, diversity, snag habitat, and future snag gap. (37-125)

Salvage logging has no net beneficial affect on LSR's. (34-105)

Response: See write-up on NWFP consistency. The Eyerly Fire Salvage Project is in the process of getting approval from REO.

Comment: The LSRA says that habitat, fuels, and scenery must all be considered before felling hazard trees. (37-126b)

Response: Pages 236-244 of the FEIS show that hazard trees were included in the analysis of all alternatives. See write-up on NWFP consistency. The Eyerly Fire Salvage Project is in the process of getting approval from REO (R6 Regional Environmental Office).

Comment: Reduction of wildlife function by salvage immediately after harvest and in the long-term is inconsistent with LSR S&G's, which require salvage not be detrimental to wildlife habitat now and in the future. (37-212)

Response: Table 4 in the Draft Biological Evaluation addresses Threatened, USFS Region 6 Sensitive, USFWS Species of Concern, and Proposed Threatened species. Only Species of Concern and R6 Sensitive Species with potential habitat were analyzed. Species that appear in table 4 that are not further addressed are outlined on page 17. Table 6 on page 18 of the Draft Wildlife Report shows what Management Indicator Species and USFWS Species of Concern were addressed in that document.

Comment: The EIS does not address the focal species found in the Metolius LSRA. (37-190)

Species of concern and focal species discussed in the LSRA are not fully considered in the EIS. (37-192)

Response: There are two Management Areas from the LSRA that are within the project boundary. Management Area H's focal species are: Spotted owl dispersal habitat, pileated, white-headed, and black-backed woodpeckers, Williamson's sapsucker, northern goshawk, great gray owl, and Cascades frog (Alder Creek). While Management Area L's focal species are: Spotted Owl (Castle Rocks site), northern goshawk, white-headed woodpecker, Williamson's sapsucker, bald eagle near river, flammulated owl.

In the Metolius LSRA it states that potential Cascades Frog is limited to the Alder Creek Area. There are no proposed units within the Alder Creek riparian area, so the project will not effect potential Cascades Frog Habitat.

Comment: Final Draft Recovery for the Northern Spotted Owl states must retain all snags over 20 inches after a fire. (34-95)

The LSRA states to manage snags for representative sizes in the long-term. The DEIS will remove mostly large snags that are needed to meet the LSRA numbers. (37-191)

Response: The snag retention levels for Alternative 2 located on page 27 of the DEIS are snag retention levels straight from the LSRA.

Comment: The DEIS fails to recognize management strategy areas and their recommendations. (37-127)

Response: Management Strategy Areas are discussed in the Draft Wildlife Report on page 18.

Comments: The LSRA uses potential population that has been discredited so the Forest Service must consider this before salvage logging occurs. (37-193)

The LSRA recommends moving large wood from areas where it is abundant to where it is deficient (LSRA pg 118). (37-200)

The LSRA recommends leaving the largest snags and CWD to maintain black-backed woodpecker (LSRA pg118). (37-201)

The LSRA mentions concerns about lack of large snags in the Horn of the Metolius area. (37-208)

Response: While there may have been a lack of snags in the horn of the Metolius, there is not a lack of snags now. Alternative 2 calls for treating 4,846 acres and that will leave approximately 12,000 acres of fire created snags unharvested, and of the acres treated snags will be retained at levels taken from the LSRA (page 27 of the DEIS).

Comment: EIS removes existing snags and CWD contrary to LSRA (p.132) (37-194)

Response: The FEIS describes snags that will be retained for alternative and these numbers are taken from the Metolius LSRA. Down wood will also be left at levels outlined in the Metolius LSRA and described in chapter 2 of the FEIS. Standards and guidelines for snags and CWD are met as outlined in the Metolius LSRA.

Comment: EIS does not show how salvage will lead to rapid attainment of habitat characteristics for 10 species listed in LSRA appendix II (p. 154, 17, 1). (37-195)

Response: Snag retention guidelines for alternative 2 can be found on page 27 of the DEIS. In areas treated within the mixed-conifer wet plant association group, 85% of the snags retained are over 15" dbh and within the mixed-conifer dry plant association 83% are over 15" dbh. In the ponderosa pine wet 78% are over 15" dbh and in the ponderosa pine dry 100% of the snags retained are over 15" dbh.

Comments: ROD states intent of salvage in LSRs is to prevent negative effects. EIS fails to identify any negative effects the project would be preventing. (30-5)

LSR is over harvested and deficient of LWM. Fire created influx of LWM that should be retained. (37-203)

Salvage recommendations should be consistent with recommendations in the Draft Spotted Owl Recovery Plan. (37-204)

Adverse consequences listed in FEMAT (p.II-8) are not addressed in document. (37-207)

All commercial removal activities will impede development of high quality LSR habitat and in violation that salvage does not focus on long-term LSR objectives. (37-6)

Where safety and LSR objectives conflict, should consider the no action alternative. (37-202)

Response: See response for NWFP consistency, FEIS p. 386. The Eyerly Fire Salvage Project is in the process of getting approval from REO.

Cumulative Effects

Comment: Address cumulative effects of Eyerly fire on evaluation indicators. (34-4, 34-11, 37-2, 40-1)

Response: The existing condition takes into account the current post-fire condition. The Eyerly fire along with other fires on the Sisters Ranger District are discussed in the Cumulative effects section.

Habitat Needs of Woodpeckers, MIS and Stoc

Comment: Indicators must address habitat needs for woodpeckers, MIS, and quality of spotted owl foraging habitat now and in the future. (34-43)

Response: The indicators in the DEIS will address the effects of the alternatives on:

- Northern bald eagle essential habitat.
- Northern spotted owls.
- Snag, cavity nesting, and down wood habitat.

Comment: The EIS states that it is still unknown what snag levels are needed to provide quality habitat for cavity dependent species (p.133). (35-8)

Response: Page 133 of the DEIS states that it is still unknown what down wood levels are needed to provide quality habitat for species associated with down wood, it does not make this statement about snags.

Comment: Too vague and brief on how salvage logging will change use by some cavity excavators (p.145). (37-96)

Similar Comment (34-58)

Response: Page 145 of the DEIS discusses cumulative effects for cavity excavators. Predicted changes in snag habitat over time can be located in Figures 3.6-7 through 3.6-10 of the FEIS.

Comment: Should not do salvage because you would lose terrestrial and aquatic habitat for at least 93 species who use snags and down wood. (37-184)

Response: The effects of the project to species related to snags and down wood can be found on pages 133 through 145 of the DEIS. There is approximately 12,000 acres of post-fire habitat that will be untreated. Within identified units snags retention guidelines were taken from the Metolius LSRA and the retained snags will provide habitat for various species.

Comment: Most snag using wildlife species are associated with snags >14.2” dbh and about one third of these use snags >29.1” dbh. (37-185)

Response: Page 27 of the DEIS shows the snag levels that will be retained. In areas treated within the mixed-conifer wet plant association group, 85% of the snags retained are over 15” dbh and within the mixed-conifer dry plant association 83% are over 15” dbh. In the ponderosa pine wet 78% are over 15” dbh and in the ponderosa pine dry 100% of the snags retained are over 15” dbh.

Reallocation of Old Growth Areas

Comment: Re-allocation of OG areas is just an attempt to salvage OG, which will oversimplify the stands ability develop into an complex forest. (37-189)

Similar Comments (35-2, 35-21)

Response: Re-allocation of Old-growth can be found in the DEIS on pages 146-148. The distribution and minimum size of old growth areas were based upon the habitat requirements of the northern goshawk for ponderosa pine and marten for mixed conifer. However, both areas suffered stand replacement fire. Therefore, the old-growth areas are not meeting habitats requirements that they were set aside for, and designation of new areas that meet the habitat definitions for goshawks and martens have been designated according to LRMP guidelines.

DecAID

Comment: Explain DecAID tolerance levels. (34-58)

Response: The definition of tolerance level can be found on page 134 of the DEIS.

Comments: Far too much emphasis placed on the Lewis’ woodpecker. (37-86a)

Why was the Lewis’ woodpecker to chosen to analyze? (37-186)

Response: DecAID was used to analyze relevant species of cavity nesters that had post-fire data including black-backed woodpeckers, hairy woodpeckers, Lewis’ woodpecker, mountain bluebird, northern flicker, western bluebird, and white-headed woodpecker. Effects to these species can be found on pages 133 through 145 of the DEIS.

Comment: The Eyerly DEIS relies heavily upon the unproven and error-prone DecAID. tool. Snag fall and recruitment rates are not accounted for in DecAID as used by the agency. The agency’s reliance on DecAID in its pseudo “analysis” of potential impacts to snag dependent species fails to recognize that “DecAID is NOT: ... a snag and down wood decay simulator or recruitment model [or] a wildlife population simulator or analysis of wildlife population viability. ... Because DecAID is not a time-dynamic simulator ... it

does not account for potential temporal changes in vegetation and other environmental conditions, ... DecAID could be consulted to review potential conditions at specific time intervals and for a specific set of conditions, but dynamic changes in forest and landscape conditions would have to be modeled or evaluated outside the confines of the DecAID Advisor.” Marcot, B. G., K. Mellen, J. L. Ohmann, K. L. Waddell, E. A. Willhite, B. B. Hostetler, S. A. Livingston, C. Ogden, and T. Dreisbach. (34-36)

Response: The DecAID Advisor is a tool that has been developed as an alternative to the biological potential models that have previously been used to determine the sizes and numbers of snags to be left on the landscape following timber harvest. Johnson and O’Neil (2001) found that the biological potential models were invalid but offered no alternative methodology for determining snag numbers and sizes. DecAID is an Internet-based summary, synthesis, and integration of published scientific literature, research data, wildlife databases, forest inventory databases, and expert judgment and experience. The information presented on wildlife species use of snags and down wood is based entirely on scientific field research and does not rely on modeling wildlife populations. As such, it offers a new way of estimating or evaluating levels of dead wood habitat that provide for a wide array of species and ecological processes.

Projections of dead standing and down wood levels are made through the use the Forest Vegetation Simulator (FVS) and the Fire and Fuels Extension (FFE). Results of the simulations were then compared to DecAID summaries. This analysis is found in Chapter 3, Wildlife section and in the Wildlife Resource Report.

Comment: Not well-suited to application in post-fire situations because too few sample points affected by fire are incorporated. (35-5)

Response: While the portion of DecAID that relies on CVS plots does not have post-fire data in it, the post-fire section that was used to analyze effects to black-backed woodpeckers, hairy woodpeckers, Lewis’ woodpecker, mountain bluebird, northern flicker, western bluebird, and white-headed woodpecker is based on post-fire habitats.

Comment: Page 143 says that the loss of large trees will decrease available replacement trees for several decades. Please carry this fact through the entire analysis and disclose the consequences for soil, small mammals, amphibians, fungi, martens and other predators, ants/pileated woodpeckers, microclimate, fuel moisture, and all the interactions thereof. (37-94b)

Unclear what salvage logging means for the woodpecker (p.138). (37-196)

Response: Page 138 of the DEIS suggests that different species of woodpeckers will have different reactions to the salvage logging. The studies explained on FEIS pp. 259-260 show that logging might displace some woodpecker species. Some species seem to show no preference toward logged or unlogged stands. While some species actually selected logged sites in the studies. FEIS Table 3.6-45 compares habitat changes by species based on numbers taken from DecAID.

Comment: [DEIS] Fails to recognize the temporal dimension to habitat development in post fire landscapes. (37-206)

Response: DecAID takes a snapshot in time and is not used as a temporal tool. However, Figures 3.6-77 through 3.6-10 shows predicted snag fall down rates and the figures allow to compare between alternatives.

Comment: CVS plots used to determine snag levels do not represent post-fire area well. (34-59, 37-91)

Response: While the portion of DecAID that relies on CVS plots does not have post-fire data in it, the post-fire section that was used to analyze effects to black-backed woodpeckers, hairy woodpeckers, Lewis' woodpecker, mountain bluebird, northern flicker, western bluebird, and white-headed woodpecker is based on post-fire habitats.

Comment: Compare dead trees greater than 21 inches dbh to the natural range of variability. (37-117a)

Response: The Table on page 27 describes retention levels for all units, plus all trees expected to live for an extended period of time will remain in the unit after activities also. There is also an estimated 12,000 acres of post-fire habitat that will not have any trees removed from it, unless they are identified as hazard trees.

Comment: How will species respond to removal of large dead trees, and how will the Forest Service maintain viable populations. (37-117c)

Response: See the viable population response, p. 588.

Comment: We are concerned about the affect of the planned transformation of the commercial logging units from burned multi-storied snag forests, to open near barren terrain where insufficient remaining snags are incapable of providing for the forest-cover which is necessary for continued goshawk use of this area. (34-69)

Response: The effects of the alternatives on goshawk habitat are described in the Wildlife section, Chapter 3 in the FEIS. Snag retention levels identified on page 27 of the DEIS outline what snags will remain. All trees expected to live will also remain in the units. The snags per acre will be met on a unit basis as outlined in Chapter 2 of the FEIS.

Comments: Why did the Forest Service list average snag densities and include areas outside of the logging areas. (37-187)

The project does not reflect all new information regarding snags and down wood. (37-188)

Response: The DecAID analysis is best done at the landscape scale. It is particularly important when planning salvage sales to determine the contribution that high densities of dead trees can make towards snag habitat in the adjacent landscape. DecAID is a synthesis of wildlife research and forest inventory data and represents new information regarding wildlife use and abundance of snags and down wood on forested landscapes across Oregon and Washington. DecAID is not a model; rather it is based on empirical data that provides a more solid basis for determining the number and distribution of snags. DecAID has been thoroughly peer reviewed and has been published in PSW-GTR-181.

Neotropical Migrant Information

Comment: Many species that rely on snags will also be affected by salvage as related to just analyzing Lewis' woodpecker. (37-86b)

Response: In the DEIS pages 132 through 145 analyze 7 species including the Lewis' Woodpecker that are cavity nesters that have been shown to use post-fire habitat. Also, in the DEIS on pages 199 through 205 addresses neotropical migrants and the effects of the project on them.

Comment: The proposed timber sales would significantly impact migratory birds in violation of the Migratory Bird Treaty Act, 16 U.S.C. §§ 703—712 (1994). (34-70)

Similar Comment (34-71)

Response: Effects discussing NTMBS can be found on pages 269 through 271 of FEIS.

Comment: The DEIS fails to consider the effects of reduced food sources and reduced structural complexity in the future forest. (37-197)

Response: The Eyerly Fire altered the habitat on the landscape and effects from the fire can be found in the cumulative effects section of the NTMBS section located on pages 203 and 204 of the DEIS.

Mixed Severity Treatments

Comment: Loss of large trees will decrease available replacement trees for several decades and what are the consequences of this loss (p.143)? (37-94a)

Response: The only trees that will be removed in the LSR are dead. In the rest of the allocation the only trees that will be removed are trees that dead or that are highly unlikely to survive for an extended period of time. That is true in the stand replacement and mixed severity areas.

Removal of Hazard Trees

Comment: The EIS fails to carry the recommendation of leaving large snags outside recreation areas through. (34-138)

Response: There will be no treatment of large trees within approximately 1 ½ miles of the Metolius River or Lake Billy Chinook that is not considered a hazard to forest visitors. Hazard trees would only include trees deemed to be hazardous along the 64 and 1170 road

and within Perry South and Monty Campground. All other large trees will be left within approximately 1 ½ miles of the Metolius River and Lake Billy Chinook.

Comment: The NWFP says to consider leaving hazard trees on site or topping as an alternative in valuable wildlife areas. (37-126a)

Response: Topping of hazard trees was not placed into an alternative based on the fact that over 17,000 acres of land was involved within the Eyerly Fire and there are many more snags on the landscape than historically.

Comment: Agency must do away with the caveat that they will protect snags “except where they create a safety hazard”. (37-213)

Response: Many trees were killed or severely injured in the Eyerly fire and are much more susceptible to falling or having large limbs or tops break out. The increased numbers of hazard trees has resulted in an elevated risk of injury or loss to forest users. Removal and utilization of hazard trees is proposed along the 1170 and 64 roads and within Perry South and Monty Campgrounds and along haul routes. Trees will be evaluated and rated for hazard levels and risk according to the guidelines of the Pacific Northwest Region publication “Long-Range Planning for Developed Sites in the Pacific Northwest: The Context of Hazard Tree Management”, Harvey and Hessburg 1992.

Comment: Agency should save snags by avoiding the activity in the hazard zone around snags. (37-214)

Response: Mitigation measures for snags can be found in the Draft Wildlife Report on page 41 and 42. One of those mitigation measures is protect large snags identified for retention during harvest and post harvest activities.

Comment: NEPA document must disclose how many snags will be protected vs. felled for safety under the preferred alternative. (37-215)

Response: All hazard trees will be removed for safety reasons. However, within the units prescription design was set up to protect large snags that have been identified for retention.

Comment: Large roadside hazards should be left on ground in LSR and riparian areas. EIS fails to explain whether these are needed to meet biological objectives. (34-57)

Response: Hazard trees within riparian reserves will be dropped and left as described on page 26 of the DEIS. Roadside hazards within the LSR will be removed in an attempt to reduce fuel loading along the roads for future fire suppression activities.

American Marten

Comment: FS must meet down wood requirement for marten in mixed conifer sites unless effectiveness monitoring is completed. (37-97)

Response: Surveys have not been completed. However, there is no suitable marten habitat (dense canopied late-successional stands) being harvested.

Comment: The EIS must address the future development of stands. 34-72

Response: Information regarding American marten can be found in the DEIS on pages 191-195 and the Draft Wildlife Report on pages 74-80. There is no suitable marten habitat (dense canopied late-successional stands) being harvested. Future development of habitat is addressed in the DEIS (pp. 194-195) and the draft wildlife report (pp. 74-80). In addition, snag and down wood material will be retained to meet requirements.

Pacific Fisher

Comment: EIS fails to recognize the quality of future fisher habitat and how salvage will severely degrade habitat by simplifying habitat structure. (37-106)

Response: Information regarding Pacific fishers can be found in the DEIS on pages 165-165 and the Draft Biological Evaluation (BE) on pages 54-59. There is no suitable habitat being harvested. Existing structure will be retained by meeting snag and down wood requirements.

Forest Plan Amendment for Big Game Habitat

Comment: Should not salvage big game habitat until a LRMP amendment is completed to incorporate Biological Winter Range for both deer and elk. (34-104)

Response: While the forest plan does not incorporate biological winter range for deer and elk, the layers are used in conjunction with key elk areas and deer habitat identified in the LRMP to make informed decision that are consistent with the Deschutes National Forests big game management strategy that is defined in the LRMP on page 4-55 for elk and 4-58 for mule deer.

NWFP (STOC Range)

Comment: The EIS fails to recognize that the Admin. Withdrawn/Metolius WL Primitive area is part of the spotted owl conservation program adopted by the NWFP (p.152). (34-100)

Response: Within the DEIS (pg 152) Table 3.6-18 shows all NWFP allocations and the Administratively Withdrawn Areas are included as spotted owl habitat.

Comment: Recommendations of draft spotted owl recovery plan are pertinent: trees >20" should be protected in salvage situations. (34-101)

Response: The Forest Service does not have to follow draft document recommendations. The 1994 ROD of the NWFP is the standards and guidelines that must be met. A more thorough description of how the project meets NWFP consistency can be found in the letter that has been produced and sent to the REO.

Comment: EIS fails to discuss the 10 acre minimum and 40% canopy cover requirements for salvage logging in LSRs. (37-102)

Response: The Eyerly project is meeting all the guidelines for salvage, including all units are greater than 10 acres and there are no units with canopy closure of greater than 40%. A more thorough description of how the project meets NWFP consistency can be found in the letter that has been produced and sent to the REO.

Comment: Forest Service said it considered sensitive areas, but extensive salvage logging is occurring in LSR's, CHU's, and AWA. (37-205)

Response: Sensitive areas were considered. LSR's, CHU's, and AWA's are not sensitive areas, but they are land allocations. All standards and guidelines area being met in all the allocation within the NWFP. A more thorough description of how the project meets NWFP consistency can be found in the letter that has been produced and sent to the REO.

CHU

Comments: Area should be managed for spotted owl recovery not just avoidance of jeopardy. (37-101)

Must disclose the current condition of the CHU and how this CHU fits into the species recovery. (35-11)

Response: The project is not degrading habitat within the CHU. All treatments within the CHU are in stand replacement areas with the attempt of lowering fuel loads for sustainable forests in the future.

Snag development on OG/Maffei

Comments: Very limited view of how snags are created in old growth stands over time. FS must research this matter further. (34-103)

Response: Studies of snag fall rates show that about half of the snags created by a disturbance event are on the ground within ten years. Miller and Keen (1960) reported on studies of snag longevity in large-diameter beetle-killed ponderosa pine. They found that 85% of the snags were still standing after five years, but that between 5 and 12 years, the rate of fall increased rapidly. At the end of 10 years, about 40% of the snags remained

(50% of the snags had fallen by the eighth year after death). About 10% of the snags were still standing after 32 years. Projecting these numbers further would lead to the conclusion that there are probably very few snags that stand for 100 years.

These views are based on east of the Cascades forest conditions, which take a very long time to establish trees large enough to meet the definition of old-growth. Also, see the FVS-FFE tables in the wildlife section that predicts few large snags (i.e. over 21 inches) will be left standing on the landscape in 100 years in any alternative.

NWFP and flammulated owls and white-headed woodpecker

Comments: The DEIS does not explain the NWFP requirements for flammulated owls or white-headed woodpecker. (34-93)

Salvage logging in the matrix must protect trees over 20 inches for the whwp. (34-94)

Response: The NWFP ROD (2001) states that snags over 20 inches dbh are valuable to white-headed woodpeckers and flammulated owls. The ROD also states that snags over 20 inches dbh may be marked after retaining best available snags to meet 100% potential population. However, all the stand replacement areas are not within suitable habitat. Mixed severity stands occur in potential habitat, however we are meeting snag requirements in the mixed severity and stand replacement areas.

Metolius WA

Comment: EIS fails to mention recommendation from watershed analysis – salvage logging should use a careful approach to avoid eliminating future management options and avoid unnecessary impacts to other resources (p.143). (37-94c)

Response: Snag retention levels will be left based on LSRA snag retention levels. Therefore, the LSRA standards and guidelines are met. The DEIS states that snags will be derived from competition in NRF. This is based on the assumption that it will take approximately 200 years or more to get trees to 21 inches dbh. By the time the large trees are present most of the snags that are retained in the units and the snags that are left in the unharvested areas will at least be on the ground if not decomposed and part of the soil.

Comment: Watershed analysis states that retaining large snags and logs are valuable in young stands as they grow. EIS states that snags will be derived from competition. Should conform to watershed analysis recommendation. (37-125)

Response: Page 27 of the DEIS states snag retention levels. Those snags are the snags that are going to be left on the landscape. The down wood requirements are mitigation measures, which can be located on pages 41 and 42 of the Draft Wildlife Report.

Riparian Reserves and Upland effects

Comment: EIS fails to show how salvaging the uplands will affect species listed in Appendix A of the watershed analysis. (37-216)

Response: All species that had habitat within the project area and are required to be analyzed can be found in the DEIS of pages 132 through 207 and in the Draft BE and Wildlife Report. A more detailed report for these species can be found in the Draft Biological Evaluation and the Draft Wildlife Report.

Pileated Woodpeckers

Comments: NEPA analysis failed to consider new information on pileated woodpeckers. (34-58)

Determining pileated woodpecker population potential based on nesting sites alone will not provide adequate habitat for viable populations. (37-138)

Response: Pileated woodpecker habitat as identified in the Metolius LSRA within Appendix II states that habitat characteristics are mixed conifer wet and dry within late-successional stands. The Eyerly project is not proposing treatment of any late-successional habitat in any alternative.

Viable Populations

Comments: Project fails to retain enough snags to provide habitat for viable populations of cavity dependent species. (37-89)

Regional standards for snags and down wood fail to incorporate the most recent science indication that more snags and down wood are required in order to maintain species viability. (37-199)

Object to use of “proxy on proxy” approach where agency uses unverified habitat modeling rather than actual population surveys as a means to ensure viability of MIS. (34-91)

EIS and specialist reports never explain what the population levels are for MIS. (35-8)

FS must refrain from destroying habitat until population monitoring is completed and documented for viable species. (34-92)

Response: Over 70 percent of the Eyerly fire area will remain in an unharvested condition, and there will be an elevated level of snags across these acres. In areas that would be harvested we are retaining snags at or above levels outlined in the Metolius LSRA. In the harvested areas: 1) Harvest in the LSR meets or exceeds Metolius LSRA snag retention guidelines, 2) Harvest in the matrix lands meets or exceeds NWFP snag retention guidelines, 3) Harvest in the AWA meets or exceeds NWFP and LRMP snag retention guidelines, 4) Harvest outside of the NWFP meets or exceeds LRMP snag retention guidelines. A detailed table showing predicted changes in habitat for post-fire cavity dependent species can be located in Table 3.6-42.

The Eyerly Fire Salvage FEIS meets or exceeds standards described in the Metolius LSRA, LRMP, NWFP, and Eastside Screens. In addition the FEIS incorporated recent science described in the DecAID advisory tool.

On November 28, 2000 the Region 6 Regional Forester updated the sensitive animals list to include species for which population viability was a concern. With the exception of the northern spotted owl, northern bald eagle, and wolverines, none of the MIS that occur in the Eyerly project area have been identified as species whose viability is of concern. A detailed analysis of northern spotted owls, northern bald eagles, and wolverines can be located in the Biological Evaluation. Where surveys were not completed for MIS, we assumed habitat was occupied.

STOC Habitat

Comment: The Forest Service claims that there will be no impact to owls because there will be no logging in suitable owl habitat (DEIS p. 154). The DEIS does not disclose that many green trees that are suitable owl habitat will be logged as part of this project. The DEIS also fails to disclose that much of the burned landscape still contains suitable owl habitat. (35-10)

Response: There are no salvage units in identified suitable owl habitat, which is considered nesting, roosting, and foraging habitat (NRF). There are also no salvage units identified in dispersal habitat. These are both found in the DEIS on page 154 and 155.

Comment: Studies show that spotted owls are capable of returning to habitat even highly altered by fire (M.Bond et al. – northern CA study). (34-51)

Similar Comment (34-39)

Response: Surveys were conducted to R-6 protocol (6 visits) on all available habitat and in historic activity areas within 1 ½ miles of the project area on public lands in 2003. Surveys are scheduled again for the 2004 season. If any activity areas are located mitigation measures will be set in place to protect newly discovered activity areas.

Comment: Fires may be beneficial to the owls by creating ecotones that may improve foraging habitat. (34-50)

Response: Within the fire perimeter there is no spotted owl suitable habitat and there is no suitable spotted owl habitat proposed in the Eyerly Fire Salvage Project. This can be found on page 154 of the DEIS.

Comment: Larger snags should be retained because they provide basis for restoration of late successional forest conditions that will support future NRF habitat. (34-102)

Response: Page 27 of the DEIS shows the snag levels that will be retained. In areas treated within the mixed-conifer wet plant association group, 85% of the snags retained are over 15" dbh and within the mixed-conifer dry plant association 83% are over 15"

dbh. In the ponderosa pine wet 78% are over 15" dbh and in the ponderosa pine dry 100% of the snags retained are over 15" dbh.

Comment: The Northwest Forest Plan ROD also says that "salvage operations should not diminish habitat suitability now or in the future." But this project will diminish habitat quality by removing standing trees for logging profiteering and by putting adjacent forests at risk from damage from edge effects. (34-52)

Response: Within the fire perimeter there is no spotted owl suitable habitat and there is no suitable spotted owl habitat proposed in the Eyerly Fire Salvage Project. This can be found on page 242 & 245 of the FEIS. The proposed action is consistent with direction found in the Metolius LSRA.

Comment: Proposed activities will violate requirement to maintain optimal late successional habitat and reduce spotted owl prey habitat. (37-198)

Response: The Eyerly Fire Salvage project proposes not treatment activities in old and late structural stands that information can be found on page 19 of the Draft Wildlife Report. On page 154 of the DEIS it states that no spotted owl suitable habitat and there is no suitable spotted owl habitat proposed in the Eyerly Fire Salvage Project.

MBTA

Comments: If activity occurs during the nesting season, harvest will likely kill nesting migratory birds in violation of the MBTA.

Protect the following birds of conservation concern (BCR 5 list).

Response: Currently the USFS and the USFWS are working on an agreement in accordance with the MBTA. The wording of the MBTA, while it reads very similar to ESA on the prohibitions on take (including harm, harass, pursue), however the MTBA pertains to intentional atake, whereas ESA it also covers unintentional take. In other words if there is unintentional take while completing a project the USFS is not in violation of the MTBA. However, it is the wildlife biologists responsibility to provide information to the decision maker on the effects of the proposed action and alternatives on migratory birds as directed under NEPA. The focal species in the land bird conservation plans were added to NEPA analysis, to disclose the effects to habitat for these birds along with the qualitative effects summaries of destroying nests or disrupting nesting behavior if the project is planned during nesting season.

Comment: The Environmental Consequences did not address the effects of noise from hazard tree removal and other human activities on bald eagles. These activities have the potential to disturb bald eagles if conducted during the nesting season or winter roosting period, and in proximity to nest sites and communal roosts, respectively. (3-3)

Response: I agree that noise from the removal of hazard tree and other activities along the Metolius River and Lake Billy Chinook have the potential to disturb eagles. However, to

minimize the effects of the hazard tree project on bald eagles the all snags within suitable bald eagle habitat that are not hazards (pose a threat to human safety) will be retained. The only suitable habitat that will be treated is a narrow strip (approximately 110 ft) along the 1170 and 64 roads and within and around the campgrounds. Seasonal restrictions will be implemented within 1/4 mile (402 meters) of any known or newly discovered eagle nest or known roost sites for all disturbance activities. The seasonal restriction zone has been extended to include all of Perry South Campground for the Spring Creek nest site due to topography and lack of a buffer to reduce noise impacts. All potential perch or roost trees (snags greater than 21 inches dbh) outside recreation facilities along the Metolius River and Lake Billy Chinook will be protected.

Comment: Wolverine are already listed as “Threatened” in Oregon by the Oregon Department of Fish and Wildlife, however the Forest Service fails, within the DEIS, to disclose any consultation with ODF&W regarding wolverine, in violation of the requirements of the NEPA, and in contravention to the necessary cooperative interagency efforts which are sorely needed to begin the recovery of this species and its required habitat. (34-65)

ODF&W was contacted during the development of this project and there issues were taken into consideration during the development of alternatives. ODF&W was also sent a copy of the DEIS to review and had a chance to comment. However, the USFS is not required to consult with ODF&W.

Comment: The Eyerly area, and the surrounding adjacent forests have been extensively logged in the past. The forests throughout are severely fragmented, and it is likely that numerous wildlife species endemic populations suffer from imperiled viability due to the significant adverse cumulative impacts from this prior logging. Proposing yet more logging, on top of both the recent fire and extensive past logging—along with other management projects proposed for forest habitat nearby, only further compounds the lack of viable wildlife habitat in the area. If approved, the action alternatives would further (illegally) jeopardize the viability of numerous wildlife species within the area. The proposed project would likely result in the unethical extirpation of wildlife species from the project area. (34-11)

Response: This can be answered with the other viability questions.

Comment: It is possible that wolverine may use the planning area as part of their seasonal and nocturnal foraging and territorial wandering patterns. Wolverine are known to have a 150 square mile or more winter range, and are also known to utilize roadless and wilderness areas—including the areas surrounding these preferred places. It is also well known that human disturbance related to the proposed activities is likely to alter the movement patterns of wolverine and other wildlife species. The presence of the Metolius Breaks roadless area within the project area, and the lack of human intrusion into the area during the winter, increases the potential for seasonal as well as nocturnal use of the project area by wolverines. (34-64)

Response: There are no activities proposed within the roadless area.

Comment: The DEIS failed to provide a thorough examination of how the project will impact both hares and squirrels, as well as other wildlife species which are potential lynx prey. Without complete analysis of how these prey species will be impacted, it is impossible to quantify and qualify the impacts to lynx. (34-62)

Response: All species that are required to be analyzed were and can be found in the Biological Evaluation and Wildlife Report.

Comment: The DEIS fails to disclose the current habitat quality for a variety of species, addressing both the fire's impacts and the cumulative impacts throughout the district's forests, impacts to LOS forest-dependent species including the current post-fire quality of both project area and adjacent LOS habitat and any corridors through the planning area connecting the LOS with adjacent contiguous forests. (34-43)

Response: There are no cumulative impacts to LOS habitat, because there is no proposed activity within LOS areas.

Comment: The DEIS fails to disclose if there are any Goshawk historic—or seasonally rotated-- nesting areas within or adjacent to the proposed Eyerly logging “units.” The DEIS also fails to disclose if the burned DOG areas may have contained nesting habitat for Goshawks either historically or in the recent pre-fire past. (34-66)

Response: There is only one known historic goshawk nest located in the project area and a description of the existing condition can be found on 189 of the FEIS.

Botanical Resources

Comment: The Project Design Elements for Noxious Weed Treatment (Section 2.8.2 on page 43) “encourages” operators to maintain weed-free equipment, and parking and staging areas, and to wash all equipment (including log trucks) after completing operations that involve travel along Road 1170-600, before moving to a new project area. The Department recommends operators be required to maintain weed-free equipment whenever they are working or traveling through areas with noxious weed infestations. (40-8)

Response: Two mitigations are addressed in this comment. The first, #11 on p. 43 of the DEIS, states: “Encourage operators to maintain weed-free equipment parking and staging areas.” Deschutes N.F. lacks authority to require weed-free parking and staging areas that are in private ownership.

The second mitigation addressed is #12, also on p. 43, which states: “Operators will be encouraged to wash all equipment (including log trucks) after completing operations with travel along Rd. 1170-600 before moving to a new area within the Eyerly Fire Salvage.”

Deschutes N.F. lacks authority to require cleaning of vehicles, including log trucks, whose travel is restricted to designated Forest Service roads. However, under the Equipment Cleaning clause WO-C(T)6.35, Deschutes N.F. can require that purchasers “clean off-road equipment prior to moving between cutting units on this timber sale that are known to be infested with noxious weeds and other units, if any, that are free of such weeds.” Because the directives of WO-C(T)6.35 are referenced in mitigation #8 (p. 43), mitigation #12 is essentially redundant, and will be dropped from the FEIS.

Comment: “Cumulative impacts are not analyzed for all elements of the environment discussed in Chapter 3 of the DEIS.” “For example, the cumulative impacts resulting from the proposed project are not thoroughly discussed in Section 3.7.3, Botanical Resources Environmental Consequences.” (40-13)

Response: The cumulative effects sections of the report entitled, Eyerly Fire Salvage Project Biological Evaluation for Survey and Manage and Sensitive Plant Species, and Noxious Weeds, were unintentionally excluded from the DEIS. They are included in the FEIS.

Comment: “Less than half of the botany and weed surveys have been completed prior to the release of the DEIS. How is the public supposed to comment on survey results we don’t even get to see. This is a NEPA violation. If the surveys are worth doing then the results are worth putting in the DEIS.” (37-110)

Response: Planned plant surveys (TES, S&M, weeds) within proposed activity units within the Eyerly Salvage project area were essentially completed at the time the DEIS was prepared. The DEIS states the plants surveys were “conducted in 54 (or 44%) of the units included in Alternative 2. Area surveyed is approximately 2390 acres, or 50% of the area proposed in Alternative 2 for some type of salvage activity.” In larger projects, plant surveys rarely cover all acres where activities are proposed. One reason for this is that surveys generally are conducted only in areas determined likely to provide suitable habitat for the various rare or uncommon plants that might occur within the project area. Following preliminary field surveys within project area, it became apparent that the Eyerly Fire had greatly altered physical and biological conditions within the fire perimeter, and that, in the near term at least, potentially suitable habitat for TES/S&M plants had been dramatically reduced. A detailed plant survey plan for the Eyerly Fire Salvage Project was prepared in May 2003. It called for about 800 acres of surveys in about 54 proposed activity units. Nearly triple this number of acres were surveyed, largely due to the paucity of diverse plant cover that, in turn, permitted larger areas of plant survey per unit of allotted time. The Eyerly Salvage Botany TES/S&M and Noxious Weed Survey Plan for 2003 is Appendix E within the Eyerly Fire Salvage Project Biological Evaluation for Survey and Manage and Sensitive Plant Species, and Noxious Weeds.

Comment: “The EIS (p. 216-217) nonetheless indicates that in the subset of the units that have been surveyed there are serious weed problems. A large fraction of the surveyed area is already infested with weeds. Salvage logging will definitely make this worse in two ways: by creating much more ground

disturbance, and by delaying the recovery of native vegetation which is competing with the weeds. Salvage logging will tip the balance in favor of the weeds because weeds are generally adapted to disturbance compared to native species. Leaving the soil undisturbed and allow natural regen to continue developing without disturbance is the best course of action. The EIS fails to fully disclose the consequence of salvage logging and delayed revegetation in terms of this serious weed problem.” (37-112)

Response: The serious risk of further introduction and spread of noxious weeds due to salvage activities within the project area is noted on page 12 of the Eyerly Fire Salvage Project Biological Evaluation for Survey and Manage and Sensitive Plant Species, and Noxious Weeds (hereafter referred to as the Botany Report). It is here noted that “The salvage harvest activities proposed in Alternatives 2 and 3 pose a high risk of the introduction and spread of noxious weeds. The risk is greatest in Alternative 2, which proposes about 1.7 times the acreage of salvage harvest that is proposed in Alternative 3. This risk can be reduced, but not eliminated, by the continued implementation of the weed management recommendations of the BAER Team Botanical Report and adherence to the mitigations included here (Mitigation Section).” This rating of “high” risk is the product of a formal weed risk assessment process that is documented in the Eyerly Fire Salvage Project Botany Report, and will be specifically stated in the FEIS.

Agency Letters

Official correspondence in response to the Draft EIS was received from the U.S. Environmental Protection Agency, Seattle, WA; and U.S. Department of the Interior, Office of Environmental Policy and Compliance. Both letters are included (in their entirety) on the following pages.



IN REPLY REFER TO:

ER 03/1028

United States Department of the Interior

OFFICE OF THE SECRETARY

Office of Environmental Policy and Compliance
500 NE Multnomah Street, Suite 356
Portland, Oregon 97232-2036

February 4, 2004

Dave Owens, Project Leader
c/o Sisters Ranger District
P.O. Box 249
Sisters, OR 97759

Dear Mr. Owens:

The Department of the Interior (Department) has reviewed the Draft Environmental Impact Statement (DEIS) for the Eyerly Fire Salvage Project, Deschutes National Forest, Jefferson County, Oregon. The Department offers the following comments for use in the development of the Final Environmental Impact Statement (FEIS).

General Comments

Metolius LSR: The Metolius LSR has undergone significant changes due to recent projects, changes in watershed conditions, and several large scale fires. Approximately 5,055 acres of the Eyerly Fire occurred within the Metolius LSR. Alternative 2 includes the salvage of dead and severely damaged trees on 1,457 acres within the Metolius LSR. Alternative 3 proposes to salvage harvest 1,050 acres within the Metolius LSR. The Department recommends the effects of these proposed salvage operations be included in a cumulative effects analysis specific to the Metolius LSR.

The Department also recommends the DEIS articulate how the proposed Eyerly Fire Salvage project will meet the portion of the project's purpose that relates to accelerated restoration of forest vegetation in the burned areas, and enhancing development of late and old-growth forest conditions within the Metolius LSR. For example, reforestation of burned areas is included in Alternative 3, and not included in the description of Alternative 2. The FEIS should clarify whether reforestation activities would be conducted under Alternative 2, and if not, whether this will affect your ability to achieve the purpose of the project.

Metolius Wildlife/Primitive Management Area (MWPMA): Alternative 2 proposes to salvage harvest 977 acres within the MWPMA, including: (1) 287 acres within the 2, 180-acre LSR-designated portion of the MWPMA; (2) 490 acres within the portion of the MWPMA that is Administratively Withdrawn under the Northwest Forest Plan (NWFP); and (3) 200 acres within the portion of the MWPMA that is outside of the NWFP area. The Department recognizes the Deschutes National Forest Land and Resource Management Plan (Forest Plan) contemplates the

potential for harvest in the MWPMA following catastrophic situations. Beyond making reference to these provisions in the Forest Plan, however, the DEIS contains no discussion or analysis of the impacts the proposed action would have on the MWPMA.

The Department understands from the Forest Plan that the MWPMA is intended to protect and perpetuate a predominately unmodified natural environment where natural ecological processes can continue to: (1) provide habitat for a wide variety of wildlife species, and to specifically maintain or enhance habitat for bald eagles, and (2) provide an opportunity for primitive dispersed recreation within the undeveloped forest environment. Given the objective of the MWPMA, the Department recommends the final EIS (FEIS) analyze the impact of salvage harvest within this management area. The importance of this recommendation is increased given that this proposed harvest in the MWPMA constitutes 20 percent of the harvest that would occur under the alternative 2, and 34 percent under alternative 3.

Deer Habitat Management Area: Alternative 2 proposes to salvage harvest 978 and 955 acres of Deer Habitat management areas in Matrix and non-NWFP land allocations, respectively. The total acres proposed for salvage harvest within Deer Habitat management areas are 36 percent of the total acres proposed for salvage harvest in Alternative 2. The DEIS does not analyze the impacts of this proposed salvage harvest on these management areas.

The Department recommends an analysis of salvage harvest impacts to these management areas be added to the FEIS. The analysis should take into account that the project area is important to the Metolius mule deer herd for winter forage and as a travel corridor for east-west migration between winter and summer ranges. The Department supports continued area closures currently in place, as stated in section 2.9.1, which restrict motor vehicle use to designated open roads within the project area. Timing of salvage activities should consider the timing of peak deer migrations, and should implement mitigation where possible, to offset adverse impacts to deer. Management of the Deer Habitat area should consider, as a long-term goal, the reestablishment of hiding cover, thermal cover and forage availability.

Threatened and Endangered Species: The DEIS analyzes impacts to threatened species, including bull trout, bald eagle, and the northern spotted owl. Based on impacts from the proposed action, the Department anticipates consultation under Section 7 of the Endangered Species Act will be necessary. The Department understands the Fish and Wildlife Service (Service) is providing input and recommendations for the proposed project, to facilitate an effective consultation on listed-species.

Page 151 of the DEIS discusses direct effects to bald eagle that would occur under Alternative 2, stating that 117 snags over 21 inches diameter at breast height (dbh) will be removed for safety reasons along the "64 road" and within Perry South Campground. Table 3.5-2 is referenced, but that table does not depict hazard trees planned for removal within bald eagle suitable habitat, and it appears that perhaps Table 3.5-17 should be referenced. On page 136, the direct and indirect effects of Alternative 2 state that 176 snags over 21 inches dbh will be removed, and Table 7 is referenced. However, Table 7 does not exist within the DEIS. To facilitate consultation, the Department recommends the proposed action describe the hazard tree removal component of the Eyerly Fire Salvage project in detail, since this proposed activity would cause adverse impacts to

bald eagles. The Department also suggests you include a table showing the number and location of hazard trees to be removed.

Finally, the DEIS states that "large snag habitat outside of designated areas is very important to retain since a large portion of the large snag habitat will be lost in the recreation sites and along major travel routes due to safety concerns." However, the discussion does not state if and where large snags for eagles will be retained. This information should be added to the FEIS.

Temporary Road Construction: Implementation of Alternative 2 requires an estimated three miles of temporary roads to access harvest units that are inaccessible using existing roads. Due to the existing high road density in the project area and disturbed soil conditions resulting from fire suppression activities on the Eyerly Fire, the Department recommends that units requiring the construction of temporary roads (i.e., Units 13, 33, 35, 37, 39 and 68) be removed from the proposed project. These units total 143.2 acres or 2.9 percent of the acres proposed for salvage harvest, thereby reducing the overall harvest volume of 23,453 million board feet (MMBF), by 1,214 MMBF, or 5.2 percent of the total harvest volume.

Should these three miles of temporary roads be constructed and the units mentioned above harvested, the Department recommends the obliteration of all of the temporary roads for the benefit of watershed conditions. The Project Design Elements for Soils (Section 2.8.1 on page 34) proposes to decommission (obliterate) logging facilities that will not be needed for future management, however, the DEIS does not state if these roads will be needed for future management. Section 2.8.1.5 (page 39) indicates that temporary roads constructed for skyline yarding will be sub-soiled after logging is completed. Table B-4 in the Appendices shows that there will be zero acres of sub-soiling in all of the units where temporary roads are proposed. The DEIS states, in the Roads and Transportation Environmental Consequences Section 3.14.3.4, that temporary roads will be obliterated following timber harvest operations. The Department recommends clarification of this project activity in the FEIS.

Noxious Weeds: The DEIS states noxious weeds have spread throughout the project area as a result of fire suppression efforts during the Eyerly Fire. Additional disturbance of the soils during salvage efforts could exacerbate the spread of noxious weeds. The Project Design Elements for Noxious Weed Treatment (Section 2.8.2 on page 43) "encourages" operators to maintain weed-free equipment, and parking and staging areas, and to wash all equipment (including log trucks) after completing operations that involve travel along Road 1170-600, before moving to a new project area. The Department recommends operators be required to maintain weed-free equipment whenever they are working or traveling through areas with noxious weed infestations.

Cumulative Impacts: Cumulative impacts are not analyzed for all elements of the environment discussed in Chapter 3 of the DEIS. Other than Key Issues 1-4, many of the cumulative impact sections do not sufficiently consider the proposed action in relation to past, present, and future activities within the project area. For example, the cumulative impacts resulting from the proposed project are not thoroughly discussed in Section 3.7.3, Botanical Resources Environmental Consequences. The Department recommends the FEIS contain a more thorough description of the cumulative environmental consequences of implementing the proposed action.

If this analysis sheds light on the need for any additional mitigation or offsetting measures, the Department recommends a description of these measures also be included in the FEIS.

Mitigation of Impacts: Mitigation of impacts related to the proposed project activities are not readily discernible in the DEIS. Mitigation Measures to be implemented for timber salvage operations were first mentioned on page 56 of the DEIS which indicated a full description would be provided in section 3.13, Mitigation Measures and Monitoring. This section of the DEIS, however, discusses Recreational Resources, and there does not appear to be a section of the DEIS that discusses Mitigation Measures and Monitoring. Some mitigation measures are interpreted within the Project Design Elements and the Best Management Practices sections. The Department recommends the FEIS provide a list and brief description of proposed mitigation measures in the summary section and in chapter 3.

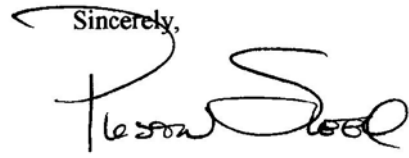
Specific Comments

Section 3.3.2.1. Streamflow: The third sentence is not clear. Perhaps it could be revised to read "Data collection began at this site in 1912 and continues to the present. The drainage area is 316 sq. mi; however, the hydrologic drainage boundary is uncertain because of inter basin groundwater exchange." The station description and realtime streamflow information for this site can be found at: http://waterdata.usgs.gov/nwis/uv?site_no=14091500.

Section 3.3.3.2. Streamflow: The Department recommends clarifying the intended meaning of the second paragraph, last sentence, which states: "Any increase in compaction (albeit less than 20%) would be compensated by an increase in vegetation recovery rates; therefore, action alternatives would have no measurable effect on streamflow." The relationship of "increase in compaction," "would be compensated by an increase in vegetation recovery rates," and "action alternatives would have no measurable effect on streamflow," seems counterintuitive and needs further explanation. The Department suggests the text be revised to clarify the connection between these three separate concepts.

If you have any questions regarding these comments, please contact Nancy Gilbert or Jennifer O'Reilly in the Fish and Wildlife Service Office in Bend, Oregon, at (541) 383-7146, or James Devine in the Geological Survey Office in Reston, Virginia, at (703) 648-6832.

We appreciate the opportunity to comment

Sincerely,

Preston A. Sleeper
Regional Environmental Officer



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION 10

1200 Sixth Avenue
Seattle, WA 98101

Jan 29 2004

Reply To
Attn Of: ECO-088

Ref: 03-014-BLM

Leslie A.C. Weldon, Forest Supervisor
Department of Agriculture -U.S. Forest Service
Deschutes National Forest
1645 Highway 20 East
Bend, OR 97701

The U.S. Environmental Protection Agency has reviewed the draft Environmental Impact Statement (EIS) for the Eyerly Fire Salvage Project (CEQ #030561) in accordance with our responsibilities under the National Environmental Policy Act (NEP A) and Section 309 of the Clean Air Act. Section 309, independent of NEP A, specifically directs EP A to review and comment in writing on the environmental impacts associated with all major federal actions and the document's adequacy in meeting NEP A requirements.

The draft EIS proposes various forest activities for the salvage of dead and damaged trees and treat fuels and plant trees to assist in the restoration of the area burned in the July, 2002 Eyerly fire in the Deschutes National Forest. The EIS identifies Alternative 2 as the preferred alternative.

We have assigned a rating of LO (Lack of Objections) to the draft EIS. This rating and a summary of our comments will be published in the Federal Register. A copy of the rating system used in conducting our review is enclosed for your reference.

You are to be commended for your proposed efforts to limit environmental impacts and to mitigate impacts from harvest and fuel reduction activities. In particular, we are pleased that salvage activities would be prohibited in the Metolius Breaks roadless area, riparian reserves and riparian habitat conservation areas and that burned old growth management areas will be replaced with identical plant association groups that will be larger in size than the original old growth management areas. The implementation of mitigation measures such as the Project Design Elements for soils, fish habitat and wildlife habitat are well thought out and should go far in minimizing environmental impacts.

We found the document organized and well written. The candid discussions regarding proposed actions, potential impacts and avoidance and mitigation measures make the document useful as a future reference when developing or evaluating other fire salvage environmental assessments. In addition, we appreciate the direct, project-specific discussion the EIS provides addressing recommendations from the Beschta et al. (1995) report.



The discussion on the impacts from the fire retardant utilized to fight the Eyerly fire was very informative. We do, however, recommend that the final EIS include requirements that protect workers in areas where fire retardant was applied from potential exposure to cyanide and other compounds that may pose human health risks.

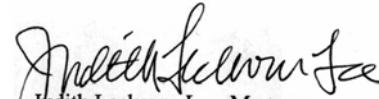
We noted that some tables included in the document that present data related to a particular alternative were not replicated for each of the alternatives. For example Table 3.2-13 presents data on the number of acres in the four main subwatersheds that will be harvested by various techniques under Alternative 3. However, there is no equivalent table for the other action alternative (Alternative 2) that proposes similar timber harvesting activities in the same subwatersheds. The document would benefit from having similar tables for each of the proposed alternatives. We recommend that unless information is unique to a proposed alternative, the document be consistent in the manner in which it presents information for each of the proposed alternatives.

We request that the final EIS contain additional information on consultation with Native American Tribes and Environmental Justice. In particular, The EIS needs to document that treaty rights and privileges are addressed appropriately. As the proposed project may have impacts on Tribes, the EIS should be developed in consultation with all affected tribal governments, consistent with Executive Order (EO) 13175 (Consultation and Coordination with Indian Tribal Governments). EO 13175 states that the U.S. government will continue "to work with Indian tribes on a government-to-government basis to address issues concerning Indian tribal selfgovernment, trust resources, and Indian tribal treaty and other rights." The EIS states that scoping for the project was conducted on a government to government level with the Confederated Tribes of the Warm Springs Reservation and that they provided comments on the proposed action. However, it does not provide any details on what those comments were and how they were addressed in the EIS. The EIS should provide discuss the Tribe's comments and concerns and the efforts that were taken to address them.

Also, The EIS should disclose what efforts were taken to meet environmental justice requirements consistent with Executive Order (EO) 12898 (Federal Actions to Address Environmental Justice in Minority and Low-Income Populations). The EIS should describe the efforts and criteria utilized to identify low income and people of color (minority) communities that may be impacted by the proposed project, and the impacts the proposed project may have on their communities. If it is determined that low income or people of color communities will bear disproportionately high and adverse effects, the EIS should describe the efforts that were taken to assure that these communities have had opportunity to provide meaningful input into the decisions being made about the project. The EIS should describe what was done to inform the communities about the project and the potential impacts it will have on their communities, what input was received from the communities, and how that input was utilized in the decisions that were made regarding the project.

Thank you for the opportunity to review this draft EIS. If you would like to discuss these issues, please contact Mike Letourneau at (206) 553-6382 or feel free to contact me at (206) 553-6911.

Sincerely,



Judith Leckrone Lee, Manager
Geographic Unit

Enclosure

cc: D. Opalski, EPA -000
C. Kelly, EPA -LaGrande

- American Marten, 208, 256, 265, 275, 285, 469, 584
- Bald Eagle, 27, 53, 68, 187, 194, 195, 240, 242, 244, 284, 426, 573, 576, 578, 588, 590
- Big Game, 7, 40, 45, 192, 210, 211, 212, 213, 249, 250, 267, 268, 277, 278, 287, 288, 357, 509, 574, 575, 584
- Bitterbrush, 7, 105, 211, 292, 335
- Black-Backed Woodpecker, 191, 204, 253, 259, 269, 279
- Bufflehead, 53, 194, 208
- Bull Trout, 27, 169, 384, 436, 467, 477, 541, 542
- Burned Area Emergency Rehabilitation (BAER), 6, 23, 33, 74, 82, 301, 329, 397, 439, 448
- California Wolverine, 194
- California Wolverine, 201, 241, 244, 246, 249, 436
- Canada Lynx, 194, 237, 462, 465, 469, 478
- Canopy Closure, 148, 178, 193, 194, 198, 202, 219, 223, 224, 225, 236, 323, 387, 400, 490, 539, 574, 575, 585
- Catastrophic Wildfire, 140, 145, 530
- Cavity Excavators, 189, 190, 202, 249, 280, 281, 504, 578
- Chinook Habitat, 171, 172
- Civil Rights, 312
- Clean Air Act, 13, 15, 28, 294
- Clean Water Act, 13, 14, 47, 119, 120, 172, 173, 428, 465, 523, 525, 531, 536
- Compaction, 26, 48, 49, 74, 77, 79, 80, 81, 83, 89, 90, 91, 94, 95, 96, 97, 98, 100, 101, 102, 111, 115, 122, 128, 133, 134, 135, 136, 137, 138, 139, 140, 144, 146, 147, 148, 149, 150, 153, 154, 172, 173, 183, 184, 185, 293, 363, 419, 422, 434, 442, 443, 445, 446, 494, 504, 513, 514, 515, 516, 523, 527, 528, 529, 537, 538, 543, 545, 546, 549, 550, 552, 553, 554, 555, 556, 559, 560, 561, 562, 563, 564, 565, 566
- Connectivity Corridors, 180, 223
- Cultural Resources, 395, 400, 457, 466, 471, 472, 479
- Decaid, 1, 68, 69, 190, 191, 203, 204, 220, 225, 226, 228, 235, 245, 252, 253, 258, 259, 269, 279, 389, 390, 449, 464, 570, 579, 580, 581, 588
- Desired Condition, 11, 23, 305
- Developed Recreation, 369, 371, 372, 401, 410
- Dispersed Recreation, 19, 35, 178, 369, 381, 406
- Economics, 17, 31, 72, 384, 502, 572
- Employment, 308, 309, 310
- Endangered Species Act, 13, 168, 188, 215, 397, 399, 400, 402, 411, 541
- Environmental Justice, 15, 16, 312, 396, 471, 476
- Equivalent Clearcut Area: ECA, 461
- Evapotranspiration, 122, 123, 124, 133, 134, 135, 148, 177, 184, 185, 500, 527, 529, 538
- Evapotranspiration, 83, 148, 538
- Existing Condition, 23, 35, 73, 78, 109, 118, 137, 147, 157, 163, 187, 191, 218, 347, 361, 523, 546, 548, 578, 591
- Eyerly Fire, 4, 9, 25, 72, , 81, 166, 187, 298, 299, 307, 325, 326, 327, 347, 348, 370,
- Fisheries, 31, 50, 52, 65, 151, 394, 396, 398, 429, 430, 431, 432, 433, 434, 437, 453, 454, 457, 459, 465, 466, 467, 468, 469, 471, 483, 524
- Forest, 33
- Forest Plan Amendment, , 22, 386, 402, 584
- Fuel Loading, 10, 11, 28, 36, 59, 60, 87, 179, 218, 219, 221, 226, 240, 242, 245, 254, 255, 256, 261, 264, 265, 272, 274, 276, 289, 290, 291, 295, 303, 329, 330, 332, 334, 336, 337, 338, 339, 340, 341, 343, 344, 389, 423, 426, 440, 450, 455, 505, 506, 572, 584
- Fuel Modeling, 453
- Fuels Treatment, 6, 26, 30, 35, 36, 39, 42, 44, 70, 72, 79, 95, 96, 101, 103, 110, 112, 260, 296, 341, 344, 347, 432, 441, 500, 554, 556, 558, 560, 561
- Goshawk, 12, 206, 207, 216, 223, 255, 263, 273, 282, 283, 591
- Ground-Based Logging, 95, 136, 444, 546
- Hazard Tree, 70, 284, 394, 459, 583
- Helicopter Logging, 33, 34
- Historic Range Of Variability, 60, 148, 327, 357, 411, 509
- Insects, 13, 18, 28, 37, 197, 223, 236, 250, 251, 252, 279, 282, 307, 320, 347, 356, 366, 367, 368, 369, 386, 390, 399, 400, 410, 440, 452, 488, 489, 490, 491, 492, 493, 494, 495, 496, 498, 506, 508, 558
- Instream Wood, 149, 152, 153, 154, 183, 186, 518, 522, 524
- Inventoried Roadless Area, 374
- Irreversibilbe and Irretrievable Commitments, 71, 385

- Key Issues, 67, 73, 118
- Lake Billy Chinook, 2, 6, 22, 53, 73, 74, 121, 123, 129, 130, 131, 132, 133, 148, 149, 151, 157, 161, 168, 170, 171, 172, 174, 175, 176, 177, 178, 180, 181, 182, 186, 195, 200, 201, 205, 206, 207, 208, 240, 241, 242, 243, 245, 246, 249, 250, 254, 255, 256, 257, 262, 264, 272, 274, 275, 281, 283, 284, 292, 293, 295, 329, 347, 370, 371, 375, 376, 380, 459, 467, 515, 523, 525, 526, 539, 540, 541, 573, 583, 590
- Lewis' Woodpecker, 203, 252, 253
- Management Direction, 9, 33, 73, 118, 120, 157, 187, 188, 347, 370, 382, 406, 438, 504, 570
- Management Indicator Species, 19, 187, 202, 252, 398, 576
- Medusahead, 301
- Metolius River, 2, 19, 29, 37, 38, 42, 43, 53, 73, 118, 119, 121, 129, 130, 131, 132, 138, 142, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 161, 163, 165, 166, 167, 168, 170, 171, 172, 174, 175, 176, 177, 178, 180, 181, 182, 183, 184, 185, 186, 193, 195, 200, 202, 205, 206, 207, 208, 214, 240, 241, 242, 243, 245, 246, 248, 249, 250, 251, 254, 255, 256, 257, 262, 264, 272, 274, 275, 281, 283, 284, 285, 292, 293, 305, 347, 365, 369, 370, 375, 376, 387, 456, 460, 461, 466, 467, 475, 515, 522, 526, 538, 539, 540, 541, 573, 583, 590
- Metolius Roadless Area, 9, 19, 29, 34, 37, 42, 76, 372, 373, 501
- Metolius Wild and Scenic River, 19, 22, 30, 369, 501
- Mitigation, 1, 9, 27, 30, 35, 39, 44, 47, 71, 78, 101, 172, 303, 306, 403, 431, 519, 524, 532, 549, 558, 560, 561, 563, 564, 566, 567, 583, 587, 588, 592
- Monitoring, I, 7, 32, 64, 65, 71, 79, 84, 87, 94, 95, 96, 102, 120, 125, 130, 132, 138, 139, 164, 301, 305, 397, 407, 432, 434, 456, 458, 463, 467, 470, 471, 474, 521, 522, 523, 537, 542, 550, 566
- Mountain Lady's Slipper Orchid 63, 299, 303
- National Environmental Policy Act (NEPA), 1, 13, 14, 35, 398, 402, 407, 484, 500
- National Fire Plan, 24, 321, 322, 449, 450, 451
- National Forest Management Act (NFMA), 13, 14, 312, 398, 407
- National Historic Preservation Act, 13
- Natural Regeneration, 12, 36, 76, 105, 115, 356, 357, 359, 447, 509, 565
- Neotropical Migratory Birds, 214, 289, 407
- Northwest Forest Plan, Iii, 4, 19, 20, 21, 22, 46, 120, 135, 141, 166, 169, 177, 179, 183, 188, 198, 244, 321, 328, 387, 407, 428, 446, 449, 451, 477, 489, 516, 517, 518, 522, 529, 535, 563, 589
- Noxious Weed, I, 60, 65, 300, 301, 302, 407, 475, 591, 593
- Old-Growth, 18, 20, 205, 243, 244, 245, 246, 262, 265, 266, 273, 275, 386, 387, 476, 504, 510, 511, 513, 579, 586
- Oregon Spotted Frog, 200, 241, 243, 246, 248
- Pacific Fisher, 202, 241, 244, 246, 251, 384, 436, 541, 584
- Pileated Woodpecker, 202, 497, 587
- Preferred Alternative, 69, 387, 389, 391, 440, 537, 583
- Proposed Action, 1, 6, 8, 9, 10, 24, 25, 26, 29, 30, 32, 35, 36, 70, 94, 110, 117, 145, 172, 173, 382, 385, 402, 442, 448, 484, 488, 489, 500, 502, 511, 513, 515, 516, 520, 524, 530, 531, 552, 570, 589
- Public Involvement, I, 24, 408
- Purpose And Need, 9
- Pygmy Rabbit, 194
- Recreation Opportunity Spectrum (ROS), 29, 371, 373
- Recreation UseS, 72, 281, 401
- Redband Trout, 151, 157, 161, 162, 163, 164, 165, 167, 170, 171, 172, 174, 175, 176, 178, 456, 460, 539, 541, 543
- Reforestation, 7, 8, 33, 40, 45, 66, 311, 314, 319, 358, 359, 408, 432, 451, 502, 504
- Responsible Official, 30, 31
- Restoration, 34
- Riparian AreaS, 125, 127, 129, 130, 429, 576
- Riparian Buffers, 129, 136, 137, 139, 140, 144, 151, 156, 515, 520, 522, 523, 532
- Scenic Integrity, 29, 380
- Scoping, I, 24, 25, 410
- Sediment Transport, 33, 51, 65, 100, 141, 146, 165, 183, 517, 518, 519, 527, 529, 531
- Smoke Exposure, 295
- Smoke Management, 28
- Snag And Down Wood, 27, 40, 45, 190, 221, 226, 235-246, 260-266, 271-277, 290-291
- Snag Retention, 40, 111, 220, 259, 269, 303, 304, 388, 487, 506, 553, 568, 569, 573, 575, 576, 586, 587, 588

Soil Biota, 87, 104, 111, 544, 547, 548, 552, 553, 554, 559, 560, 561, 565
Soil Fertility, 558
Soil Productivity, 73, 76, 77, 78, 83, 84, 85, 92, 110, 111, 112, 328, 372, 424, 444, 529, 547, 548, 550, 558, 559, 562, 567
Soil Resource Inventory (SRI), 49, 74, 75, 410, 462, 566
Soil Survey, 75, 477
St. Johnswort, 300, 301
Summer Range, 210, 211, 287

Threatened, Endangered, And Sensitive Wildlife, 187, 460
Unavoidable Adverse Effects, Iii, 384
Undeveloped Recreation, 18
Unemployment, 307, 308
Visual Quality, 17, 18, 210, 374
Water Temperature, 118, 120, 130, 145, 154, 163, 168, 170, 177, 180, 181, 453, 522
Winter Range, 210, 211, 212, 257, 267, 268, 277, 278, 288, 584, 591