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Final Environmental Assessment

KELSEY VEGETATION MANAGEMENT

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

ALTERNATIVES
ALTERNATIVE 1 – NO ACTION
ALTERNATIVE 2 – PROPOSED ACTION
ALTERNATIVE 3

ALTERNATIVE 3 is the PREFERRED ALTERNATIVE

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DOCUMENT STRUCTURE

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

- ***Chapter 1 Introduction:*** Includes information on the history of the project proposal, the purpose of and need for the project, the agency's proposal for achieving that purpose and need, and public involvement.
- ***Chapter 2 Alternative Discussion:*** Provides a description of the alternatives for achieving the stated purpose. Alternatives were developed based on issues raised by the public and Forest Service. A comparison table of the activities of each alternative is included. Mitigation measures, Best Management Practices, and Project Design Criteria that would prevent adverse effects to the environment, through alternative implementation, are listed.
- ***Chapter 3 Affected Environmental and Environmental Consequences:*** Describes the existing condition of each resource and the effects each alternative would have on the environment. The effects of the No Action Alternative provide a baseline for evaluation and comparison with the other alternatives.
- ***Chapter 4 Agencies and Persons Consulted:*** Provides a list of preparers and agencies consulted during the development of the environmental assessment.
- ***Appendices:*** The appendices provide more detailed information to support the analyses presented in the environmental assessment.

CHAPTER 1 – INTRODUCTION

SUMMARY

The Bend-Fort Rock Ranger District of the Deschutes National Forest, Oregon, proposes to improve and protect Forest Service managed lands within the Kelsey planning area. The proposed activities would occur within the following management areas: Deer Habitat, General Forest, Scenic Views, Wild and Scenic Rivers, and the Newberry National Volcanic Monument (NNVM). The proposed activities would occur within:

- The Bend southern urban growth boundary Wildland/Urban Interface and Sunriver Wildland/Urban Interface.
- The western one-third of Newberry National Volcanic Monument (NNVM).
- A portion of the Upper Deschutes Wild and Scenic River Corridor.
- The Ryan Ranch Key Elk area east of the Deschutes River.
- Critical deer winter range.

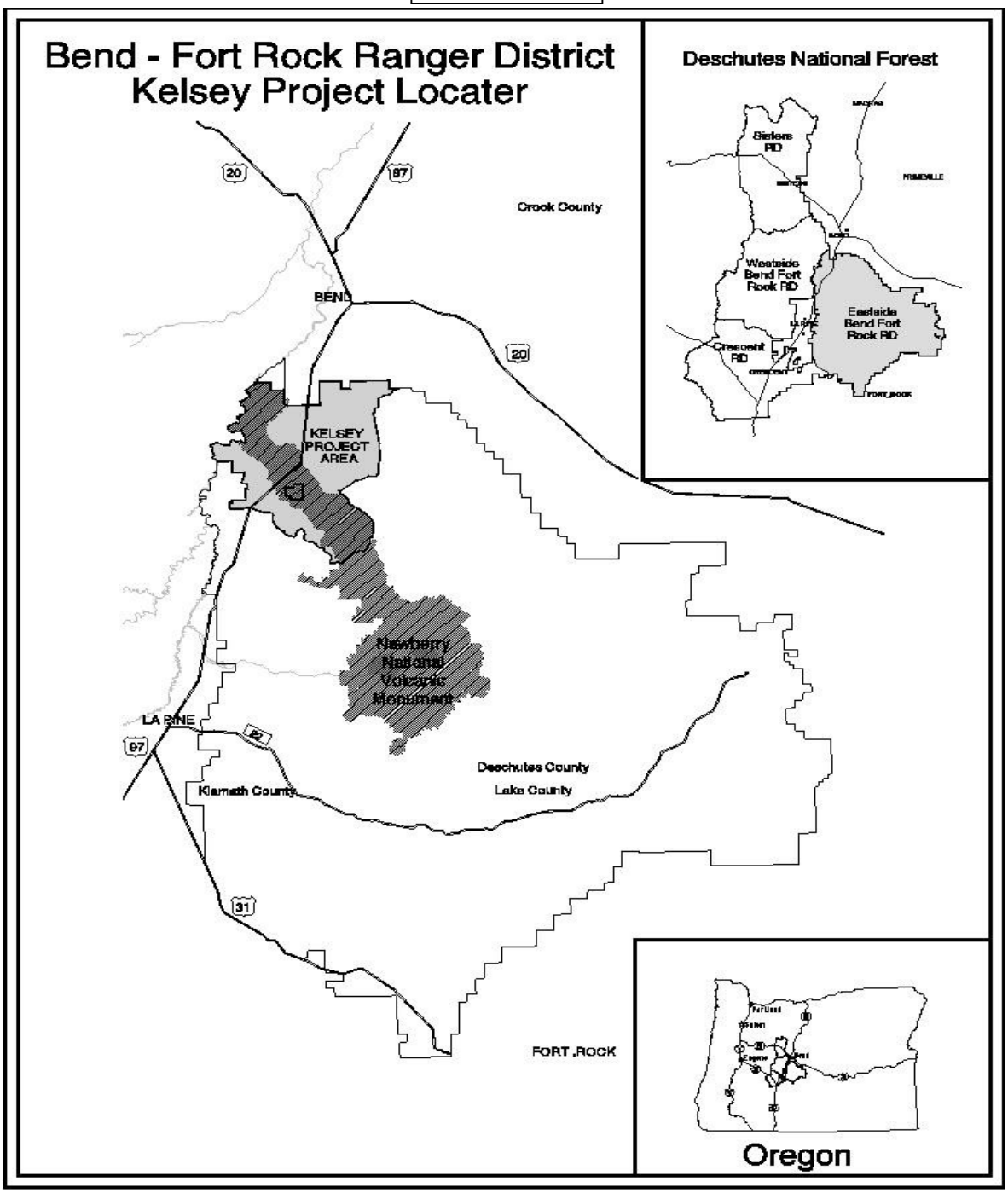
The proposed vegetative and fuel reduction activities presented in Alternative 2 (Proposed Action) and Alternative 3 (Preferred Alternative) would focus on and treat those areas identified at high risk to disturbance. In addition to the two action alternatives, the No Action Alternative was analyzed. Treatments are intended to sustain, enhance, and protect long-term productivity and resiliency of the forested ecosystem while protecting, enhancing, and maintaining all Forest resources. The proposed treatments would:

- Reduce the risk of high fire intensity from wildfire and future prescribed burning.
- Reduce the risk and intensity of disease pathogen spread and insect outbreaks to levels likely encountered in the historic past.

PROJECT AREA LOCATION

The original Kelsey planning area, 46,175 acres (Figure 1, page 6), including 570 acres of private land, encompasses approximately 10 miles of the east bank of Deschutes River, within the Upper Deschutes Wild and Scenic River boundary, from Sunriver to the southern urban growth boundary of Bend. It includes a portion of the Newberry National Volcanic Monument (18,140 acres of the planning area), and is adjacent to the High Desert Museum. The analysis area was redefined following the 18 Fire (3,520 acres within Kelsey) and totals 42,655 acres. Elevations range from 3,900 to 6,000 feet. The planning area is located in T.18 S., R. 11 E., Sections 26-28, 33-36; T.18 S., R. 12 E., Sections 26-29, 32-36; T. 19 S., R. 11 E., Sections 1-4,2-28,33-36; T. 19 s., R. 12 E., Sections 2-11, 14-23, 26-33; T. 20 S., R. 11 E., Sections 1-5,11-14; and T. 20 S., R. 12 E., Sections 3-11,14-22,28,29.

FIGURE 1


Bend - Fort Rock Ranger District
Kelsey Project Locater
Deschutes National Forest
Sisters RD
Westside Bend Fort Rock RD
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Crook County
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BACKGROUND

The Bend-Fort Rock Ranger District of the Deschutes National Forest has analyzed vegetation and natural fuel reduction treatments within the Kelsey planning area. The planning area lies outside the area of the Northwest Forest Plan (NWFP) boundaries. The nearest Inventoried roadless area is located approximately 2.5 miles southeast, within NNVM, and separated from the planning area by two (2) roads that bisect NNVM from east to west. Proposed activities are consistent with the Monument Plan. No permanent or temporary road construction is planned within the NNVM. The analysis area has been previously roaded, logged, and has existing skid trails and landings. A special order prohibiting OHV use along the southern urban growth boundary Wildland/Urban Interface, signed by Forest Supervisor, Leslie A.C. Weldon, December 21, 2001, will continue to be enforced. Off highway vehicle (OHV) use will be analyzed at a later date.

The 18 Fire in July 2003 burned approximately 3,520 acres within the planning area along the northeast boundary, with an additional 290 acres burned in the adjacent Fuzzy planning area. The planning area boundary, the purpose and need, and the decision to be made have remained the same as before the fire. Approximately 1,085 acres that were proposed for vegetation treatments within the fire perimeter have been removed from this analysis. The changes are reflected in the renamed Alternative 2 (Proposed Action). The area within the fire perimeter is being analyzed separately from this environmental assessment.

There are no known Threatened or Endangered species. The Deschutes River is a 303(d) listed stream. The parameters for which it is listed are temperature (September 1 to June 1), chlorophyll a, dissolved oxygen, sedimentation, and turbidity. Within the planning area there are 1) bufflehead ducks and redband trout, both listed as sensitive on the Region 6, Regional Forester's Sensitive Species List; 2) cultural resources; 3) populations of noxious weeds; and 4) five management area (MA) allocations.

PURPOSE OF AND NEED FOR ACTION

The Forest Supervisor for the Deschutes National Forest, the District Ranger for the Bend-Fort Rock Ranger District, and the Interdisciplinary Team members for the Kelsey planning area have determined the need for reductions in shrub density and other natural fuels and stand density. Vegetation management activities are intended to reduce the risk of high intensity, stand replacement wildfire, the imminent risk of beetle infestations, and the acres of dwarf mistletoe infection. Activities are also intended to move toward improving conditions in Deer Habitat and Scenic Views.

The purpose and need within the Kelsey planning area is to:

- Reduce shrub density, tree density (trees less than 21 inches diameter-at-breast-height), and other natural fuels to reduce the risk of high intensity wildfire in primarily singe storied, black bark ponderosa pine and to limit wildfires, including crown fire, to less than 1,000 acres,.
- Reduce the tree density (trees less than 21 inches diameter at breast height) to assist in transitioning toward a forest ecosystem that is more resilient and resistant to disturbance, focusing on areas that could carry a crown fire, areas that are imminently susceptible to bark beetle attack, and areas that have a moderate to high incidence of dwarf mistletoe infection.
- Reduce tree density (trees less than 21 inches diameter at breast height) to accelerate ponderosa pine dominance and tree growth in young stands. These stands would eventually provide habitat for wildlife species dependent on larger late and old structure (LOS) stands, large ponderosa pine that emphasize scenic quality, and trees that may provide firm fiber for commercial uses.
- Provide areas of vertical and horizontal tree diversity for deer within the Deer Habitat Management Area (critical deer winter range), through the creation of development of small, reforested openings.

- Reduce the amount of over mature bitterbrush to improve deer forage diversity and productivity.
- Maintain or enhance scenic views of areas that display the inherent scenic qualities of Central Oregon, including the Cascade Mountains (from Lava River Cave), lava flows, and open, park-like large ponderosa pine and the Outstandingly Remarkable Values of the Wild and Scenic River corridor.
- Provide commercially viable firm fiber from thinning (trees less than 21 inches diameter at breast height).

In response to these concerns, the Bend-Fort Rock Ranger District initiated this project to not only address urban interface concerns, but to continue implementation of a long-term, economically feasible, fuel reduction and forest health improvement vegetation management program across the District. The purpose and need is consistent with the desired future conditions of the Wild and Scenic River Corridor, Newberry National Volcanic Monument and the Deschutes National Forest Plan. During the last 20 years, there have been more than 25 large wildfires greater than 100 acres on the District. Due to extreme fire behavior, these fires have been difficult to control; resulting in the loss of dozens of homes and important riparian and old growth habitat. While reducing fuels immediately adjacent to the urban interface can help control low to moderate intensity wildfire, the reduction of fuels at a larger landscape level is essential to reduce the risk of high intensity crown fires moving through or over areas adjacent to the urban interface, administrative sites, and recreation areas. From a forest health perspective, a larger landscape approach is needed to protect important forest values such as water quality, scenic views, old growth and wildlife habitat.

ALTERNATIVE 2 (PROPOSED ACTION)

The Kelsey project proposes to treat 9,750 acres (Table 1, page 9). To modify fire behavior, treatments are proposed on 4,035 acres or 41 percent of the planning area. These treatments would only include prescribed fire and mechanical shrub treatment. On the remaining 5,715 acres, tree density would be reduced using pre-commercial thinning or commercial harvest (separately or in combination). Of the 5,715 acres, 4,970 acres or 87 percent of the pre-commercial or commercial harvest (separately or combination) area would also be treated by prescribed fire and mechanical treatment. The proposed action would treat approximately 92 percent of the area with prescribed fire and mechanical shrub treatment. Reforestation would occur on approximately 280 acres of the 5,715 acres for wildlife, mistletoe, and structural diversity.

What: The Forest Service proposes to address the purpose and need by meeting 4 objectives.

1. Reduce current fuel loading; both tree and shrub density to lessen the potential effects of future fire behavior potential.
2. Reduce tree density to maintain or improve forest health (beetle risk and dwarf mistletoe).
3. Enhance and protect wildlife habitat by closing and decommissioning roads and improving habitat effectiveness by treating vegetation within deer and elk thermal cover habitats.
4. Completing the activities within 10 years from the beginning of project implementation.

The action includes precommercial thinning and pruning (2,990 acres), commercial harvest (4,970) acres, and fuels reduction (9,255 acres) on approximately 9,750 acres. Some acres overlap because they would receive multiple treatments (such as precommercial thinning and fuels reduction) in the same unit. Fuels reduction treatment areas were identified that have been strategically located to modify fire behavior. These areas were located within the wildland urban interface, along roads, around old growth areas, and other areas of concern. Ponderosa pine stand areas were also identified that were heavily infected with mistletoe for treatments.

Reforestation would occur on approximately 280 acres. Small patch clearcuts (4 to 12 acres in size) for wildlife habitat and Oregon State University study areas will require reforestation by hand planting ponderosa pine proposed on approximately 109 acres. Uneven-aged treatments in mistletoe-infected areas will create openings that will require planting on approximately 171 acres of reforestation. In addition, herbicide spot application (3ft. radius around planted trees) would occur across 280 acres proposed for reforestation totaling approximately 44 acres.

Commercial logging would utilize a modern ground-based system (such as feller-buncher) and designated skid trails to minimized soil disturbance. An estimated 0.5-mile of temporary road would be needed to access commercial harvest to units 232 and 233. All temporary roads would be obliterated following their use and reconditioned to a natural state. Road densities as proposed under the roads analysis would go from the existing 4.0 miles per square mile to 2.9 miles per square mile within the Kelsey analysis area. Only roads used for access to vegetation treatment units will be considered for closure or decommissioning. A seasonal closure is proposed to occur within deer habitat from December 1 through March 31.

Why: The Kelsey analysis area was assessed to identify and strategically located specific areas across the landscape that would reduce the potential of disturbance, including natural and human caused wildfire, insect infestation, and disease vectors. The proposed vegetative and fuel reduction activities would focus on and treat those areas identified as the potential risk to disturbance. Treatments are intended to sustain, enhance, and protect long-term productivity and resiliency of the forested ecosystem while developing, enhancing, maintaining, and protecting wildlife and fish habitat. The proposed treatments would reduce the risk of high intensity fires, disease pathogens, and insect vectors.

When: Project implementation would begin in 2004. The proposed commercial treatments would be completed by 2010. The precommercial thinning, reforestation, and fuels treatments would occur over approximately a 10-year period.

How: The project would be implemented through a combination of timber sales, service contracts, force account crews and partnerships. No permanent system roads would be created. An outcome of the treatments described above, an estimated 12 million board feet of wood would be commercially removed from 2,725 acres of the total treated 9,750 acres.

These treatments would: 1) reduce tree stocking on approximately 5,665 acres through precommercial thinning, commercial harvest, and prescribed burn; 2) enhance and protect wildlife habitat on approximately 4,740 acres; 3) treat approximately 3,980 acres with infection of dwarf mistletoe to improve stand resiliency; and 4) mechanically treat brush and/or prescribe burn on approximately 9,005 acres to reduce fire flame lengths and transition towards a more historic low intensity and frequent fire regime. Proposed treatments may overlap within proposed units.

All measurements in this document are approximate.

Table 1: Alternative 2 (Proposed Action) – Vegetation, Fuels, and Associated Treatments

Treatment Type	Acres	Description
Mechanical Shrub Treatment and/or Prescribed Fire	4,035	Mechanical Shrub Treatment – Mechanical Mowing of Shrubs
With Precommercial Thinning and/or Pruning	745	Prescribed Fire – Burn under late and old structure ponderosa pine or underburn to reduce shrub and tree density
Commercial Harvest and Mechanical Shrub Treatment and/or Prescribed Fire	2,220	Thinning – Cutting conifers to reduce tree density – Both commercial and precommercial
With Precommercial Thinning and/or Pruning	2,000	Tree planting – Reforestation of thinned acres
With Tree Planting	280*	
Herbicide Spot Application	44	Sub-soiling – Tilling soil for reforestation or road rehabilitation
With Sub-soiling	740*	Pruning – Hand removing tree limbs
Commercial Harvest	505	
With Precommercial Thinning and/or Pruning	245	
With sub-soiling	15*	
Total Acres	**9,750**	

***** Acres are overlap acres and not counted in total acres. Refer to Table 2.

DOCUMENTS TIERD TO AND MANAGEMENT DIRECTION

This section lists signed documents that are tiered to and provides a discussion of each document regarding management allocations and direction**.** The alternatives of the project respond to the goals and objectives, standards and guidelines described for the areas in:

Deschutes National Forest Land and Resource Management Plan (***Forest Plan as amended, 1990***) and its accompanying Final Environmental Impact Statement as amended by the Revised Continuation of Interim Management Direction Establishing Riparian, Ecosystem, and Wildlife Standards for Timber Sales (Eastside Screens): "The National Forest Land and Resource Management Plan (Forest Plan or Plan) was developed to guide all natural resource management activities and establish standards/guidelines for the Deschutes National Forest. The purpose of the plan is to provide form the use and protection of Forest resources, fulfill legislative requirements, and address local, regional, and national issues and concerns." Following is a brief summary of the goals in each Management Area (MA) (Figure 2, page 12) located within the planning area:

- **Deer Habitat (MA-7):** 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.
- **General Forest (MA-8):** Emphasize timber production while providing forage production, visual quality, wildlife habitat and recreation opportunities for public use and enjoyment.
- **Scenic Views (MA-9):** Provide Forest visitors with high quality scenery that represents the natural character of Central Oregon.
- **Old Growth (MA-15):** 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.
- **Wild and Scenic Rivers (MA-17):** To protect the outstandingly remarkable values identified and maintaining the free flowing nature of the river.

Newberry National Volcanic Monument Plan (1994) guides all management and restoration activities within the Monument and is consistent with the intent of the Wild and Scenic Rivers Act within the river corridor. The Monument Plan takes precedence over the Forest Plan. The Monument legislation requires for natural ecological succession of vegetation to the maximum extent practical. It also requires the management plan to consider a program to reestablish old-growth ponderosa pine ecosystems. The Monument has three (3) management zones within the Kelsey planning area:

- **River Zone:** Minimize disturbance to wildlife habitats, while ensuring their long-term sustainability and diversity. Direct recreation use away from this zone.
- **Lava Butte Zone:** Serve a large number of day-use visitors with a variety of short-term, day oriented interpretive programs and recreation opportunities. Manage facilities to support a comprehensive theme-based interpretive program. Manage vegetation to provide high quality scenery, with some emphasis on preserving and sustaining large, old growth ponderosa pines, and to provide some habitat that allows for deer migration.
- **Transition Zone:** Serve visitors interested in day-use recreational and interpretive opportunities, with emphasis on trail opportunities, both recreational and interpretive. Work to reduce fuel loads enough to allow safe reintroduction of fire (prescribed) without endangering large, old growth ponderosa pine.

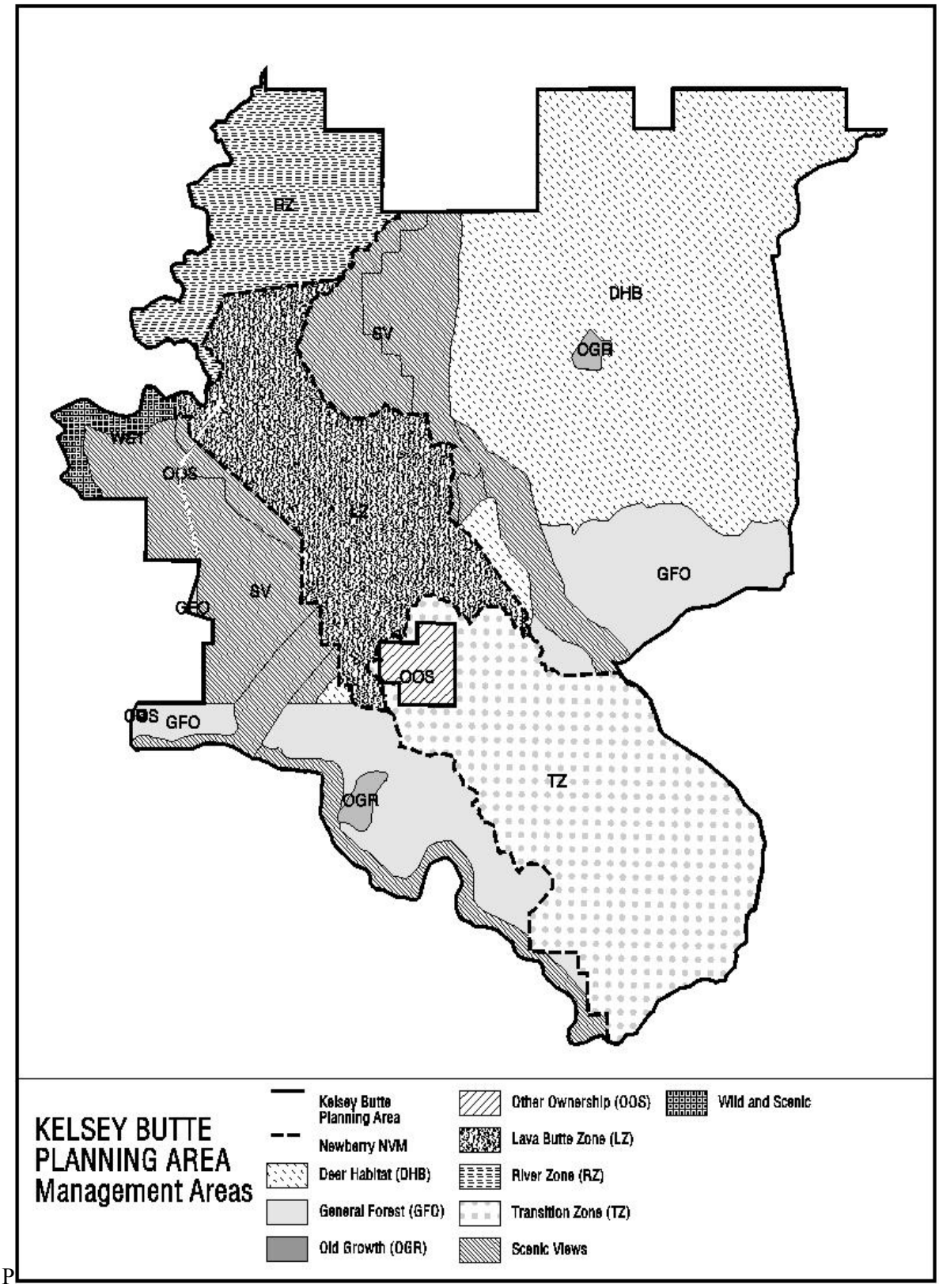
Upper Deschutes Wild and Scenic River and State Scenic Waterway Comprehensive Management Plan (***River Plan, 1996***): designates the section of river forming that portion of the western boundary of the Kelsey

planning area from the north boundary of Sunriver to the southern urban growth boundary of Bend to be within section 4a and 4b of the Recreational Opportunity Spectrum. Sections 4a and 4b are designated as "Scenic." Scenic is defined as "Those rivers or sections of rivers that are free of impoundments, with shorelines or watersheds still largely primitive and shorelines largely undeveloped, but accessible in places by roads."

- **Section 4a** – Roaded Natural: A small portion of land may be privately owned. The landscape appears natural, but roads and trails access the area, and some facilities are present. Visitors can expect less interaction with other people. Modifications to the landscape generally harmonize with the environment.
- **Section 4b** – Rural: About half of the land may be privately owned. Facilities (such as shelters, buildings, roads, campgrounds, and parking lots) are present and visitors are likely to encounter many other people. Parts of the landscape have been modified, and the sights and sounds of other people will be readily evident. Aquatic, riparian, and upland vegetation all have a significant effect on all other river values and is an outstandingly remarkable river value. Page 29 within the River Plan describes the standards for vegetation. Native riparian vegetation will be healthy and dominate the periodically inundated and saturated areas within the river corridor. Riparian areas will be managed to support riparian dependent species. Upland vegetation will continue to be dominated by ponderosa and lodgepole pine. The forest will be characterized by disturbances, which mimic the effects of periodic occurrence of small, low intensity fires to perpetuate a mosaic of stand structures and ages and reduce the risk of high intensity fires. This mosaic will provide wildlife with thermal and breeding cover, dispersal habitats, and connection to water sources.

Inland Native Fish Strategy (***INFISH, 1995***)***:*** delineated Riparian Habitat Conservation Areas (**RHCAs**) for riparian-dependent resources to receive primary emphasis. These RHCAs include traditional riparian corridors, wetlands, intermittent streams, and other areas that help maintain the integrity of aquatic ecosystems. These areas are to be managed to maintain or restore water quality, stream channel integrity, channel processes, sediment regimes, instream flows, diversity and productivity of plant communities in riparian zones, and riparian and aquatic habitats to foster unique genetic fish stocks that evolved within the specific region. **PACFISH** does not apply here because historically anadromous fish did not make it past Big Falls on the Deschutes River, approximately 50 downriver of the Kelsey planning area.

FIGURE 2


BZ
DHB
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SV
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OOS
OOS
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TZ
OGR
KELSEY BUTTE
PLANNING AREA
Management Areas
Kelsey Butte Planning Area
Newberry NVM
Deer Habitat (DHB)
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Old Growth (OGR)
Other Ownership (OOS)
Lava Butte Zone (LZ)
River Zone (RZ)
Transition Zone (TZ)
Scenic Views
Wild and Scenic

P

DECISION TO BE MADE

Based on this environmental assessment, resource specialists reports and biological evaluations, the Forest Supervisor, Deschutes National Forest, will decide whether to:

- Use mechanical shrub treatments, prescribed burning, precommercial thinning, commercial harvest, and pruning to 1) improve forest health; 2) reduce natural fuels and wildfire risk; 3) improve/protect wildlife habitat; and 4) improve scenic views.
- Plant tree seedlings, following harvest treatments on 280 acres within units for deer habitat, treating mistletoe infected trees, and provide structural diversity.
- Spot application, if necessary, of herbicides around planted seedlings to reduce competition from grasses and shrubs.
- Reconstruct roads associated with proposed commercial harvest units to provide safe access for vehicular traffic.
- Close and decommission roads associated with proposed treatment units to mitigate reductions in vegetation within deer and elk thermal and hiding cover habitats, improving habitat effectiveness.
- Implement a seasonal road closure within Deer Habitat (MA-7) to reduce intentional/unintentional harassment in mule deer winter range during critical foraging and fawning times.
- Construct approximately 2,000 feet of pole fencing around the five (5) acre aspen stand to protect aspen sprouts from big game foraging.
- Implement Mitigation Measures.

DOCUMENTS INCORPORATED BY REFERENCE

- **1998 Deschutes National Forest Integrated Fuels Management Strategy (IFMS)**: "The IFMS provides guiddance for prescribed fire, mechanical brush mowing, and small diameter tree thinning and release.." "The IFMS Recommended Strategic Actions are not required to implement the natural fuels activities, but were developed to assist the Forest with program development towards meeting long term goals in an integrated, adaptable and effective manner."
- **1998 Deschutes National Forest Noxious Weed EA**: "Integrated Weed Management Plan (**IWMP**) ". IWMP provides direction for the management and control of noxious weeds on the Deschutes National Forest.
- **2000 Bend-Fort Rock, Plantation Herbicide EA**: Analyzed herbicide use on the reduction of noxious weeds on several projects located on the Bend-Fort Rock Ranger District.
- **Official Record: Kelsey Vegetation Management EA** – Includes all specialists reports used to prepare EA.

SCOPING AND PUBLIC INVOLVEMENT

Announcement of the proposed Kelsey project was included in the 1999 summer edition Central Oregon Schedule of Projects that reaches approximately 3,200 interested individuals and groups through quarterly mailings. The original project included fish habitat improvement and a non-motorized trail that were later analyzed and implemented separately. Off highway vehicle (OHV) use was also addressed and will be analyzed separately. The October 2001 Kelsey Vegetation Management EA scoping letter requesting public involvement was provided to approximately 220 individuals, businesses, and organizations that have expressed an interest in the project development process. Included in this mailing were the Confederated Tribes of Warm Springs, Burns Paiute Tribe, and The Klamath Tribe. The Bulletin, the local newspaper, reported on the original Proposed Actions and the scoping letter was placed on the Deschutes and Ochoco National Forest web site. In addition, a field trip to the Newberry National Volcanic Monument to review the project area (within the monument) was provided for members of the public that commented on proposed activities within the Monument during initial scoping.

COMMENTS RECEIVED FROM THE PUBLIC

Scoping responses were received from 35 groups or individuals regarding vegetation management. The comments were grouped and summarized in and used as issues used in alternative design, or are addressed under alternatives considered but eliminated from detailed analysis. Detailed comments and responses can be found in Appendix I, page 207 of this document under initial Scoping and 30-Day Comments.

ISSUES

Many of the public comments received were used to focus the analysis in areas where the public desired a specific resource to be addressed. All comments received have been assessed as to their relevance to each of the resources being addressed within the Kelsey planning area. Many of the comments have been addressed in the Proposed Action, alternative development, and analysis of the effects of actions. These comments were used to formulate issues and to design alternative activities and mitigations. Some comments were used to explore alternatives that were not further developed. Internal Forest Service comments and analysis were also used in the development of alternatives.

Key Issues: Issues used to develop alternatives or specific activities of the action alternatives. The following key issues and concerns were the basis for designing an additional alternative other than the proposed action. Each key issue statement is followed by a more detailed explanation. Each key issue has a unit of measure developed for the reader to easily distinguish between each alternative and how it responds to the issue. A comparison of the alternatives is located in Chapter 2.

Key Issue #1: **Landscape-Level Sustainability**

A relatively high percent of the management allocations would continue to be imminently susceptible to bark beetle attack: General Forest (51%), Deer Habitat (35%), Scenic Views (Foreground, Partial Retention (43%) and Middleground, Retention (34%)), Old Growth (80%), and Deschutes River, Scenic Section (78%). Imminently susceptible areas would likely experience significant change in structure or character as a result of a bark beetle attack. Following proposed treatments of the proposed action, 30 to 80 percent of several management allocations within the planning area would remain imminently susceptible to bark beetles. In the event of a bark beetle outbreak, the goals and objectives of the management areas may be compromised.

- ***Unit of Measure:*** Acres imminently susceptible to bark beetle attack proposed for treatment.

Stands thinned to relatively wide spacing (30 to 35 feet) would not fully utilize site growth potential. Within the General Forest Management Area, thinning to a wide spacing is proposed to meet wildlife and fuels objectives (Appendix C, page 152). A general forest management objective is to have all stands utilizing site growth potential. Thinning to a tighter spacing may more fully optimize site growth potential and also meet wildlife and fuels objectives.

- ***Unit of Measure:*** Acres treated with in General Forest Management Area proposed for thinning to a spacing of 30 to 35 feet.

Key Issue #2: **Wildland Urban Interface Fuels Reduction**

Following proposed fuel reduction activities, areas of highly flammable shrubs would remain untreated in the Wildland/Urban Interface and adjacent to defensible space corridors. Further analysis and field reconnaissance following development of the Proposed Action identified a need to provide additional acres of fuels treatments

along Forest Road 9710, Forest Road 9720 within the Monument, and along the Wildland/Urban Interface of Lava Lands Visitor Center, Sunriver, Deschutes River Woods, Sunset View, and Woodside Ranch. The risk of high intensity wildfire without additional fuels treatments would remain adjacent to these areas.

- ***Unit of Measure:*** Acres proposed for fuels treatment adjacent to the Wildland/Urban Interface and along defensible space corridors.

More emphasis should be placed on the use of fire and less on the use of mechanical (mowing) treatments within Newberry National Volcanic Monument. Treatments are proposed to reduce fire hazard and reestablish historic ponderosa pine fire regimes within Newberry National Volcanic Monument. It may be possible to safely use fire without the use mechanical treatments in proposed units. Planned or natural prescribed fire is the preferred treatment (Monument Plan), although mechanical treatment (mowing and thinning) may be needed prior to safely introducing fire.

- ***Unit of Measure:*** Acres proposed for prescribed fire and/or mechanical treatment within the Monument.

OTHER ISSUES OR CONCERNS

- Proposed reforestation treatments would be expensive, costing approximately $500 per acre. Approximately 280 acres in Alternative 2 are proposed for harvest methods that will necessitate reforestation treatments. Harvest treatments are proposed to: 1) promote deer hiding cover; 2) reduce level of dwarf mistletoe infection; 3) increase ponderosa pine stocking; or 4) create uneven-aged stand structures for scientific study. Different harvest methods may meet or partially meet treatment objectives while incurring no reforestation costs. Varying reforestation treatments may reduce reforestation costs.

- Previously pruned areas are in need of thinning so that growth and commodity value are not lost. To meet the goals and objectives within the General Forest Management Area identified within the analysis area there is a need to have a more intense management. Thinning these areas is needed to optimize growth and commodity value for timber production (Forest Management Goals, Forest Plan 4-2).

- There is a need to promote or restore quaking aspen. Small populations of quaking aspen are present within the planning area. Unit activities would not preclude encouraging the enhancement of incidental populations of quaking aspen. One unit would be designated for this objective. Incidental populations may be treated to provide habitat for various wildlife species.

CHAPTER 2 – ALTERNATIVE DISCUSSION

This section provides discussion of a No Action Alternative and two (2) action alternatives. It also includes a brief discussion of alternatives that were considered and responds to why they were eliminated from further analysis. This chapter also includes a comparison of the alternatives. Mileage and acreage figures used throughout this document are approximate figures.

ALTERNATIVES CONSIDERED IN DETAIL

This section provides a description of the alternatives responding to the "Purpose and Need" that are considered to be reasonable and viable by the Decision Maker (the Deschutes National Forest Supervisor). Alternatives, other than the No Action Alternative, are designed to move towards the desired condition that is consistent with the standards and guidelines of the Forest Plan.

Description of Treatments Common to Alternative 2 (Proposed Action) and Alternative 3: Table 2 describes the treatments that are proposed and overall objectives for these treatments.

Table 2: Description of Vegetation and Fuels Treatments

TREATMENT TYPE	TREATMENTS	OBJECTIVES
Fuel Treatment Only	Mechanical Shrub Treatment; Underburn	Reduce natural fuels to reduce risk of wildfire; Provide fuel break/safety corridor; Create strategic fuel breaks including along the wildland/urban interface; Reintroduce fire into fire-associated ecosystem.
Vegetation Treatment with Planting	Commercial Harvest; Precommercial Thin; Pruning; Mechanical Shrub Treatment; Underburn; Subsoil and Plant; Herbicide Treatment	Reduce natural fuels to reduce risk of wildfire; Promote deer hiding cover and vertical stand diversity; Reduce level of mistletoe infection; Maintain or increase ponderosa pine dominance.
Vegetation Treatment with no Planting	Commercial Harvest; Precommercial Thinning; Pruning; Mechanical Shrub Treatment; Underburn; Whipfell; Subsoil	Reduce level of dwarf mistletoe infection and risk of insect infestation; Maintain/ accelerate ponderosa pine growth; Promote open, park-like stands; Increase winter sunlight on Cottonwood Road; Reduce natural fuels to reduce risk of wildfire; Provide fuel break/safety corridor; Create strategic fuel breaks.
Precommercial Thinning and Pruning only	Precommercial Thinning; Pruning; Mechanical Shrub Treatment; Underburn	Reduce natural fuels to reduce risk of wildfire; Provide fuel break/ safety corridor; Create strategic fuel breaks; Improve forest health.
OSU (Oregon State University) Study	Commercial Harvest; Precommercial Thinning; Pruning; Mechanical Shrub Treatment; Underburn; Subsoil and Plant; Herbicide Treatment	Reduce natural fuels to reduce risk of wildfire; Provide fuel break/ safety corridor; Protect long-term study plot; Reduce level of dwarf mistletoe infection; Accelerate development of single-stratum late and old structure; Promote deer hiding cover and vertical stand diversity; Enhance deer forage.

To reduce the amount of debris that is associated with thinning treatments, activities would occur to reduce debris and the risk of a high intensity fire within those units. Commercial harvest would include whole tree yarding, removing the whole tree to the landing prior to removing tree limbs. Units with commercial and precommercial thinning would have remaining debris piled and burned or scattered within the unit.

Alternative 1 (No Action)

This alternative provides a baseline that compares relative changes and their effects that would occur with implementation of proposed activities in either Alternative 2 (Proposed Action) or Alternative 3. Under this

alternative, the acres of high-density stands would continue to present an elevated risk of crown fire, insect infestations, and the spread of disease vectors. High-density stands, ground vegetation, and dead vegetation and other ground debris would continue to present a high-risk of a high intensity wildfire. Fires would continue to be responded to and suppressed by fire suppression crews. No vegetation or fuels reduction treatments, wildlife habitat or scenic view enhancement activities, or activities to restore natural processes to soil would occur.

Alternative 2 (Proposed Action)

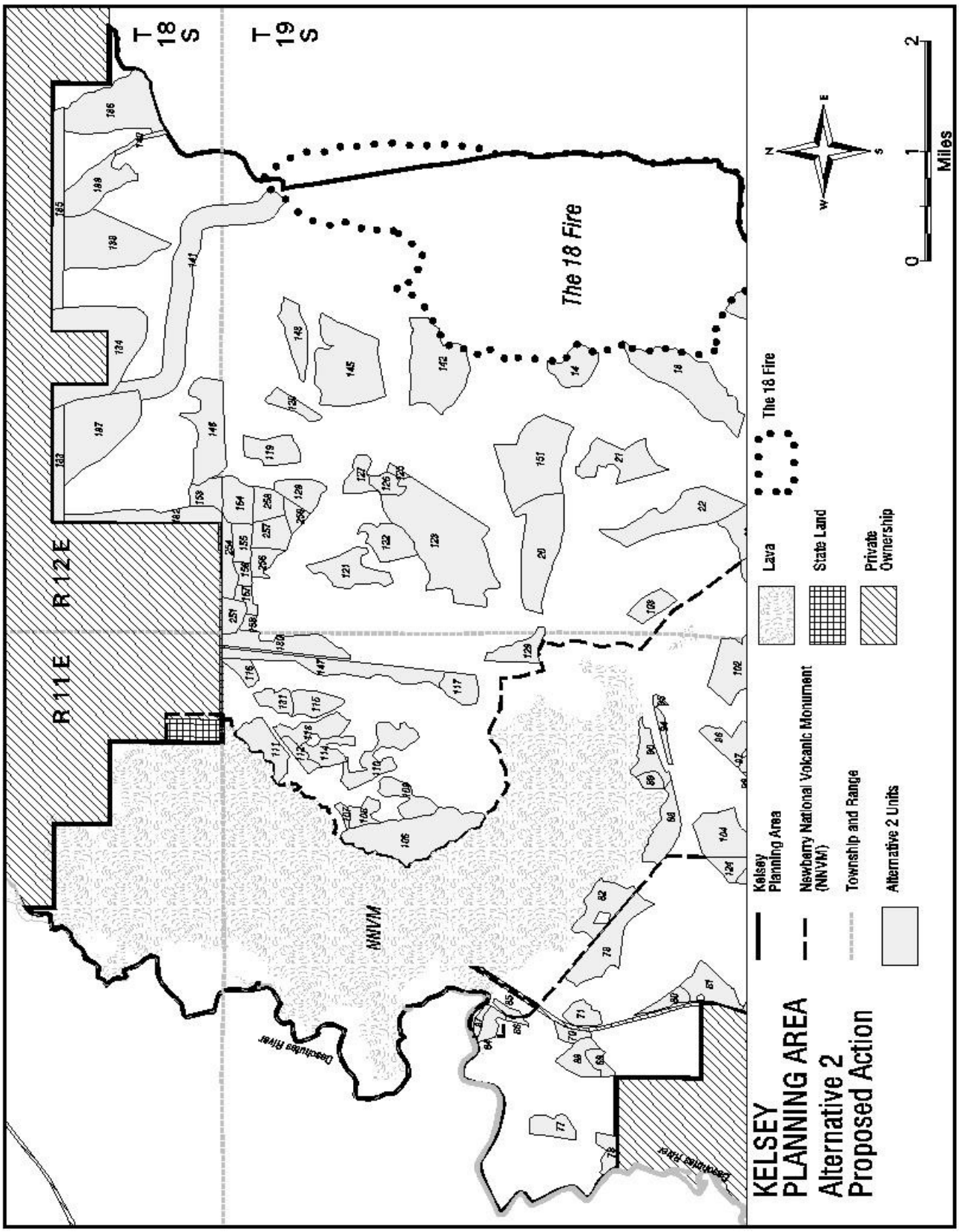
Alternative 2 (Proposed Action) was developed to address Key Issues: 1) Landscape-Level Sustainability and 2) Wildland Urban Interface fuels reduction. Approximately 9,750 acres are proposed for treatment. This acreage figure is slightly different from the Proposed Action that was presented in the public scoping letter. Thirty-eight acres were treated under the Lava Lands Non-Commercial Thinning Categorical Exclusion. Figures 3a and 3b, pages 18 and 19, identify proposed units and treatment type. Table 3 and Table 11 (page 30), and Appendix B, page 150 provide proposed activity summaries for Alternative 2. Proposed fuels treatments would treat approximately 40 percent to 70 percent of the acreage, dependent upon site-specific needs. Proposed commercial harvest is outside the Riparian Habitat Conservation Area (**RHCA**). Total fiber volume from vegetative treatments, trees less than 21 inches in diameter, is estimated to be between 20.9 and 31.3 CCF (10.9 to 16.3 MMBF).

Table 3: Alternative 2 (Proposed Action) – Commercial Harvest, Prescribed Fire, Mechanical Shrub Treatment (MST), and Associated Treatments

TREATMENT TYPE	UNIT NUMBER	ACRES
Mechanical Shrub Treatment (MST) and Prescribed Fire (or combination)	9,10,20,24,25,30,77,79,81,82,84-86,90,95,101,104,107,116 123,132-143,145,151,153-155,157,158, 251	4,035
• **With Precommercial Thinning and/or Pruning:**	29,31,40,46,48,53,55,57,62,63,83,106,108-110,114,115,131	745
Sub-Total		**4,780**
Commercial Harvest and MST and Prescribed Fire (or combination):	11-13,22,23,39,41,42,45,50,52,54,56,67,73-75,94,105,124 126,146-149,152,156,256,263-265,269	2,220
• **With Prcommercial Thinning and Pruning (or combination):**	7,8,14,21,26,27,35-38,49,58-61,64,66,68-71,78,80,87-89,96,98-100 102 103,111,112,117,129,130,150,254,258,259,261,262,267,268	2,000
• **With Reforestation:**	7,8,14,21,26,27,36,58,59,68,258,259,261,262,267,268	280*
• **With Sub-soiling:**	7,8,14,21,26,27,36,58,59,68,259,262,267	740
Sub-Total		**4,220**
Commercial Harvest:	47,119-122,125	505
• **With Precommercial Thinning and Pruning (or combination):**	33,34,65,97,113,127,128	245
• **With Sub-soiling:**	33	15
Sub-Total		**750**
Total		**9,750**

* Identified units total 763 acres. Of the 763 acres identified for treatment, 280 acres would be reforested.

FIGURE 3a


T 18 S
T 19 S
R11E
R12E
The 18 Fire
NNVM
Deschutes River
Deschutes River
KELSEY
PLANNING AREA
Alternative 2
Proposed Action
Kelsey Planning Area
Newberry National Volcanic Monument (NNVM)
Township and Range
Alternative 2 Units
Lava
State Land
Private Ownership
The 18 Fire
N
E
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W
0
1
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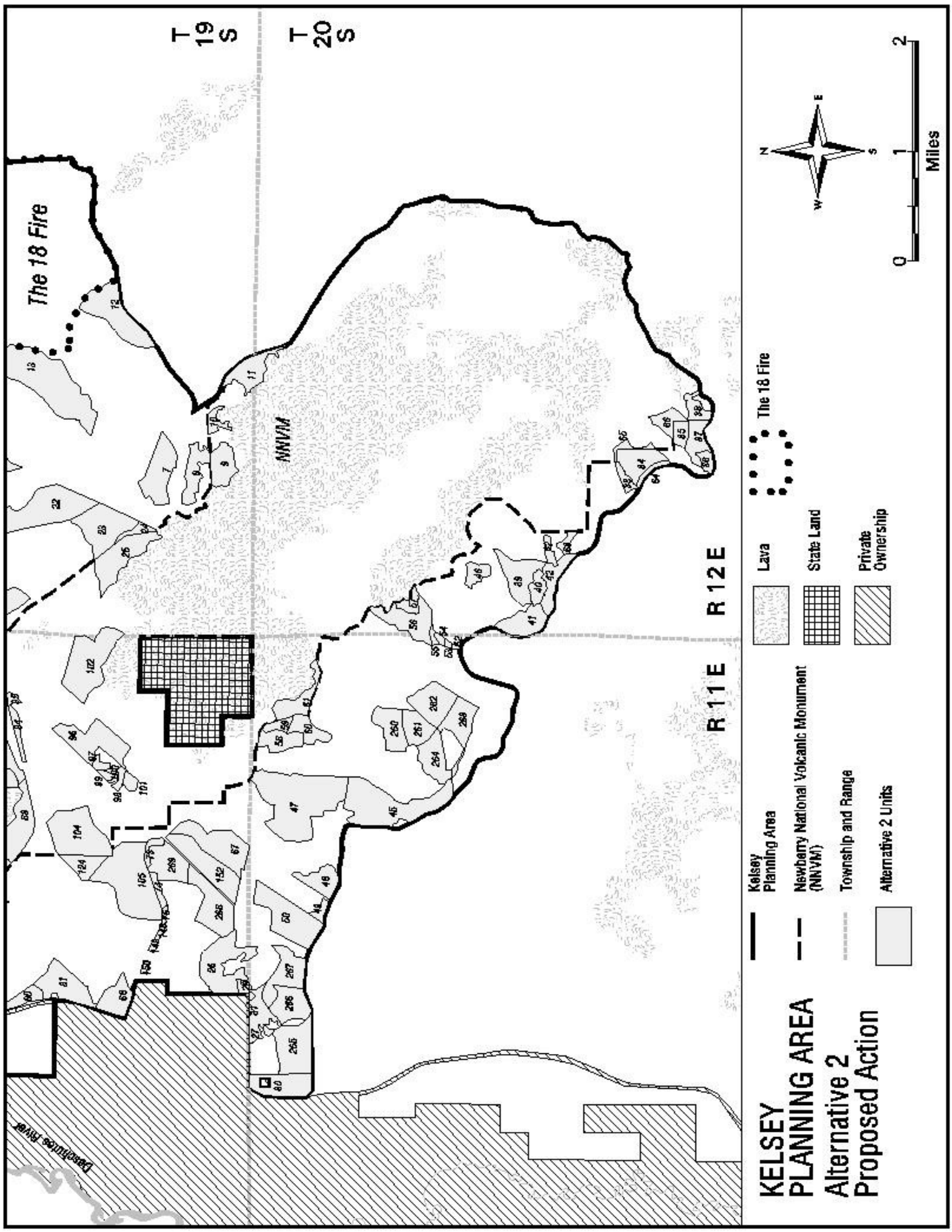
Miles

FIGURE 3b


T 19 S
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The 18 Fire
NNVM
Deschutes River
KELSEY
PLANNING AREA
Alternative 2
Proposed Action
Kelsey Planning Area
Newberry National Volcanic Monument (NNVM)
Township and Range
Alternative 2 Units
Lava
State Land
Private Ownership
The 18 Fire
N
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0
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Miles

Alternative 3

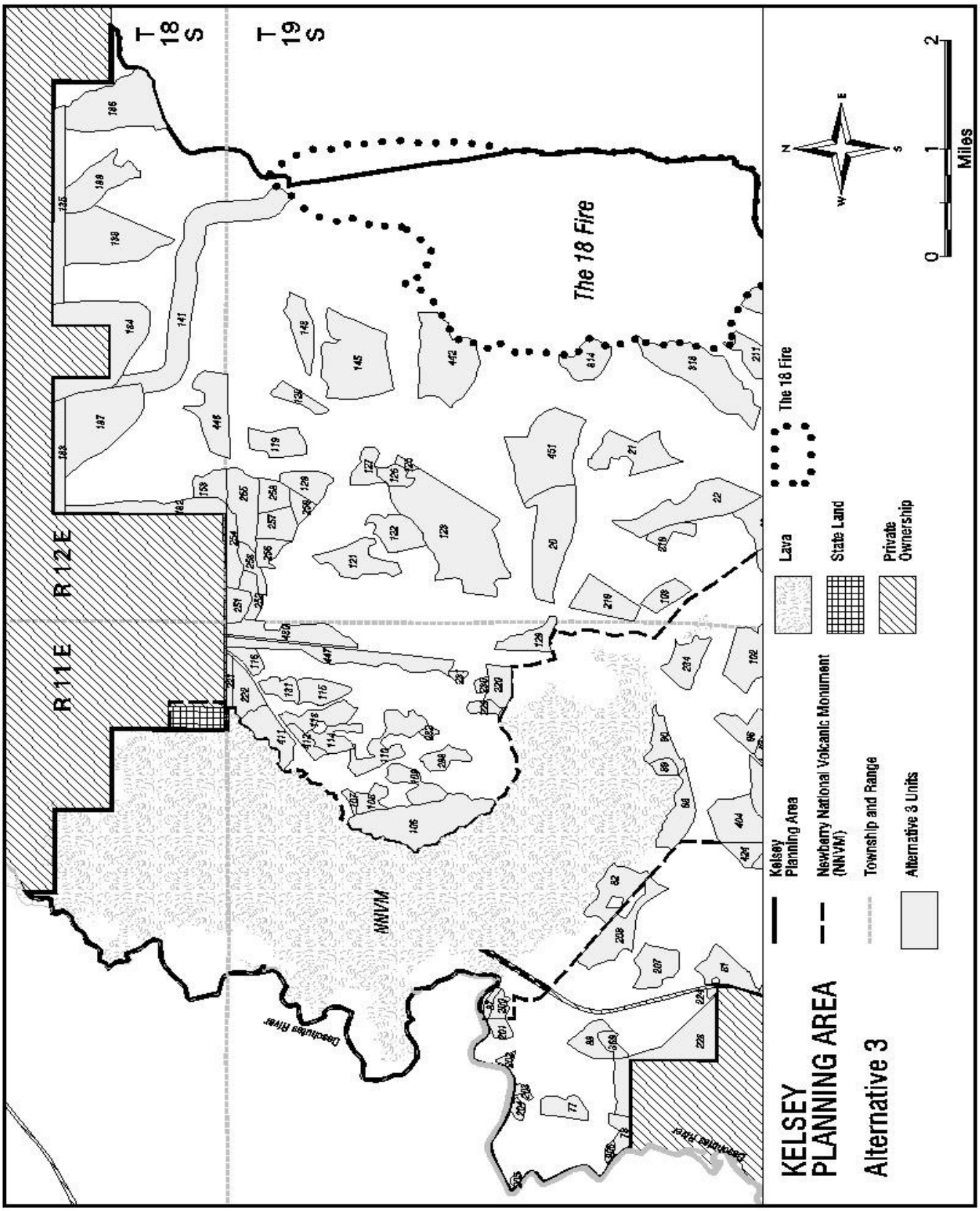
Alternative 3 (Preferred Alternative) was also developed to address Key Issues: 1 Landscape-Level Sustainability and 2 Wildland Urban Interface fuels reduction, but treated more acres. Approximately 11,080 acres are proposed for treatment. Figures (maps) 4a and 4b on the following pages identify proposed units and treatment type. Table 4, Table 5 (page 24), and Appendix B (page 149) provide proposed activity summaries for Alternative 3. Proposed fuels treatments would treat approximately 40 percent to 70 percent of the acreage, dependent upon site-specific needs. Proposed commercial harvest is outside the Riparian Habitat Conservation Area (**RHCA**). Total fiber volume from vegetative treatments is estimated to be between 24,200 and 36,400 CCF (12.6 to 19.0 MMBF).

Table 4: Alternative 3 – Commercial Harvest, Prescribed Fire, Mechanical Shrub Treatment (MST), and Associated Treatments

TREATMENT TYPE	UNIT NUMBER	ACRES
Prescribed Fire and MST (or combination):	9,20,24,77,81-83,90,107,116,123,132-139,141,143,145,153, 207, 208 222,223,226,234,236-238,245,251,252,255,270,274, 275,325 404,451	4,495
• **With Precommercial Thinning and/or Pruning:**	29,31,48,53,55,57,62,63,106,108-110,114,115,131,221,271,281,340 346	735
Total		**5,230**
Commercial Harvest and MST and Prescribed Fire (or combination):	11,22,23,39,41,42,45,73-75,126,148,149,152,209-211,218,219,220, 225,227,239,248,253,256,263-265,269,277,312-314,352,354,356,367 405,424,446,447	2,700
• **With Precommercial Thinning and Pruning (or combination):**	21,26,37,49,61,78,87-89,96,98-100,102,103,129,150,200,201,206 224,254,258,259,261,262,267,268,272,273,276,307,308,327,338,368 369,411,412,430,442	1,900
• **With Reforestation:**	21,26,258,259,261,262,267,268,442	210
• **With Sub-soiling:**	21,26,259,262,267,442	505
Total		**4,600**
Commercial Harvest:	119-122,125,213,230,231,240-244,246,347	835
• **With Precommercial Thinning and Pruning (or combination):**	33,65,97,113,127,128,202-205,229,232,233,247,278,335,360,366	415
• **With Sub-soiling:**	33	15
Total		**1,250**
Total Acres		**11,080**

Figure 4a, Page 22
Figure 4b, Page 23

FIGURE 4a


T 18 S
T 19 S
R 11E
R 12E
The 18 Fire
NNVM
Deschutes River
Deschutes River
KELSEY
PLANNING AREA
Alternative 3
Kelsey Planning Area
Newberry National Volcanic Monument (NNVM)
Township and Range
Alternative 3 Units
Lava
The 18 Fire
State Land
Private Ownership
N
E
S
W
0
1
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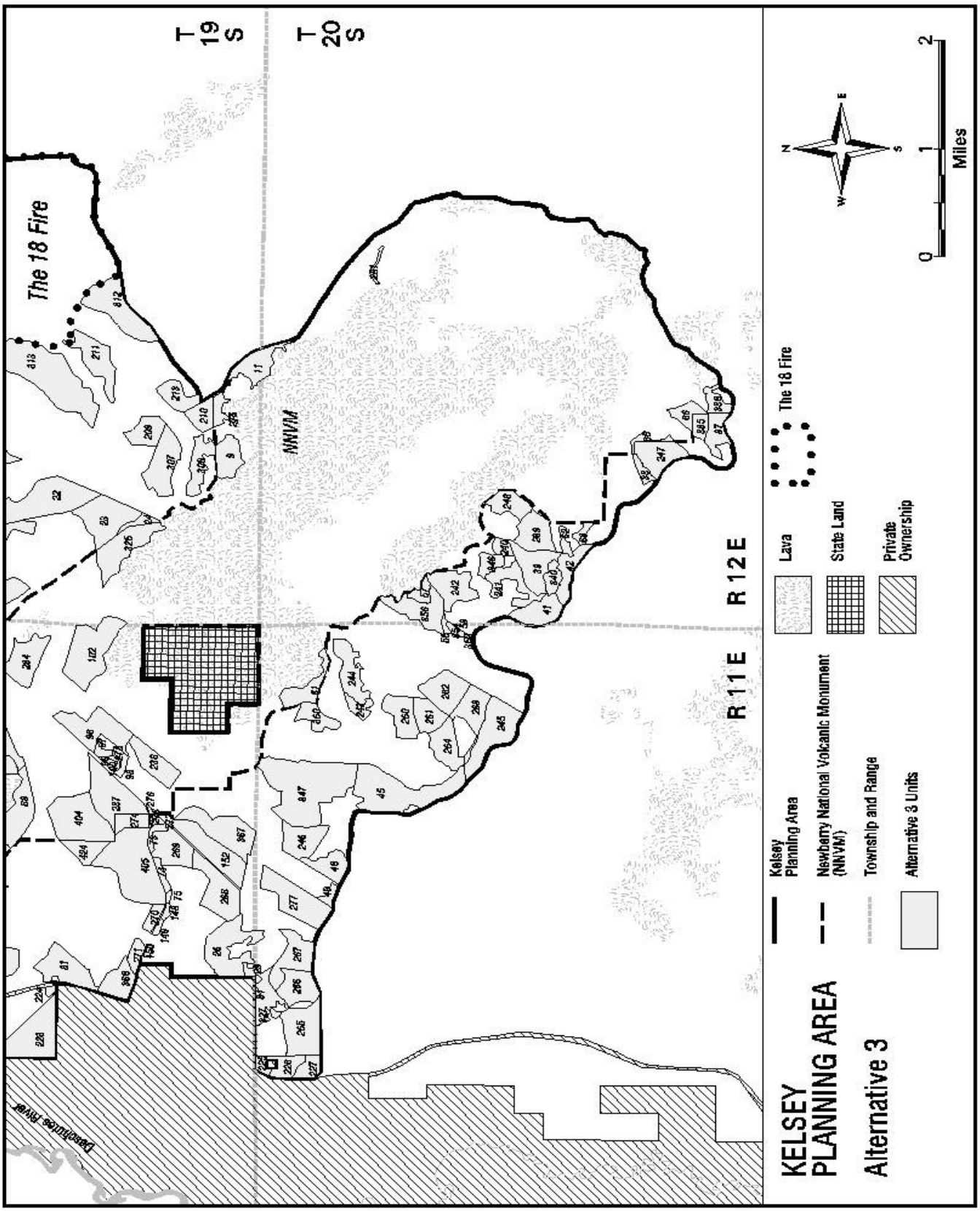
Miles

FIGURE 4b


T 19 S
T 20 S
R 11 E
R 12 E
The 18 Fire
NNVM
Deschutes River
KELSEY PLANNING AREA
Alternative 3
Kelsey Planning Area
Newberry National Volcanic Monument (NNVM)
Township and Range
Alternative 3 Units
Lava
State Land
Private Ownership
The 18 Fire
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Miles

Fuels Reduction: With Alternative 2, fuels reduction objectives would be achieved using prescribed fire (separately or in combination with mechanical shrub treatment) on 48 percent (4,789 acres) of the total acres proposed for treatment. With Alternative 3, prescribed fire would be used on 46 percent (5,165 acres) of the total treatment acres. No commercial harvest is proposed on these acres. Mechanical shrub treatments may be necessary to reduce fire intensity, scorch heights and spotting potential.

Reforestation: Proposed application of herbicide would occur on approximately 15 percent of each unit proposed for herbicide treatment, approximately 44 acres (Alternative 2) and 36 acres (Alternative 3). The total is less than 1 percent (0.1 percent) of the forested acres of the planning area.

Within one (1) to two (2) years following mechanical shrub treatment or underburning, if surveys indicate that shrubs, grasses, or sedges are re-establishing and have potential to adversely affect seedling growth, vegetation would be treated with herbicide within the units. A second application of herbicide would be done approximately two (2) years following initial treatment if surveys indicate competing and unwanted vegetation again has potential to exceed the action threshold.

Treatment would spot apply, within a 3 foot radius of all planted ponderosa pine (200 to 250 trees per acre), a dry granular form of hexazinone (Pronone^{R}MG) that inhibits photosynthesis. It is a water-dispersible, general herbicide providing both contact and residual control of many weeds, including annual and biennial weeds, brush, woody vines, and many types of perennial grasses. It can be applied over ponderosa pine without damage. Granular forms of this herbicide act through root uptake and movement in an upward direction through the plant. Approximately 13 percent to 16 percent of an acre would receive an application of herbicide. The proposed application rate of the product (0.26 to 0.30 active ingredient, pounds per acre) is at the low end of the application rates (0.3 to 2.5 active ingredient, pounds per acre) displayed in the risk assessment (SERA 1997, Page 2-6, Table 2-3).

Application would occur either in the spring after the ground thaws or in the fall before snowfall. A summary of the herbicide analysis can be found in Chapter 3, page 115. Refer to EA Appendix F, Herbicide Analysis, page 177 for the complete discussion and analysis. Table 6 displays total acreage for units proposed for reforestation, reforestation acres within those acres, and proposed herbicide treatment acres within reforestation acres.

Table 5: Units and Acres Proposed for Herbicide Treatment

Unit	Unit Acreage (Gross)	Alternative 2		Alternative 3	
		Reforestation Acres (Net[1])	Herbicide Treatment on Reforestation Acres (Net[2])	Reforestation Acres (Net[1])	Herbicide Treatment on Reforestation Acres (Net[2])
Group Regeneration Harvest					
14	72	25	4	0	0
21	112	39	6	39	6
259	27	7	1	7	1
262	69	17	2	17	2
267	69	17	2	17	2
442	211	0	0	74	11
Subtotal	**751**	**105**	**15**	**154**	**22**
Stand Regeneration Harvest					
7	80	32	5	0	0
8	46	18	3	0	0
26	102	41	6	41	6
27	47	19	3	0	0
36	14	6	1	0	0
58	41	16	2	0	0
59	15	6	1	0	0

Table 5: Units and Acres Proposed for Herbicide Treatment					
Unit	Unit Acreage (Gross)	Alternative 2		Alternative 3	
		Reforestation Acres (Net[1])	Herbicide Treatment on Reforestation Acres (Net[2])	Reforestation Acres (Net[1])	Herbicide Treatment on Reforestation Acres (Net[2])
258	46	12	2	12	2
261	44	11	3	11	3
268	84	21	3	21	3
Subtotal	**519**	**182**	**29**	**85**	**14**
Total Acres	**1270**	**287**	**44**	**239**	**36**

[1] **Group regeneration harvest:** net acreage is 25 to 35 percent of gross unit acreage; **Stand regeneration harvest:** net acreage is 40 percent of gross unit acreage.

Monument activities: The proposed treatments would reduce stand density, natural fuels, and associated insects and disease. The proposed activities displayed in Table 6 are consistent with Monument direction regarding acres of treatment allowed per year or decade.

Table 6: Newberry National Volcanic Monument (NNVM) Proposed Treatments				
Treatment *	Alternative 2		Alternative 3	
	Treatment Acres within NNVM	% of Total NNVM Treatment	Treatment Acres within NNVM	% of Total NNVM Treatment
Underburn Only	62	6%	502	42%
Mechanical Shrub Treatment (MST)	15	1%	0	0
MST/Underburn	263	27%	140	12%
Underburn/MST	119	12%	0	0
Commercial Thin with:				
No other Treatment	20	2%	50	4%
MST	17	2%	2	<1%
MST/Underburn	430	44%	116	10%
Underburn	59	6%	368	32%
Total Acres of Treatment	985	100%	1,178	100%

Proposed Activities Common to Alternatives 2 and 3

One (1) temporary road and road reconstruction would be needed to access and support management activities and to improve existing roads. Sufficient funding to cover annual and deferred maintenance on all roads is not expected. Unclassified, non-system roads would be closed when associated with vegetation management activities or when other funding becomes available.

Road Access: Approximately 22.0 miles of roads would be reconstructed (Table 7, page 26) prior to thinning activities. In addition to road reconstruction work, other roads that would be used for timber haul would require maintenance, primarily blading and shaping of the roadbed and brush removal. Reconstruction activities on Road 1801 would include the restoration of drainage features and applying spot surfacing as required. Intersections with Roads 1801100, 1801460, and 1801540 would be straightened or realigned. Road 9710 and Road 9720 would be resurfaced with crushed aggregate and have drainage features restored.

Table 7: Road Reconstruction Activities – Milepost Location and Total Miles per Road Segment			
Road Number	**Reconstruction Location**	**Alternative 1 (Miles)**	**Alternatives 2 and 3 (Miles)**
1801	Milepost 0.0 (jct. 18) to Milepost 3.4 (jct. 97)	0.0	3.4
9710	Milepost 0.00 (jct. 97) to Milepost 8.4 (jct. 9720)	0.0	8.4
9720	Milepost 0.3 to Milepost 10.5 (jct. 9710)	0.0	10.2
Total		**0.0**	**22.0**

A roads analysis was completed for Forest roads within the Kelsey planning area, including those that were analyzed in the 18 Fire Draft Environmental Impact Statement (DEIS). Roads were analyzed for management necessity and impacts on resources. Roads proposed for closure are within the biological winter range of mule deer, including key elk habitat, and were determined to be unnecessary for short-term management objectives. Roads associated with units would be closed or decommissioned following completion of proposed Forest activities. Approximately 35.2 miles of roads are proposed for closure (27.9 miles) or decommissioning (7.3 miles). Closed roads would be available for future forest management as needed. Decommissioned roads would no longer be accessible by motor vehicles. Figure 11a and 11b (following pages) display roads that are proposed for closure and decommissioning and those to remain open, including those analyzed in the 18 Fire DEIS. Table 8, display roads proposed for closure and Table 55 proposed for decommissioning within the analysis area.

Table 8: Proposed Road Closures Following Treatments Within the Kelsey Analysis Area							
Road Number	**Road Miles**	**Alternative 2 Associated Units**	**Alternative 3 Associated Units**	**Road Number**	**Road Miles**	**Alternative 2 Associated Units**	**Alternative 3 Associated Units**
1800063	1.2	138	138	9721225	1.0	50	277
1801440	0.2	146	446	9721230	2.6	67,152	152,367
1810290	0.4	151	451	9721530	0.6	47	246,347
1815640	1.7	136	136	9721850	1.1	262	262
9701525	0.5	122	122	4001050	1.7	265,266,267	265,266,267
9702630	0.2	N/A	204	4001051	1.7	265	265
9702631	0.2	N/A	204	4001105	0.3	265	265
9702651	0.2	78	78	4001130	0.4	266,267	266,267
9702670	0.4	68, 83	83, 369	4001140	0.3	27,29	29,327
9710380	1.4	7	307	4001250	0.5	26,29	26,29
9711600	2.2	13	223, 313	4001300	2.2	268,269	268,269
9720400	0.5	N/A	245	4001720	1.0	81	81
9720600	2.2	40,41,42	41,42,340	4001815	1.3	105	207,405
9720730	0.7	N/A	239,248	4001830	0.4	105	105
9720750	0.3	39,40	39,340	4001850	0.5	104	104
Total Road Closures Within Kelsey Analysis Area – 27.9 Miles							

Table 9: Proposed Road Decommissioning/Convert to Other Uses Following Treatments			
Road Number	**Road Miles**	**Alternative 2 Associated Units**	**Alternative 3 Associated Units**
1800022	0.1	134	134
1800050	0.1	141	141
1801390	0.4	196	446
1801850	1.7	130	430
1810280	0.4	142	442
9701170	0.6	158	252

Table 9: Proposed Road Decommissioning/Convert to Other Uses Following Treatments			
Road Number	**Road Miles**	**Alternative 2 Associated Units**	**Alternative 3 Associated Units**
9710280	0.6	96	96,234
9710290	2.0	96	234
9711410	0.8	14	14
9711412	0.6	14	14
Total Road Decommissioning Within Kelsey Analysis Area – 7.3 Miles			

Motorized access within the Green Mountain Winter Range Habitat Unit (WRHU) would be restricted during a four-month seasonal closure, from December 1 to March 31. Use within the seasonal closure area would be by permit only, if use would be other than roads displayed in Table 10. Seasonal closure would mitigate low thermal cover levels and reduce deer/vehicle interaction risk during critical springtime foraging and fawning activities.

Table 10: Proposed Motorized Road Access During Seasonal Closure Within Kelsey Deer Habitat	
Road Number	
1800000	9710000
1810000	9711000
1810012 (Gas Line)	9714000

Figure 5a

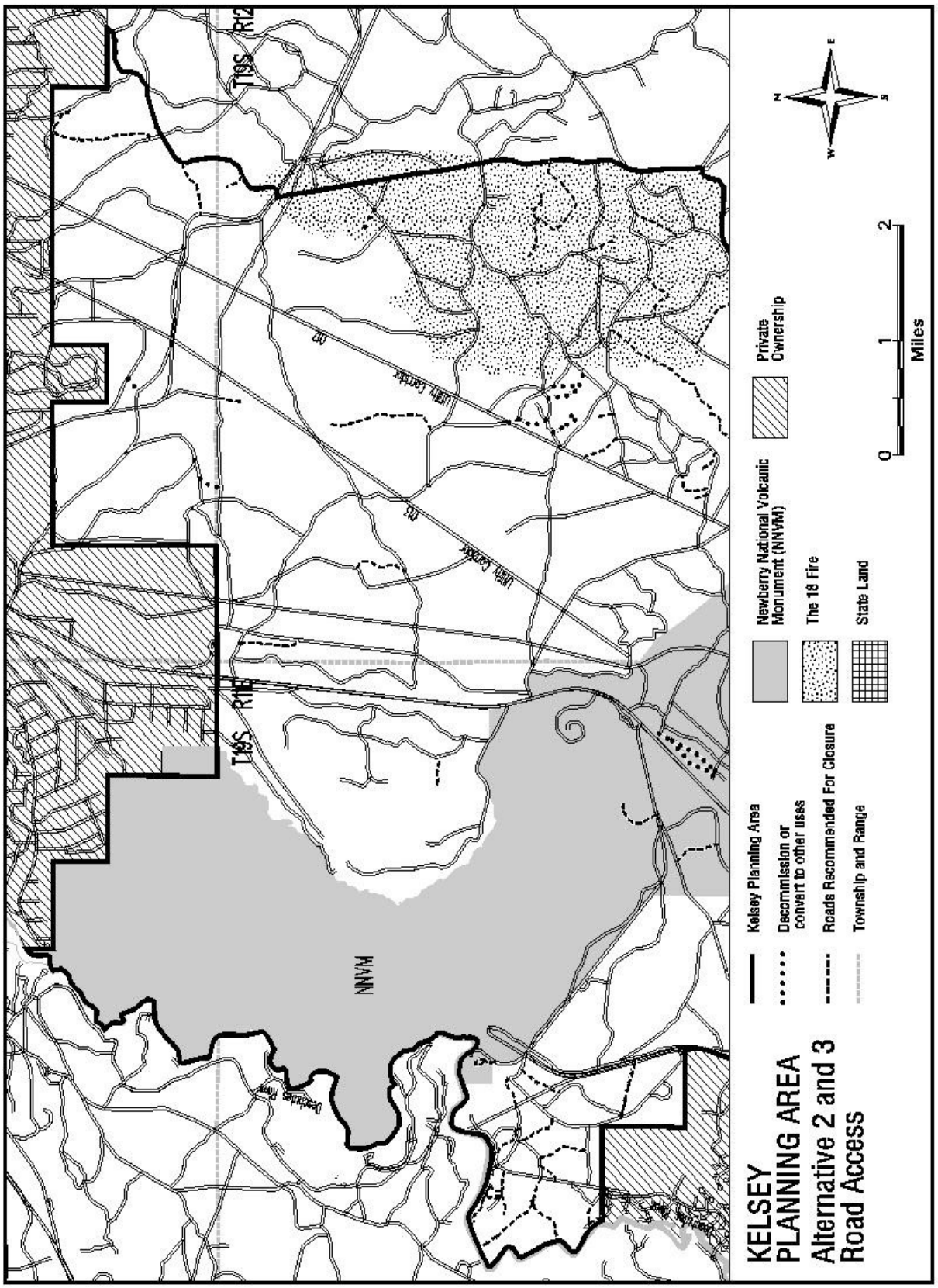
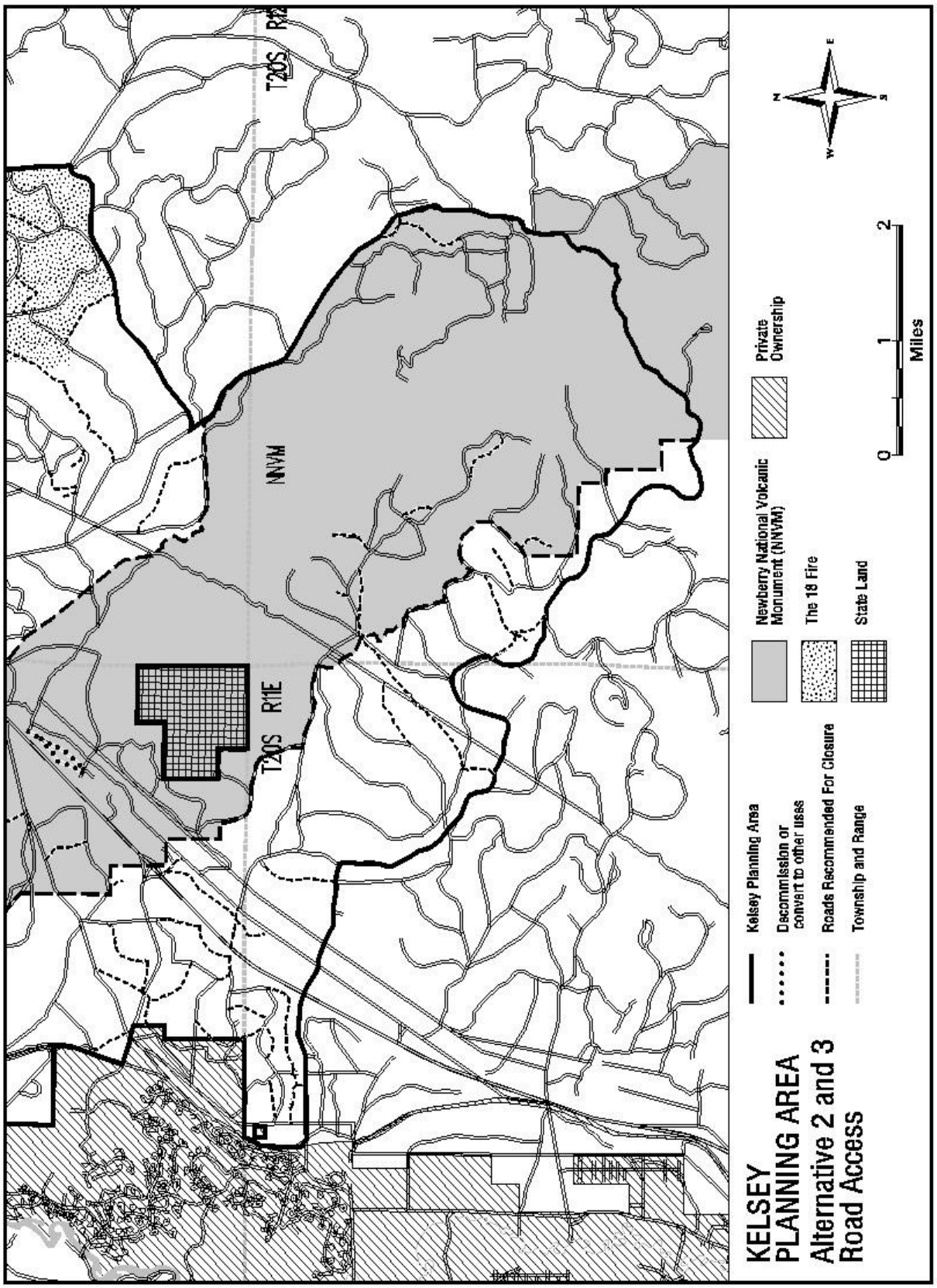

KELSEY
PLANNING AREA
Alternative 2 and 3
Road Access
Kelsey Planning Area
Decommission or convert to other uses
Roads Recommended For Closure
Township and Range
Newberry National Volcanic Monument (NNVM)
The 18 Fire
State Land
Private Ownership
0
1
2
Miles
T19S
R12
T20S
R11E
NNVM
Deschutes River
Little Cultus
Little Cultus

Figure 5b


T20S R12E
T20S R11E
NNVM
KELSEY
PLANNING AREA
Alternative 2 and 3
Road Access
Kelsey Planning Area
Decommission or convert to other uses
Roads Recommended For Closure
Township and Range
Newberry National Volcanic Monument (NNVM)
The 18 Fire
State Land
Private Ownership
0
1
2
Miles

COMPARISON OF THE ALTERNATIVES

Table 11 compares the alternatives in relation to the activities proposed in Alternatives 1 (No Action), 2 (Proposed Action), and 3. Measurements are approximate.

Table 11: Comparison of Alternatives

	Alternative 1 (No Action)	Alternative 2 (Proposed Action)	Alternative 3 (Preferred Alternative)
Mechanical Shrub Treatment (MST): Acres	0	7,500	8,045
MST – NNVM: Acres		844	258
Prescribed Fire: Acres	0	5,495	7,315
Prescribed Fire – NNVM: Acres		933	1,126
Commercial and Precommercial Thinning: Acres	0	5,660	6,635
Wildland Urban Interface: Acres to be Treated	0	2,965	3,225
Defensible Space: Miles to be Treated	0	20	20
LOS Development: Acres	0	3,580	4,320
Reduce Imminent Susceptibility to Bark Beetle Attack: Acres	0	3,585	4,430
Reduce Severe Dwarf Mistletoe: Acres	0	3,980	4,380
Thinning to 30-35 Foot Spacing: Acres	0	3,015	1,715
Pruning: Acres	0	1,000	900
Reforestation: Acres/Cost	0	275/$322,000	210/$212,000
Herbicide Treatment: Acres	0	44	36
Aspen Enhancement: Acres	0	0	5
Pole Fence Around Aspen Stand: Feet	0	0	2,000
Total Treatment Acres *	**0**	**9,750***	**11,080***
Estimated Commercial Harvest Volume	0	13.6 MMBF (±20%) 26.1 CCF (±20%)	15.8 MMBF (±20%) 30.3 CCF (±20%)
Road Reconstruction: Miles	0	22.0	22.0
Road Closure: Miles	0	27.9	27.9
Road Decommission: Miles	0	7.3	7.3
Seasonal Closure – Deer Habitat	No	Yes	Yes

Total treatment acres: Many units have multiple treatment types. The sum of specific treatment acres is greater than total treatment acres.

ALTERNATIVES CONSIDERED BUT ELIMINATED FROM DETAILED ANALYSIS

- An alternative that would implement vegetation management activities (precommercial thinning and prescribed fire) without the removal of commercial wood fiber (restoration only) was considered, but eliminated from consideration because it was not identified as an issue in scoping. It did not meet the desired results or condition (s) identified in the Purpose and Need and under what authority resource management activities are implemented is discretionary.

  In the publication titled "The Use of Fire in Forest Restoration", Carl E. Fiedler (1996) describes the goal of restoration in ponderosa pine forests as follows: "A primary goal of restoration treatments in ponderosa pine … forests is to create more open stand structures, thereby improving tree vigor and reducing vulnerability to insects, disease, and severe fire. An additional goal in some stands is to manipulate existing species composition and site conditions to favor regeneration of ponderosa pine . . .". This primary goal is captured in the purpose and need for action identified for the Kelsey Planning area. Objectives of proposed thinning include: improving tree vigor and reducing vulnerability to bark beetle, mistletoe, and severe fire. Proposed regeneration harvest treatments would create site conditions to favor regeneration of ponderosa pine.

  During public scoping a restoration only alternative was not identified. Developing a restoration only alternative that eliminates commercial harvest could be done with the Decision Notice that authorizes implementation of one of the action alternatives without commercial harvest. For example, the effects of eliminating commercial timber harvest and implementing only restoration projects would be similar to Alternative 3 in regards to heritage resources, transportation system access and recreation management. Under this alternative, a total of 1,054 acres would be prescribed burned or mowed, 23.4 miles of road closed and 41 acres subsoiled. A total of 338 acres would be precommercially thinned to accelerate the development of LOS lodgepole and ponderosa pine. The effects on scenic views would be similar to Alternative 1, while the effects on other resources would be a blend between Alternatives 1 and 3. To date an estimated $170,000 has been required to complete the EA. Similar to Alternative 3, additional funding from a variety of sources (with the exception of KV) would be used to complete the restoration work identified in the EA. The actual work would be accomplished by a variety of methods including service contracts, force account crews and volunteers.

  Fiber harvest, which can be an outcome of vegetation management, provides economic benefits, employment and returns to local and federal governments. The district examines areas where vegetation management is needed and makes a determination of whether commercial timber harvest is an ecologically appropriate and economically feasible method of achieving desired resource conditions. The high, density ponderosa pine stands and existing lodgepole pine shelterwood areas within the Kelsey project area have the capability to provide an economic return as an outcome of vegetation management.

  Vegetation management and restoration activities in the Kelsey EA are designed to maintain and restore a healthy forest ecosystem. Eliminating commercial firmwood fiber removal would effectively eliminate the opportunity to reduce fuel loads on 5,230 acres classified as extreme for fire behavior potential, while exacerbating a worsening forest health trend. The analysis shows that treating these additional acres could be done with only minor short-term effects. As noted before commercial firmwood fiber removal can be one of many outcomes of vegetation management. Most vegetation management projects include service contracts, force account work, volunteer labor and where appropriate, commercial firmwood fiber removal to implement. The majority of fuels treatment and other vegetation management activities with the preferred alternative are treatments consisting of prescribe burning, mowing, hand piling, and precommercial thinning.

Reduction of stand density is necessary to create more open stand structures that would meet a variety of objectives including: making stands more resistant to wildfire and bark beetle attack, opening up views of scenic features, and reducing shade on the Cottonwood Road. To achieve desired density reduction with fire would be clearly unreasonable - a relatively high intensity fire would be necessary. Such a fire would result in higher level of density reduction than is desired. Scorch heights associated with this type of fire would put surviving trees at an increased risk of bark beetle attack. Scorch heights and tree mortality would not be desirable within scenic view allocations.

To achieve desired density reduction, it has been demonstrated on the District that cutting trees is an effective and feasible method. Carl E. Fiedler (1996) states, "a primary advantage of cutting is that it allows for the controlled removal of specific trees in terms of number, size, species, and location. Cutting trees also allows them to be used for forest products, generating income to offset treatment costs." Commercial fiber removal is an effective means of reducing stand density to meet a variety of treatment objectives. Commercial harvest will not increase fuel loadings, as the purchaser of any commercial timber sale assumes responsibility for the disposal of slash resulting from the purchaser's operation.

In addition, funding for fuels reduction is not tied to harvest receipts. Our current (Forest Service Manual 2436) direction states that the purchaser of any commercial timber sale assumes responsibility only for the disposal of slash resulting from the purchaser's operation.

- During initial scoping for the Kelsey project, an issue was identified concerning the use of mechanical treatment within Newberry National Volcanic Monument. An alternative was considered that would decrease the amount of mechanical treatment, including commercial harvest, within the Monument. This alternative was eliminated from detailed study. Proposed harvest in the Monument is necessary to reduce fire hazard and move towards reestablishing historic ponderosa pine old growth stands.

- An alternative making more use of prescribed fire to reduce fuels was considered but eliminated from detailed analysis. With Alternative 3, commercial harvest (mechanical treatment) is proposed on 1,758 acres to meet a primary treatment objective of fuels reduction. The feasibility of using only fire (separately or in combination with mechanical shrub treatment) on these acres was considered. Commercial harvest was found necessary to meet the purpose and need for action on all, but 219 of these acres (Unit 313). This was not considered a large enough difference to warrant developing a separate alternative. In the Decision Notice, either of the action alternatives could be modified to exclude commercial harvest from Unit 313.

  Foregoing use of commercial harvest would not be reasonable on approximately 1,358 acres. On approximately 1,296 of these acres (Units 23, 39, 41, 45, 49, 152, 225, 227, 254, 277, 312, 368, 405, 424, 446, and 447) there is a purpose and need to reduce risk of bark beetle outbreak in addition to reducing fuels. To make the stands more resilient to beetle attack, tree density must be reduced. On approximately 62 acres (Unit 269), fuel treatment objectives are to create a strategic fuelbreak and create a defensible/safe egress route along the Cottonwood Road and Highway 97. To meet the egress route objective, tree density must be reduced. On all these acres, use of fire to accomplish desired density reduction would be clearly unreasonable. To achieve desired thinning, a relatively high intensity fire would be necessary. Such a fire would result in higher level of density reduction than is desired. Scorch heights associated with this type of fire would put surviving trees at an increased risk of bark beetle attack. Scorch heights and tree mortality would not be desirable within scenic view allocations.

  Foregoing use of commercial harvest would also not be reasonable on an additional 140 acres (Units 78, 206, 224, and 430). These acres proposed for treatment are located within the wildland urban interface by Sunriver and along the Highway 97 corridor. No past thinning has occurred within these stands. Ladder fuels are present. Use of fire within the urban interface without prior thinning would pose too great a threat of torching.

Use of fire would result in crown scorch levels higher than is visually desired. Scorch heights associated with this type of fire would put surviving trees at risk of bark beetle attack.

Foregoing use of commercial harvest would not meet fuel reduction objectives in the short or long-term on approximately 41 acres (Unit 42). Within this stand of ponderosa and lodgepole pine, prescribed fire would likely kill the lodgepole pine (approximately 18 lodgepole pine trees per acre with an estimated volume of 1,025 board feet per acre). In the short term, snags in this area would not meet the objective of creating a defensible/safe egress route along road 9720, the primary access route to Lava Cast Forest. In the long-term as these snags fall, the increase of coarse down woody would not meet the fuels objective. Mortality level may not meet the visual quality objectives. Snags by road 9720 would be a safety concern.

On approximately 219 acres (Unit 313), the objective of creating a strategic fuelbreak could be met, though not as effectively, by forgoing the use of commercial harvest and using only prescribed fire in combination with mechanical shrub treatment.

MITIGATION MEASURES, BEST MANAGEMENT PRACTICES, AND K-V PROJECTS – COMMON TO ALTERNATIVE 2 (PROPOSED ACTION) AND ALTERNATIVE 3

Alternatives are designed to be consistent with the desired condition specified in the Forest Plan and the standards and guidelines contained within. Many Forest Plan Standard and Guidelines and Eastside Screens were applied in the design of the alternatives and are not listed here. The following would be applied to reduce potential adverse impacts of Alternative 2 (Proposed Action) and Alternative 3 (Preferred). If implementation or layout problems or opportunities are encountered, the appropriate specialist will be consulted.

MITIGATION MEASURES

Botany

1. Begin project activities in uninfested areas before operating in weed-infested units (30, 50, 68, 73-75, 84-87, 96-101, 105, 117, 129, 130, 133, 134, 137, 141, 147-150, 152, 265, 267-269).
2. Inspect all limited-term ground-disturbing operations, including temporary roads, in noxious weed infested and uninfested areas for at least three growing seasons following completion of the project. Provide follow-up treatments if necessary.
3. Treat weeds in road decommissioning and reclamation projects before roads are made impassable. Reinspect and follow-up based on initial inspection and documentation.
4. Ensure that equipment and vehicles used in prescribed fire projects are free of weed seed and propagules before entering the project area, especially units where cheatgrass does not occur.
5. Clean equipment before leaving the project site, if operating in areas infested with weeds.
6. To the extent feasible, during mowing or burning, avoid mowing or lighting obvious high-density cheatgrass locations, such as cattle water sets, hunter camps, or adjacent to roads.
7. Leave a 15 to 20 foot untreated buffer strip along edges that lie adjacent to roads to reduce the spread or introduction of cheatgrass in proposed mowing units.
8. Where appropriate and practical, stockpile weed-seed-free topsoil and replace it on disturbed areas (road embankments or landings).
9. Treat weeds in project area, emphasizing treatment of weed infestations on existing landings, skid trails, and haul roads before activities commence.

Wildlife

1. **Neotrop-1:** To avoid negative effects to birds including nest destruction, loss of broods, and direct mortality of adults, do not conduct mechanical shrub treatments or prescribed burning during the period of April 1 – August

15. For prescribed burning, surveys will be conducted prior to the activity to determine if there are any nesting species. Spring treatments should be done prior to the plants' break of dormancy.

2. N**est-1:** In the event that raptor nests are discovered during project preparation or implementation, active nest sites will be protected from disturbing activities within ¼ mile (1 mile for use of explosives) of the nest by restricting operations during the nestling period (Forest Plan WL-3).
   March 1 - August 31: red-tailed hawk & northern goshawk
   February 1 – July 31: golden eagle
   April 15 – August 31: Cooper's hawk & sharp-shinned hawk
3. **Nest-2:** To prevent negative effects to active Cooper's hawk and northern goshawk nests, develop burn prescriptions such that smoke from prescribed burn operations drifts away from active nests.
4. **Nest-3**: Northern Goshawk Seasonal Operating Restriction – Active nest sites should be protected from disturbing activities within ¼ mile (1 mile for explosives) of the nest by restricting operations during the nesting period of March 1 – August 31 (WL-11, Eastside Screens). The seasonal operating restriction applies to the following units:
   Alternative 2: Units 13, 22
   Alternative 3: Units 22, 244, 313
5. **Nest-4:** Cooper's Hawk Seasonal Operating Restriction – Active nest sites should be protected from disturbing activities within ¼ mile (1 mile for explosives) of the nest by restricting operations during the nesting period of April 15 – August 31 (WL-19). The seasonal operating restriction applies to the following units:
   Alternative 2: Units 45, 121
   Alternative 3: Units 45, 121
6. **BG-1:** To provide stand diversity and big game hiding and thermal cover, with the exception of commercial harvest units in the Ryan Ranch Key Elk Area (they have their own mitigation, see BG-2), units in the OSU study, and units:
   Alternative 2: 21, 33, 49, 73-75, 87, 97 – 100, 112, 117, 120, 148-150, 230-232, 254
   Alternative 3: 21, 33, 49, 73-75, 87, 97 – 100, 120, 272, 273, 276, 278, 352, 354, and 442,
   all commercial harvest treatments will retain approximately 10% of the unit treatment area in untreated clumps. Untreated clumps should be ½-6 ac in size, be the densest available, and distributed throughout the unit. As a general rule, untreated clumps will be located greater than 200 ft from open roads and be distributed approximately 600-1,200 feet apart (WL-59, M7-10, M7-15).
7. **BG-1A:** Unit 146 (Alternative 2) /446 (Alternative 3) will drop western portion (of 030 rd) and retain 20% of the unit in untreated clumps similar to the above mitigation in an area of high deer use and compensate for aggressive fuel treatment (M7-10, M7-16).
8. **BG-1B:** Drop the following units in order to off-set the loss of thermal cover as a result of the 18 Fire and improve distribution of remaining cover (M7-10, M7-16).
   Alternative 2: 122, 127, 128, 14, and portion of 142 east of powerline.
   Alternative 3: 122, 127, 128, 314, and portion of 442 east of powerline
9. **BG-2:** Ryan Ranch Key Elk Area – To provide cover and visual screening throughout the area, 30% of the following commercially harvested units in the Key Elk Area that contain cover will be retained in untreated clumps greater than 2 ac in size (WL-47, 49, & 51):
   Alternative 2: 26, 27, 68-71, 78, 80, 88, 268
   Alternative 3: 26, 78, 88, 200-206, 224, 225, 227, 271, 268, 327, 368, 369
10. **BG-3:** Deer Habitat Seasonal Operating Restriction – To minimize disturbance of big game during winter periods, activities associated with commercial harvest, precommercial thinning, and mechanical shrub treatment should not occur during the period of December 1 through March 31 of the year within the Lava River and Green Mountain WRHU (reference M7-23).
11. **BG-4:** To prevent disturbance of wintering deer, a seasonal closure of December1-March 31 of each year for all motorized vehicles, including over-the-snow motorized vehicles will be implemented within the Green Mountain WRHU and Ryan Ranch KEA. Motorized vehicle access will be allowed on designated travel routes only, or by special permit.

12. **BG-5:** To provide a seed source for shrub re-establishment, habitat for shrub-nesting songbirds, bat prey (moths), chipmunk and ground squirrels, and to retain mule deer forage and camouflage cover, between 30-50% of the unit acreage would not be treated in prescribed burning and/or mechanically treated fuels units (M7-14). The untreated acreage will be distributed in a mosaic of islands of untreated shrubs, varying size from 0.5-6 acres. Logs and rock outcrops should be included in untreated areas, such that these features retain no treatment buffers of at least 25-30 feet (WL-74 & WL-75).
    - Spacing between 6 ac islands would be approximately 300 feet and would generally not exceed 100 feet. Spacing between the smaller islands (less than 6 acre) could be less than 300 feet to capture key features.
    - Retain untreated buffers and islands no closer than 400 feet from the boundary with private/urban land.
    - This mitigation applies to **all units except** :
      Alternative 2: 33, 34, 47, 65, 97, 113, 119-122, 125, 127, and 128
      Alternative 3: 33,65,97,113,119-122,125,127,128,202-205,213,229-233,240-244,246,247,278,335,347,360
13. **BG-6:** Protect the guzzler in Unit 264 (both Alternatives) from any potential damage during project implementation.
14. **LOS-1:** To maintain connective corridors between LOS classified stands and be consistent with Eastside Screens direction, the portions of the following units that are within LOS corridors need to be either 1) deleted from the units and not treated or 2) the prescription in the portion of the unit in the corridor needs to be changed to a prescription that maintains stand stocking levels to the upper third of site potential.
      Alternative 2: 23, 26, 67, 69, 80, 102, 129, 264, 268
      Alternative 3: 23, 26, 102, 129, 264, 268
15. **Cave 1:** Trees will not be harvested in a 150-200 foot radius around the entrance to Lava River Cave (Forest Plan CV-3). Prescribed burning operations will avoid smoke from entering the cave. This mitigation applies to Unit 100.
16. **Snag-1:** Within all commercial thinning and fuels treatment units maintain snags at the following levels:

Table 12: Snags to be Retained in Commercial Thinning and Fuels Treatment Units

Habitat Type	Average Snags Per Acre ≥ 10inches" dbh	Average Snags Per Acre ≥ 20 inches dbh
PPDF Small/Medium trees 50% tolerance level Units: all units not listed under the other habitat types	1.6	1.1
PPDF Small/Medium trees 80% tolerance level[2] Units: 129, 88, 89, 239, 248, 277	4.8	2.5
PPDF Large tree 50% tolerance level Units: 37, 61, 65, 243, 244, 247, 335, 338, 360, 366	2.9	3.6
Lodgepole Pine[3] Screens Draft EIS Units: 78, 205, 206, 224, 368	1.21 6	0.59 (> 12")

17. **Snag-2:** Retain all existing snags (including soft) as wildlife trees for roosting and foraging except where impractical because of human safety, other resource protection, or project logistics (Wildlife Tree and Log Implementation Strategy, Forest Plan WL-38).

18. **CWM-1:** Within all commercial harvest and fuels treatment units develop harvest and fuels treatment prescriptions to retain existing CWM in the following quantities:

Table 13: Log Retention at 50 Percent and 80 Percent Tolerance Levels					
Number of Logs*		**Log Length (feet)**	**Log Diameter (inches)**	**Percent of ground cover (total of logs)**	
50% Tolerance Level	80% Tolerance Level			50% Tolerance Level	80% Tolerance Level
4	5	20-40	5-10	0.2	0.3
8	10	20-40	10-20	0.8	1.0
4	6	20-40	20-40	0.5	0.8
Total: 16	20			1.5	2.1

*Lodgepole pine areas fall under the 50 percent tolerance level for this table. A lack of 20-40 inch diameter lodgepole pine is expected, thus the 10-20 inch diameter category would absorb those numbers (i.e. 12 logs that are 20-40 feet long and 10-20 inches diameter).

19. **CWM-2:** Develop prescribed burn prescriptions to minimize charring of logs (Forest Plan WL-72). Fire prescription parameters will ensure that consumption will not exceed 3" total (1.5 inches per side) of diameter reduction in featured logs (Eastside Screens).
20. **CWM-3** During prescribed burn operations, avoid direct ignition of CWM that is greater than 12 " in diameter and 6' in length and snags.
21. **CWM-4:** Within commercial harvest and fuels treatment units that are below minimum management levels for CWM leave one slash pile (approximately 100 sq. ft) or concentration (Approximately 200ft) per acre to supplement qualifying material (Forest Plan WL-72 & 73)

Fisheries and Hydrology

1. Use of mechanized equipment, fire, and hand piles would be allowed within the RHCA to within 100 feet of the Deschutes River: a) incorporate silt fences as needed; b) minimize ground disturbance; c) re-vegetate site as soon as feasible; d) use straw wattles or erosion cloth to protect bare slopes; e) avoid operations during excessive soil moisture conditions.
2. No fire lines would be allowed within RHCAs.
3. Thinning activities within the RHCA would only occur on adequate snow covered or frozen ground.
4. Avoid operations during periods of high soil moisture conditions.
5. Assure that water control structures are installed and maintained on skid trails that have gradients of 10 percent or more (LRMP SL-1); (Timber Management BMP T-16).

Soils

1. Use old landings and skidding networks whenever possible. Based on harvest history, approximately 151 acres of past harvest overlap a portion of proposed Unit 01. Assure that water control structures are installed and maintained on skid trails that have gradients of 10 percent or more. Ensure that erosion control structures are stabilized and working effectively (Forest Plan SL-1; Timber Management BMP T-16, T-18).
2. In all proposed activity areas, locations for new yarding and transportation systems would be designated prior to the logging operations. This includes temporary roads, spur roads, log landings, and primary (main) skid trail networks. (Forest Plan SL-1 & SL-3; Timber Management BMP T-11, T-14 & T-16).
3. **Surface Drainage on Temporary Roads**: minimize erosive effects of concentrated water through the proper design and construction of temporary roads (Road BMP R-7).
4. **Road Maintenance**: conduct regular preventive maintenance to avoid deterioration of the road surface and minimize the effects of erosion (Road BMP R-18, R-19).
5. **Coarse Woody Debris/Down Wood**: Retain adequate supplies of large woody debris (greater than 3-inches in diameter) to provide organic matter reservoirs for nutrient cycling following completion of all project activities (Forest Plan SL-1). It is recommended that a minimum of 5 to 10 tons per acre of woody debris be retained on dry, Ponderosa Pine sites to help maintain long-term site productivity.

6. **Maintain duff layer**: Strive to maintain existing sources of unburned or partially-consumed, fine organic matter (organic materials less than 3-inches in diameter; commonly referred to as the duff layer), wherever possible, within planned activity areas. (Forest Plan SL-6; Fuels Management BMP F-2; Timber Management BMP T-13).
7. Maintain spacing of 100 to 150 feet for all primary (main) skid trail routes, except where converging at landings. The Timber Sale Administrator must approve closer spacing, due to complex terrain, in advance. Main skid trails spaced 100 feet apart limit soil impacts to 11 % of the unit area. For the larger activity areas (greater than 40 acres) that can accommodate wider spacing distances, it is recommended that distance between main skid trials be increased to 150 feet to reduce the amount of detrimentally disturbed soil to 7 percent of the unit area (Froehlich, 1981, Garland, 1983). This would reduce the amount of surface area where restoration treatments, such as subsoiling, would be required to mitigate impacts to achieve soil management objectives.
8. Restrict grapple skidders to designated areas (i.e., roads, landings, designated skid trails) at all times, and limit the amount of traffic from other specialized equipment off designated areas. The use of harvester machines will be authorized to make no more than two (2) equipment passes on any site-specific area to accumulate materials.
9. Avoid equipment operations during times of the year when soils are extremely dry and subject to excessive soil displacement.
10. Avoid equipment operations during periods of high soil moisture, as evidenced by equipment tracks that sink deeper than during dry or frozen conditions.
11. Operate equipment over frozen ground or a sufficient amount of compacted snow to protect mineral soil. Equipment operations should be discontinued when frozen ground begins to thaw or when there is too little compacted snow and equipment begins to cause soil puddling damage (rutting).
12. Prevent additional soil impacts in random locations of activity areas, between skid trails and away from landings, by machine piling and burning logging slash on existing log landings and skid trails that already have detrimental soil conditions (Forest Plan Standards and Guidelines (SL-1 and SL-3); Timber Management BMPs T-2, T-4, T-9, T-11 and T-12; Forest Service Soil and Water Conservation Practices Handbook (FSH 2509.22); Froehlich et al 1981; Clayton, 1990; Garland, 1983; Fact; Experience)
13. Reclaim all temporary roads, all log landings and approximately 500 feet of all primary (main) skid trails that lead into log landings by applying appropriate soil restoration treatments in activity areas proposed under both Alternative 2 and 3. Decommission (obliterate) of local system roads that are recommended for removal from the transportation system (FS Road Numbers are identified in the Roads and Transportation Section of this EIS). Road decommissioning treatments would apply to both of the action alternatives. Options for improving the hydrologic function and productivity on these disturbed sites include the use of subsoiling equipment to loosen compacted soils, redistributing humus-enriched topsoil in areas of soil displacement damage, pulling available slash and woody materials over the treated surface, and planting shrubs and tree seedlings to establish effective ground cover protection (Forest Plan Standards and Guidelines for Soil, Water and Riparian Resources (SL-1 and SL-4); Watershed Management BMP W-1; Cafferata, 1983; Garland, 1983; Johnson, 1995; Experience, Logic).

Range

1. Avoid and protect fences that are constructed with primarily wood materials. Reconstruct metal and wood fences damaged during treatments (Units 20, 67, 132-136, 141, 145, 146, 154).
2. Prior to treatments, Current Trend (CT) Study Plots (Unit 45) will be measured and plots and transects will be flagged. Avoid flagged CT plots to protect stakes used to locate the plot and transects.
3. Leave 25-foot buffer around the water set to prevent cheatgrass spread, if present.
4. Flag and avoid Parker 3-step enclosures and surrounding study areas from prescribed fire or mechanical treatments.
5. Range specialists will review contracts and burning plans prior to approval and implementation.

Herbicides

1. Public notification will be used for all applications requesting that people who know or suspect that they are

hypersensitive to herbicides contact the Forest Service to determine appropriate risk management measures.
2. Areas treated with herbicides would be posted with public warning signs. The signs would be posted along roads, OHV trails, or other points where people would be likely to enter a unit. Signs would include the treatment date, the activity performed and who to contact for further information. Signs would remain up for at least 48 hours.

Cultural
1. Avoid burning, constructing fire lines, mopping up fires, mechanical shrub treatments, mechanical thinning, machine piling, and subsoiling within cultural sites. Avoid historic properties in commercial harvest units, landings, temporary roads, and skid trails. Avoid constructing fire lines and fire mop up during meadow enhancement activities.
2. Minimize maneuvering of equipment in prehistoric site areas.
3. Hand thin small trees that encroach within a cultural site area.

Scenic Resource
1. Flush cut stump within 100 ft. (minimum) of road corridor within Foreground Scenic View.
2. Paint on backsides of all leave trees (within 100 ft. from road right-of-way). When possible, use cut tree marking to minimize painted trees left behind. Remove ribbons and other markers following completion of the project.
3. Slash treatment will be completed within one year for Retention and two years for Partial Retention.
4. Minimize ground disturbance within the foreground viewing areas to reduce soil contrast. Design and locate skid trail and landing area at least 300 feet away from primary travel corridors if possible.
5. Avoid fire scorch above 2/3 of live tree crown within the foreground landscape. Severely burned damaged trees shall be removed.

Silviculture
1. No more than 50 percent of the live crown ratio of dominant and co-dominant ponderosa pine should be scorched during proposed underburns.

General
Limit noise associated with harvest and mechanical fuel treatment proposed within one-quarter mile of Sunriver and during the primary tourist season (Memorial Day through Labor Day). The mitigation would apply to:
Alternative 2 (Proposed Action): 30, 68, 69, 78, 80, 81, 83
Alternative 3: 78, 81, 83, 206, 223, 224, 225, 226, 227, 368, 369
1) Saturday – operating hours 7:30 am to 7:00 pm.
2) No operations on Sundays or holidays (Memorial Day, Independence Day, and Labor Day).

BEST MANAGEMENT PRACTICES (BMPS)
The following Best Management Practices (BMPs) in Table 14 will be implemented to prevent water quality degradation, primarily from sediment delivery to aquatic ecosystems. BMPs should be selected and tailored for site-specific conditions to arrive at the project level BMPs for the protection of water quality. A complete explanation of the BMPs is found in *General Water Quality Best Management Practices* (USDA, 1988) and is available at the District Office or Supervisors Office.

Table 14: Relevant Best Management Practices (BMP)

Resource and Best Management Practice	Description of Best Management Practice
Soil and Water	**Roads**
R1	General guidelines for the location and design of roads minimize resource damage.
R2	Erosion control plan, to limit and mitigate erosion and sedimentation.
R3	Timing of construction activities, to minimize erosion by avoiding wet weather conditions.

Table 14: Relevant Best Management Practices (BMP)	
Resource and Best Management Practice	**Description of Best Management Practice**
R6	Dispersion of subsurface drainage associated with roads to minimize road failure.
R7	Control of surface road drainage associated with roads to minimize erosion and sedimentation.
R8	Constraints related to pioneer road construction to minimize sedimentation.
R9	Timely erosion control measures on incomplete roads and stream crossing projects.
R11	Control of sidecast material where needed to minimize sedimentation.
R15	Disposal of right-of-way and roadside debris to prevent adverse effects to aquatics.
R19	Road surface treatment to prevent loss of materials.
R20	Traffic control during wet periods to minimize erosion and rutting.
R23	Obliteration of temporary roads and landings to reduce sedimentation.
	Timber
T1	Timber sale planning to introduce water quality and hydrologic considerations into the sale planning process.
T2	Timber harvest unit design to ensure favorable conditions for aquatics.
T3	Use of erosion potential assessment for timber harvest unit design.
T5	Limiting the operating period of timber sale activities.
T6	T6- Protection of unstable lands to minimize resource damage.
T7	Streamside management unit designation to protect aquatics.
T8	Streamcourse protection to protect the natural flow of streams.
T9	Determining tractor loggable ground.
T10	Log landing location to minimize effects to aquatics.
T11	Tractor skid trail location and design.
T13	Erosion prevention and control measures during timber sale operations.
T-21	Servicing and Refueling of Equipment: To prevent pollutants from entering water, all servicing and refueling of equipment shall occur outside of RHCAs. Equipment may be used to obliterate roads and dispersed campsites.
	Fire and Fuel Management Units
F2	Consideration of water quality in formulating prescribed fire prescriptions.
F3	Protection of water quality during prescribed fire operations.
F4	Minimizing watershed damage from fire suppression efforts.
F5	Repair or stabilization of fire suppression related watershed damage.
	Watershed Management
W5	Cumulative watershed effects to protect beneficial uses.
W7	Water quality monitoring to establish trends and protect aquatics.
	Vegetative Manipulations
VM2	Tractor operations excluded from wetlands and meadows.
VM4	Soil moisture limitations for tractor operation to avoid rutting and erosion.

KV PROJECTS

Required Reforestation

- **Site Preparation:** Areas less than minimally stocked following harvest treatments that would require planting: Treatment would consists of felling mistletoe infected and poor vigor ponderosa pine trees (primarily less than 5 inches dbh) and, if present, residual lodgepole pine (primarily less than 3 inches dbh). Ponderosa pine seedlings would be planted using an auger or a planting hoe.
- **Site Preparation Whipfell for Natural Regeneration:** Ponderosa pine and lodgepole pine stands planned for natural regeneration: Treatment would consist of felling mistletoe infected and poor vigor ponderosa pine trees (primarily less than 5 inches dbh) and lodgepole pine (primarily less than 3 inches dbh).

- **Animal Damage Control**
  Big Game: To protect planted seedlings, apply repellent or tubing to planted trees to protect seedlings from big game browse.
  Gopher: Gopher baiting would occur in planted areas to minimize damage to seedlings.
- **Stocking Surveys – Planting:** Year one (1) of planting, two years following planting (3 year) and four years following planting (5 year) to monitor reforestation progress, animal damage, and competing vegetation growth.
- **Machine Pile/Site Preparation for Natural Regeneration:** Mechanical piling lodgepole pine seed tree units for site preparation and slash reduction.
- **Stocking Surveys – Natural Regeneration:** Two (2) years following site preparation (3 year exam) and 4 years following subsoiling (5 year exam) to monitor natural regeneration progress, animal damage, and competing vegetation growth.

Non-Required KV Work

Mitigation

- **Subsoil:** Units or portion of units planned for natural regeneration or planting would be subsoiled.
- **Precommercial thin and slash treatment within scenic views:** Fall small diameter trees. Slash treatment would likely be hand piling. Other slash treatments may be possible.

Stand Enhancement

- **Pruning (for mistletoe reduction):** Prune mistletoe infected branches from ponderosa pine trees within or adjacent to areas prior to ponderosa pine planting to prevent spread of mistletoe.
- **Pruning (for value): P**rune ponderosa pine seedlings within existing plantations to improve future wood quality.
- **Precommercial thin and slash treatment:** Improve diameter growth, vigor, and quality of the remaining trees by falling small diameter trees.
- **Release (Existing Plantations):** Mechanically treat shrubs, reducing shrub canopy cover, to improve growth of trees and reduce risk of stand replacing wildfire.
- **Release (New Plantations):** Reduce unwanted vegetation within approximately a 6 foot radius of planted seedlings by manually grubbing/pulling shrubs or applying herbicides.

Noxious Weeds

- Inspect all limited-term ground-disturbing operations, including temporary roads, in noxious weed infested and uninfested areas for at least three growing seasons following completion of the project. Provide follow-up treatments based on inspection results. (KV funding may be used to inspect KV projects.) Prioritize areas for inspection, and treatment if needed, to make the most efficient use of available funding.

CHAPTER 3 – AFFECTED ENVIRONMENT (EXISTING CONDITION) AND ENVIRONMENTAL CONSEQUENCES

The Affected Environment (existing condition) and Environmental Consequences (Effects) section provides the scientific and analytical basis for alternative comparison. This section describes the beneficial or adverse impacts to the environment that would occur if the various alternatives were implemented. Probable effects are discussed in terms of environmental changes from the current condition and include qualitative as well as quantitative assessments of direct, indirect, and cumulative effects.

Impacts are defined as follows:
Direct effects: Those effects that occur at the same time and in the same general location as the activity causing the effects.
Indirect effects: Those effects that occur at a different time or different location than the activity to which the effects are related.
Cumulative effects: – Those effects that result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions.

Specialist reports have been summarized in the following discussions within this section. For more detailed and supporting documentation, please refer to the specialist reports in the Official Kelsey Record located at the Bend-Fort Rock District Office (see Wildlife Report and Biological Evaluation; Botany Biological Evaluation and Noxious Weed Risk Assessment; Fire and Fuels Report; Silviculture Report; Hydrology and Fisheries Reports; Soils Report; Roads Analysis and Report; Recreation Report; Cultural Resources Report; Scenic Resources Report; and Range Report)

For supplemental and supporting documentation, refer to the Appendices listed in the Table of Contents of this report. The appendices include Wildlife and Botany Biological Evaluations, Botany Noxious Weed Assessment, Herbicide Analysis, Riparian Habitat Conservation Area (RHCA) and Riparian Management Objectives, and Roads Analysis.

FIRE AND FUELS

FUELS AND VEGETATION

Existing Condition: Historically, fuel levels were kept low with frequent fire return intervals of 8 to 15 years, allowing fire to burn at lower intensities (Agee 1993). Changes in forest density, forest composition, and public use have occurred across the Kelsey planning area since the early 1900s when wildfire suppression and tree harvest activities began. Fire suppression during the past 80 to 90 years has allowed naturally occurring fuels to increase above historic conditions within the planning area. Large sized, fire resistant ponderosa pine dominated stands with little ground vegetation has been converted to smaller sized ponderosa pine and heavy bitterbrush stands primarily as a result of the cessation of aboriginal burning, timber harvest, and fire suppression. These stands are presently less fire resistant as a result of increased tree and shrub densities and ground fuel accumulations. Presently, fires frequently burn at higher intensities, killing substantial amounts of vegetation, including large trees.

- More than one-third (37 percent) of the planning area is classified as high or extreme for wildfire behavior potential. These areas include the wildland/urban interface (**WUI**), with developed residential communities within the urban areas adjacent to the WUI.
- In the current condition, tree and shrub densities in the project area would possibly allow the initiation and spread of high intensity, stand replacement wildfire greater than 1,000 acres. Much of the planning (61 percent) is comprised primarily of stand initiation, single-story ponderosa pine, established primarily following logging in the 1920s and 1930s, with younger stands comprising another 26 percent. Trees in stands of stand initiation average 75 years old with an average diameter of 12 inches diameter at breast height (4.5 feet above the ground) in these stands. Remnant larger, older ponderosa pine trees are scattered throughout the analysis area, making up less than one (1) percent of tree structure.
- Approximately 50 percent of the forested acres of the planning area are classified as imminently susceptible to bark beetle. Mistletoe is prevalent throughout the planning area with some areas of severe infection.
- Currently, it is impractical to rely on natural succession and disturbance processes to resolve decades of fuels accumulations in much of the planning area. Thinning and other fire/fuel hazard reduction treatments are necessary.

Recent large fire activity (past 7 years) within the general locale of the planning area has occurred in similar ponderosa pine and bitterbrush habitat. Stands of second growth ponderosa pine and plantations have been lost in recent wildfires. The 1996 Skeleton fire (17,789 acres) fire burned on both federally managed and private lands and 19 homes were destroyed. Other large recent wildfire fire activity occurring within the planning area were the Green Mountain (1995, 223 acres) and Bessie Butte (1995, 430 acres) fires, the Evans West (1996, 4,230 acres) fire to the southeast, and the 18 Fire within the planning area (2003, 3800 acres). Between 1987 to present there have been 92 known fire occurrences (40 lightning, 15 arson and 37 other fires). The planning area is heavily used for hiking, biking, horse and off highway vehicle (OHV) riding. With increasing recreational use in close proximity to the city of Bend, human caused fire occurrences are predicted to increase.

Change in fire behavior is accomplished by strategically designed treatments that allow for defensible space both adjacent to the WUI and major access roads while at the same time providing for larger blocks of land that have overall acceptable fuel loads where suppression forces have more opportunity to anchor fire lines safely and increase chances of control. Modeling by Mark A. Finney of the Rocky Mountain Research Station has shown that with strategically designed fuels treatments, the greatest reduction in expected rate occurs with the first 20 percent of a landscape followed by the next 25 percent.

Approximately 10 to 12 miles of private lands interface with National Forest land (Wildland/Urban Interface) within the planning area. Included in the Interface are Sunriver Resort and several subdivisions. Smaller private tracts of land are in close proximity to the analysis area and new home starts continue. The Wildland/Urban

Interface adjacent to Woodside Ranch has received a total of 261 acres of fuel treatments, including mowing of shrubs and thinning. The existing fuels condition in these areas is capable of moderate to extreme fire behavior under summer conditions. Treatments of natural fuels within and around developed areas may not be sufficient to ensure protection of privately owned structures. During extreme burning conditions, embers may be carried long distances and ignite private lands.

Roads currently allow access to most areas for fire suppression activities. Fuel conditions adjacent to many roads do not provide an adequate defensible space (fuel break/safety corridor) or safe escape route for suppression forces or the public in the event of a high intensity wildfire.

The planning area has Long Term Site Productivity (LTSP) study plots located within the southern portion of the planning area. These are on-going studies that are planned to continue for the next 50 or more years. One of the primary research goals of these study sites is to provide information that will contribute to a better understanding of the role of fire in contemporary ponderosa pine ecosystems. These plots are located in an area of natural fuels that is high risk for wildfire.

Vegetation and fuels vary somewhat across the analysis are. The area is represented by:

- Multiple aged ponderosa pine stands with shrub fields understory (approximately 70 percent).
- Ponderosa pine and lodgepole pine mixed stands (approximately 2 percent).
- Lodgepole pine stands (approximately 1% percent).
- Mixed conifer stands (approximately 4 percent).
- Non-forested (approximately 23 percent.).

Thirteen (13) fire behavior fuel models (Rothermel 1972, Albini 1976) represent the Planning Area and interpret fire behavior potential. A large area of the analysis area is occupied with non-vegetation (lava flows). The following are the predominant fuel models:

- **Fuel Model 2** (**short grasses in open pine stands):** rapid rate of spread similar to fuel model 6 but with less intensity. Fireline intensity would limit direct attack, flame lengths reaching 7-feet with a 6 miles per hour (MPH) wind. Spotting could occur up to 1/3 of a mile from the main fire. Retardant is usually very effective due to the open or sparse timber and light ground fuels. Ponderosa pine mortality will occur, primarily in trees under 60-70 feet tall. Large open grown ponderosa pine should survive.
- **Fuel Model 3 (tall grasses):** A more rapid rate of spread than fuel models 2 and 6, and of shorter duration. Intensities would be high but would subside almost immediately due to the usual total consumption fuel. Wind would have a strong influence, displaying a greater rate of spread.
- **Fuel Model 5 (young or low green shrubs):** Low fire behavior characteristics. Rate of spread with a 6 MPH mid-flame wind would only be approximately 400 feet or 1.4 acres per hour. Spotting would be short range and scorch height would be less than 4 feet. Tree mortality would be low. Flame lengths would be just over 2 foot flame lengths with a 6 MPH mid-flame wind, allowing direct attack.
- **Fuel Model 6 (dormant shrubs):** A wildfire could burn approximately 100 acres per hour (60 feet per minute). Fireline intensity would be high, prohibiting direct attack when flame lengths are greater than 4 feet. A 6 MPH mid-flame wind would create 8-foot flame lengths. Spotting could occur up to 1/2 mile further if timber is torching or crowning. The probability of a spot fire would be 80-90 percent. Tree mortality would be high from the heat intensity and scorch of live foliage 60-80 feet from the ground. Heavy needle accumulations in shrubs can add to the flammability. This fuel model, with a ponderosa pine overstory, would have a more intense fire behavior than described above. The Skeleton fire 1996 (17,789 acres) was a fuel model 6, ponderosa pine overstory wildfire.
- **Fuel Model 8 (compact conifer litter layer with little to no undergrowth): S**imilar to fuel model 5, with less fire behavior potential. This compact fuel layer limits flame length and fireline intensities. With a 10 MPH mid-flame wind speed the flame length would be 2 feet. Occasional fuel concentrations would increase fire

behavior. With large single structured stands the fire would be limited to the ground and spotting distances would be short range.

- **Fuel Model 9 (long-needle litter):** This model has been modified to describe a portion of fuels in the planning area. Shrubs (bitterbrush) and grasses with needle cast accumulations under ponderosa pine. Shrubs do not have the size or crown cover of the fuel model 6. Fires can burn intensely, scorching as high as 80 feet with substantial tree mortality. Flame lengths would be greater than 4 feet with a 6-mile an hour mid-flame wind speed. Spotting could occur up to 1/2 mile and further with torching and crowning.
- **Fuel Model 10 (dead and down woody fuels):** Not as rapid a rate of spread as fuel model 2 or 6. Heavy ground fuels would cause fire intensity to be much greater. Flame lengths would be greater than 6 feet with a 6 MPH mid-flame wind speed. High intensity wildfires with torching and crowning would occur in moderate to high-density stands, as occurred during the Paulina fire 1988 (12,592 acres). Long range spotting could occur one (1) mile or more from the main fire. A closed timber canopy keeps retardant from reaching the ground. Heavy ground fuels allow the fire to burn through a light retardant application. These fires are stand-replacing fires with extreme temperatures that can damage soils.
- **Fuel Model 11: S**imilar to fuel model 10 with a little less fire behavior potential. Not as rapid a rate of spread but with similar fire intensity due to the heavy fuels. Direct attack would be almost impossible with much over a 2 MPH mid-flame wind speed. High intensity wildfires with torching and crowning would occur in moderate to high-density stands. Long range spotting could occur one (1) mile or more from the main fire.

Fires can be expected to burn actively in the analysis area assuming average daytime summer conditions for flat terrain: 85 degrees Fahrenheit, relative humidity 12-15 percent, fuel moistures (3-4 percent 1 hour, 5-6 percent 10 hour, and 6-7 percent 100 hour fuels), and mid-flame winds around 4-6 miles per hour (MPH). The rate of spread and intensity of fires will increase with the addition of slope or greater wind. Table 15 summarizes current fire behavior potential and acreage.

Table 15: Acreage[1] Totals for Fire Behavior[2] Potential – Current and Post-Treatment (Acres)

Fire Behavior Potential	Alternative 1 (No Action)	Alternative 2 (Proposed Action)	Alternative 3
Extreme/High	16,925	7,918	7,119
Moderate	12,335	6,917	6,719
Low	6,187	20,612	21,411
Non-vegetated (Lava)	10,728	10,728	10,728
Total	**46,175**	**46,175**	**46,175**

An estimated 37 percent of the project area is classified as high or extreme for fire behavior based on current vegetation and fuel loadings. These areas are located primarily in large acreage blocks in the low to mid elevations. Lava Lands Visitors Center and Lava River Cave are high use/value recreational sites located inside the Newberry National Volcanic Monument (NNVM). Fuel accumulations adjacent to Lava Lands Visitors Center, Lava River Cave, and the Wildland/Urban Interface exceed natural levels and pose a high risk to public and firefighter safety.

FIRE ECOLOGY

Broad changes in stand structure can be attributed to fire exclusion, historical grazing practices, and timber harvest. Fire has played a profound role upon the development and structure of ponderosa pine stands. Fire has played a role upon the development and structure of ponderosa pine stands within the Kelsey planning area as it has across the whole western United States. Fire history intervals in the ponderosa pine forests indicate a fire return interval of 4 to 5 years, depending on the site conditions and weather patterns.

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

[2] For a detailed explanation of the fire behavior fuel models, refer to the Kelsey Fire, Fuels, and Air Quality Report pages 2-6 located in Appendix D of the Official Record located at the Bend/Fort Rock District Office.

The process of stand development in ponderosa pine forests is a result of the shade intolerance of ponderosa pine, periodic good years of seedling establishment associated with years of above normal precipitation, and frequent fire. Gaps in the forest created by insects, wind, or disease and cleaned by a fire, allow the shade intolerant pine to become established. In this opening, the stand of young trees will be protected from fire because of lack of fuels on the forest floor, while the fire will burn under mature stands and remove any reproduction there. As the trees in the openings continue to grow, they provide enough fuel to carry the fire and thin the stands. These groups escape relatively quickly to the canopy and maintain co-dominance for very long periods of time. So, what appears to be an open "park like" even-aged and single-storied structure is actually characterized by groups of trees of varying ages.

SMOKE MANAGEMENT (AIR QUALITY)

Smoke emissions connected with the alternatives are of concern due to the project area proximity to urban areas and subdivisions. Under wildfire conditions, emissions would be approximately 60 tons of PM 10 resulting from forest conditions usually being windier, hotter and drier with torching and crowning of the timber canopy under summer conditions.

Smoke generated particulate matter measuring 10 microns and less in size (PM-10) is small enough to affect human health. Estimates of high intensity wildfire smoke emission in the planning area could range from 240 pounds to 2,000 pounds or more per acre of PM 10s, increasing the potential to negatively affect human health in areas affected by smoke.

MANAGEMENT

Most of the stands proposed for treatment within the Kelsey planning area are black bark small (6 to 16 inches dbh) to medium (16 to 21 inches dbh) diameter mid seral stands that do exhibit single storied structure. Currently densely stocked stands and previously thinned stands have a heavy concentration of either trees or brush and needle drape. This type of condition increases the likelihood of a large-scale stand–replacing wildfire. Fires that have occurred near the Kelsey project area in ponderosa pine forests over 1,000 acres in the past 8 years (such as 18, Evans West, and Skeleton fires) was much more intense than the fire behavior that was typical 100 years ago. Much of the 18 Fire had open wide spaced trees with high density of bitterbrush. The fire was carried by the bitterbrush and quickly moved into the crown of trees. Flame lengths from the bitterbrush easily reach the tree crowns. Adjacent areas where recent management treatments occurred (mowing, thinning, piling, and underburning) the fire intensity decreased and the fire was suppressed.

Alternative 1 (No Action)

Direct and Indirect Effects: Existing stands and plantations would remain at high risk to loss from wildfire. No management activities would occur, other than custodial duties such as wildfire suppression. More acres would transition towards increased fuel loadings, which would increase fire intensities and rates of spread. Fuels reduction would only occur during wildfires. An increase in fire intensity would likely be lethal to fire resistant species such as large ponderosa pine and high-density mixed species stands with ladder fuels (allow fire to reach crowns). Late and old structure ponderosa pine restoration, using prescribed fire, in the Newberry National Volcanic Monument would not occur. Fuels would continue to accumulate adjacent to or near high use/value recreation developments with subsequent increased risk of loss to these facilities.

Improved safety areas for firefighter suppression activities and adequate public/firefighter evacuation routes would not be developed. The effectiveness of aerial delivered retardants into adjacent wildland/urban interface residential developments would be limited due to high fire intensity and long range spotting from airborne embers. The opportunity to expand fuel treatments to provide a more defensible Forest boundary would not occur. Heavy equipment would be required for fireline construction due to fire intensity and limited safe access.

Smoke from wildfires would likely have an adverse impact on Bend, other surrounding communities, and adjacent developments. Continued accumulations of surface fuels would contribute to a substantial decrease in air quality from associated smoke emissions from wildfire.

Alternative 2 (Proposed Action)

Direct and Indirect Effects: The risk of large acreage (greater than 100 acres), high intensity wildfires would be reduced. Approximately 9,750[3] acres would have fuels treatment reduction treatments (MST, underburning, MST with underburning), including density reduction (tree thinning). A return to a low intensity fire regime using prescribed fire would be initiated on approximately 5,495 acres. Approximately 7,500 acres would have Mechanical shrub treatment (mowing, MST). Proposed vegetative and fuels treatments would help fragment continuous ground and tree crown fuels. To meet wildlife objectives in deer winter habitat, blocks of continuous high hazard fuels (shrubs and/dense tree stands) would remain untreated. These areas could support an intense wildfire of 100 acres and greater during average summer conditions. Overall, fire behavior potential would be reduced from high/extreme to moderate or low within treated units.

The risk of wildfire spreading to the Wildland Urban Interface (WUI) boundaries from private residential or commercial developments would be reduced. Approximately 2,965 acres of WUI (1,965 acres east of Highway 97 and 1,000 acres west of Highway 97) would be treated through mowing, prescribed fire, and thinning. Treatments on approximately 20 miles of forestland adjacent to primary and secondary roads would also reduce ground fuels and stand density. These fuel breaks/safety corridors would provide areas of opportunity to control wildfires and provide evacuation routes for the public and firefighters.

Elk habitat and critical mule deer winter range would be treated with prescribed burning, mechanical shrub treatments, and thinning. Fuels treatments would fragment the continuous high-risk ground fuels and dense stand structures, improving protection and maintenance of these habitats.

Prescribed fire with no mechanical treatments (mowing) would exhibit longer flame lengths, increased tree scorch, tree mortality, smoke emissions, and operating costs, fewer opportunities that would allow prescribed burning, and potential fire control problems. Areas with initial high fuel loads would require slow reduction of existing accumulation, taking longer to achieve the desired condition.

Alternative 3

Direct and Indirect Effects: Proposed activities would be similar to Alternative 2 (Proposed Action). Total number of acres proposed for fuels treatment would increase from approximately 9,780 acres to approximately 11,080 acres (approximately 13 percent) from Alternative 2. Approximately 7,315 acres would have prescribed burning and approximately 8,045 acres would have MST. Vertical and horizontal fuels that can facilitate the development of a relatively benign ground fire into a more high intensity and potential stand replacement crown fire would be reduced. Prescribed fire would be used across approximately 1,820 more acres within the planning area in Alternative 3. Alternative 2 (Proposed Action) would treat approximately 185 additional acres using MST than Alternative 3. Treatments within Newberry National Volcanic Monument (approximately 213 acres) would provide more emphasis on the reintroduction of fire with less use of mechanical treatments in reducing fuels buildup. Approximately 3,225 acres, 8 miles, of wildland/urban interface boundary would have fuels reduction treatments an increase of approximately 260 acres from Alternative 2.

Direct and Indirect Effects Common to Alternative 2 (Proposed Action) and Alternative 3: The proposed fuels reduction activities are compared by alternative in Table 12.

[3] Approximately 9,930 acres are the total acres proposed for fuels reduction treatments, including thinning. Prescribed fire is proposed on 5,495 acres and MST on 7,500 acres. The difference between 12,995 and 9.930 acres is 3,065 acres that are overlap acres (acres that are proposed for both prescribed fire and MST treatments).

Table 16: Proposed Fuel Treatment Acres (Gross Acres)		
Proposed Treatments*	**Alternative 2 (Proposed Action)**	**Alternative 3**
Underburning	1,506	1,761
MST (Mowing) / Underburning	3,987	5,554
MST Only	3,514	2,491
Whole Tree Yarding	4,974	6,164
Hand Piling	1,602	1,448
Machine Piling	176	384

*More that one treatment may occur in designated units.

Proposed treatments would enhance fire suppression effectiveness and safety, and reintroduce fire into fire associated ecosystems. Within proposed units, wildfire intensity would be reduced and provide suppression forces an opportunity to successfully suppress a wildfire. Depending on shrub and other vegetative growth, wildfire risk reduction treatments could become less effective in 5 to 10 years in some areas and ineffective in 15 to 20 years in others. Proposed treatments would reduce fuel continuity across the planning area. To meet wildlife objectives in deer winter habitat, continuous untreated high hazard fuels (shrubs and/dense tree stands) would remain that could support a high intensity wildfire of 100 acres and greater during average summer conditions. A wildfire could decrease deer winter habitat and cause soil sterility, long range spotting due to flying embers, and increased tree mortality.

Proposed treatments would create approximately two-miles of defensible space within the Wildland/Urban Interface, while meeting wildlife objectives. The use of major roads in a defensible space strategy would especially be used near areas where public safety is of high concern. Only under extreme conditions would wildfire burn through treated areas. This would provide a safer environment for firefighters, reduce the risk of wildfire entering private lands, and aid in the suppression of fires that start on private lands and move toward or onto federal ownership. Road closures could increase the response time and, under certain weather and fuel moisture conditions, allow fires to become larger.

The effects of prescribed fire with no mechanical treatment would result in longer flame lengths, higher tree scorch, increased tree mortality, increased short-term smoke emissions, potential control problems, reduced time frames for safe burning, red needles in scenic corridors, and higher operating costs. Areas with initial high fuel loads would require a longer time period to reduce the existing fuels accumulation to the desired condition. Fire maintenance activities would occur when necessary to maintain a reduced wildfire risk. Prescribed fire would be used where shrubs like greenleaf manzanita (*Arctostahylos patula*) and snowbrush (*Ceanothus velutinus*) exist. A second burn would kill plants that sprout from seeds prior to producing seed of their own. This multiple entry strategy could be used to reduce shrubs from understories.

In the areas where restoration of historic fire regimes is planned, prescribed fire would be returned every 8-15 years or as needed. Areas with initial high fuel loads would require slow reduction of existing accumulations. Units proposed in the Newberry National Volcanic Monument, identified as burn only, would possibly require multiple entries to achieve the desired condition. The first few entries into these areas would be with low intensity prescribed burns to gradually reduce fuel loadings, requiring an early spring burn. As fuel loads are reduced, through prescribed burns, intensity could increase until historic conditions have been reached.

The use of mechanical shrub treatments (mowing), prior to burning, would substantially reduce smoke emissions. Potentially, mowing 500 acres prior to burning could reduce emissions from 16 tons of PMT 10 to 6 tons of PM 10. Estimated smoke emissions are compared by treatment and alternative in Table 17, page 48.

Table 17: Estimated Total Smoke Emissions* From Proposed activities		
Proposed Treatments[4]	**Alternative 2 (Proposed Action)**	**Alternative 3**
Landing Piles	62.1 Tons PM10	73.3 Tons PM10
Underburning	200.7 Tons PM10	267.4 Tons PM10
Machine Piles	23.2 Tons PM10	35.0 Tons PM10
Hand Piles	11.6 Tons PM10	13.0 Tons PM10
Total	**297.6 Tons PM10**	**388.7 Tons PM10**

***** The total sum of tons of smoke emissions for each alternative would occur over a period no longer than 10 years.

Cumulative Effects Common to Alternative 2 (Proposed Action) and Alternative 3: Past and proposed fuel treatments to reduce natural fuels, including stand density, would limit potential wildfire size to less than 400 acres per occurrence under average conditions. Treatments maintained through time would improve the likelihood for continued monitoring of Long-Term Site Productivity study plots through the life of the study. Monitoring would indicate when re-entry with fuels treatments would be necessary. Anticipated road density reductions under the Kelsey Access EA would have the potential to increase fire suppression response time and fire size and may reduce human caused fires.

The combination of past and proposed tree density and fuels reduction activities would reduce many acres to low or moderate fire behavior. The risk of large acreage losses from wildfire would be reduced.

Proposed activities adjacent to Long-Term Site Productivity study plots would reduce ground and aerial fuels that contribute to crown fire initiation and spread. Treatments maintained through time would improve the chances for continued monitoring of LTSP plots and data collection through the life of the study.

The placement of center barriers on Highway 97 that bisects the planning area, north to south, could increase the response time of suppression crews. Crews traveling on the opposite side of the barriers would need to go to the end of the barriers and return to an effective access route.

[4] **Underburning (UB)** - The use of prescribed fire under a stand of trees (usually ponderosa pine) to consume (remove) accumulated ground fuels (either naturally occurring or created through an activity), and some ladder fuels; **Mechanical Shrub Treatment (MST)** - The use of mechanized equipment to cut, chop, grind or otherwise reduce shrub or ground fuel vertical structure; **Hand Piling** - The use of personnel to gather accumulated fuels (usually smaller fuels such as woodcutting slash or small thinning slash) and place it in a pile configuration to be burned or left for wildlife.

SILVICULTURE

SPECIES COMPOSITION

Existing Condition: The dominant plant association group within the planning area is ponderosa pine (dry and wet). Plant association groups (PAGs) (Table 18, page 50) combine plant associations (Volland, 1985) by their climax species, site potential, and temperature and moisture similarities. Ponderosa pine (*Pinus ponderosae*) is the dominant conifer species within the Kelsey planning area. Other conifers include lodgepole pine (*Pinus contorta*) and white fir (*Abies concolor*). The three species occur together within the mixed conifer PAG. Ponderosa and lodgepole pine can occur together in other PAGs, but most frequently within the ponderosa/lodgepole pine grouping. Aspen is found in small, isolated areas, most commonly adjacent to lava outcrops.

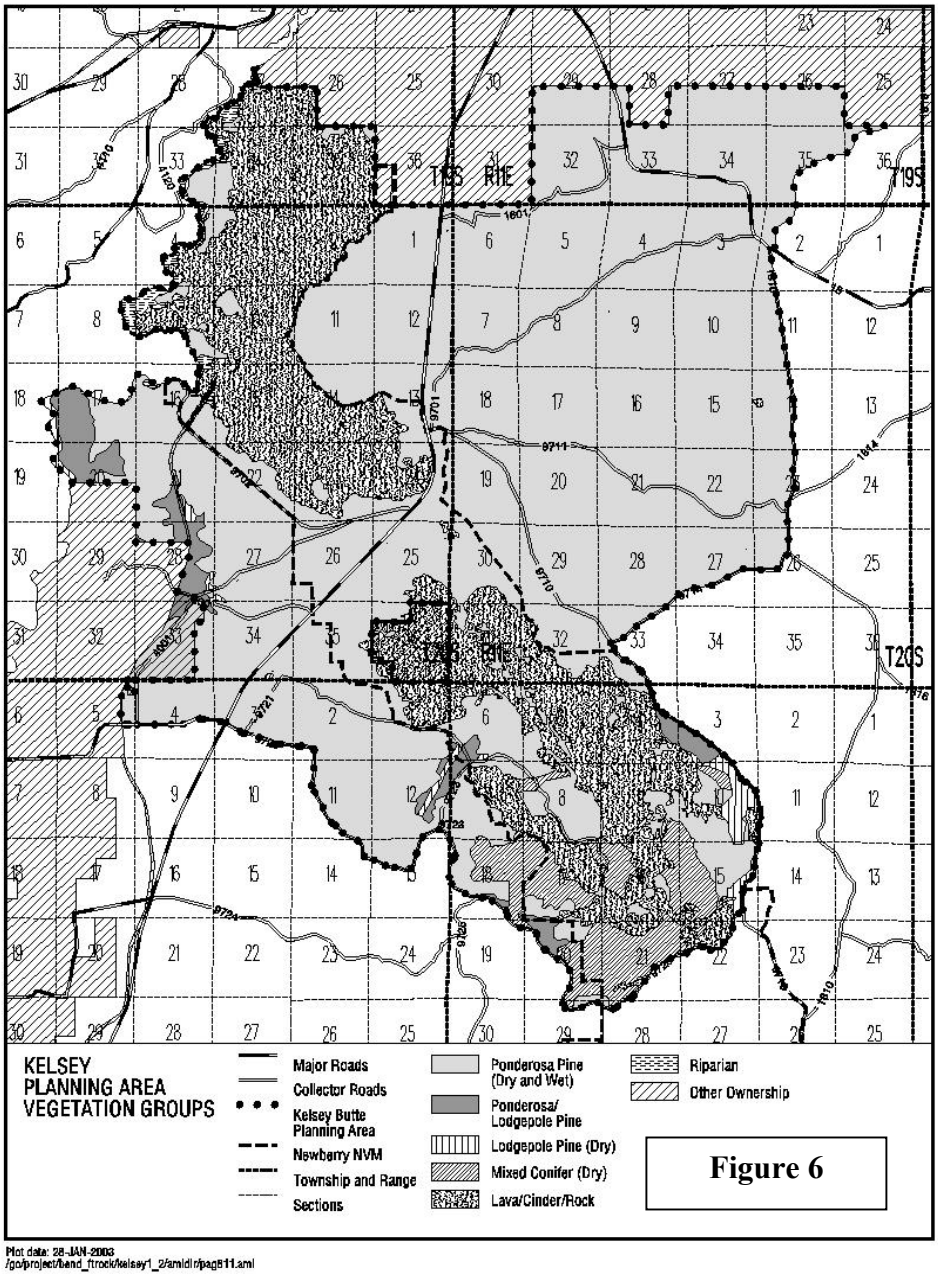


Table 14: Plant Association Groups And Non-Vegetation Types Within Kelsey Planning Area			
Vegetation/Non-Forest Classification	**Acres**	**% of Planning Area**	**% of Forest Area**
Forest Plant Association Groups (PAGs)			
·Ponderosa pine (Dry and wet)	32,185	70%	91%
·Ponderosa/lodgepole pine *	1,039	2%	3%
·Lodgepole pine (Dry)	423	1%	1%
·Mixed Conifer (Dry)	1,905	4%	5%
Subtotal of Forested Area	**35,552**	**77%**	**100%**
Non-Forest Groups			
·Cinder/Lava/Rocks	10,288	22%	---
·Riparian	294	1%	---
·Water	33	<1%	---
Subtotal of Non-Forest	**10,615**	**23%**	**---**
Planning Area Total**	**46,167**	**100%**	**---**

***** A subset of the lodgepole pine PAG. Identified where 1953 timber type data indicate the presence of ponderosa pine.
****** Includes other ownership within the outer boundary of the Kelsey Planning Area.

Alternative 1 (No Action)
Direct and Indirect Effects: No changes to existing species composition would occur. White fir and lodgepole pine would continue to be more common than would have occurred with historic disturbance regimes. Continued exclusion of fire would favor an increase of these species. Fire exclusion and conifer competition would limit the potential for aspen to mature or regenerate.

Alternative 2 (Proposed Action) and Alternative 3
Direct and Indirect Effects: Thinning treatments would favor retaining ponderosa pine over lodgepole pine and white fir. White fir and lodgepole pine stocking would be reduced, although these species would remain in some units following thinning. In units proposed for underburning following thinning, no more than 15 percent of the residual basal area would be in lodgepole pine. Residual stocking of white fir could be as high as 60 percent in some units. Mortality of lodgepole pine and white fir would be expected following proposed underburns. Thinning and underburning, separately or in combination, would generally increase ponderosa pine dominance and decrease the amount of lodgepole pine and white fir. Favoring ponderosa pine would be similar to what would have occurred under historic disturbance regimes. Favorable conditions for the germination of ponderosa pine, lodgepole pine and white fir seeds would be provided by reduced canopy cover and exposed mineral soil. Treatment units would likely regenerate where lodgepole pine and white fir are present to serve as a seed source. Lodgepole pine would be most successful in regenerating openings. White fir would be most successful regenerating areas with heavier canopy cover. Potential for these seedlings to establish and mature would depend on frequency of future underburns.

Aspen treatments (5 acres) would be to underburn, cut all conifers less than 10 inches dbh, handpile slash, and construct a buck/pole fence around the 5 acres. Proposed treatment to increase aspen stocking would reduce amount of conifer (ponderosa and lodgepole pine) understory stocking. Proposed underburn would stimulate sprouting of aspen.

Cumulative Effects: Past harvest, pre-commercial thinning, and reforestation treatments within or adjacent to the project area would not have a cumulative effect on increasing or reducing species diversity. Species diversity did not change as a result of the 18 Fire. Ponderosa pine seedlings will be planted across approximately 2460 acres.

TREE DENSITY AND STRUCTURAL STAGE
Existing Condition: Forest vegetation was classified using structural stages described in Appendix B of the 1995 Revised Continuation of Interim Management Direction Establishing Riparian, Ecosystem and Wildlife Standards for Timber Sales. The proportion of these structural stages historically present (historic range of variability - **HRV**)

was estimated for the time period between 1850 and 1910. HRV is a reference for understanding forest succession and disturbance regimes. For a detailed description of classification methods, historic disturbance regimes, and determination of HRV, refer to Attachment 2 of the Kelsey Silviculturist Report of the Official Record.

The majority (55 percent) of the forested portion of the planning area is within the understory reinitiation structural stage (Table 19**)**, which is above HRV. Stands in this structural stage have a young cohort of trees establishing under an older cohort of trees (a cohort is a class of trees arising after a common natural or artificial disturbance). Within the Kelsey Planning area, ponderosa pine stands with this classification were primarily established following historic logging in the early 1920's and 1930's. These stands generally appear to be single story. Trees average 75 years in total age. They have an average diameter of 12 inches (4.5 feet above ground) and an average height of 60 feet. Some remnant older ponderosa pine trees can be present and average 160 years in total age, 24 inches dbh, and 85 feet tall. Tree density is low enough to allow for the establishment and growth of forbs, grasses, shrubs, and conifer seedlings in the understory.

Single- and multi-story late and old structure (**LOS**) is currently below HRV **(**Table 19**)**. Late and old structure ponderosa pine stands typically have 18 to 40 trees/acre (USDA Forest Service, 1993). Within the planning area, ponderosa pine stands were classified as late or old structure if there were greater than or equal to 13 trees per acre and 21 inches in diameter.

Table 19: Structural Stage Before And After Proposed Treatment Compared to Historic Range Of Variability (HRV)

Structural Stage *	Historic Range of Variability (HRV)	Alternative 1 No Action		Alternative 2 Proposed Action		Alternative 3	
		Percent Forested Area	Relation to HRV	Percent Forested Area	Relation to HRV	Percent Forested Area	Relation to HRV
Stand Initiation	0 – 15%	15%	Within	15%	Within	16%	Above
Stem Exclusion, Closed Canopy	0 – 20%	17%	Within	13%	Within	13%	Within
Understory Reinitiation	10 – 30%	55%	Above	60%	Above	60%	Above
Multi-story without Large Trees	0 – 30%	12%	Within	11%	Within	10%	Within
Multi-story with Large Trees	10 – 35%	<1%	Below	<1%	Below	<1%	Below
Single-story with Large Trees	20 – 55%	None	Below	None	Below	None	Below

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

Alternative 1 (No Action)

Direct and Indirect Effects: No treatments to change existing vegetation conditions or trends would occur. Natural disturbances could change the existing proportion of structural stages. High intensity wildfires have the greatest potential to create rapid, large-scale change. In the event of a high intensity wildfire, more of the stand initiation structural stage would be created. An addition of 2,380 acres would put the amount of stand initiation structural stage above HRV.

Approximately 12,460 acres of ponderosa pine stands currently have potential to develop into a late or old structural stage (Table 20, page 52). In the absence of natural disturbances (fire, bark beetles), it will take a projected 50 to 60 years for these stands to meet the diameter requirement for late or old structure. At that time, the amount of late or old structure could be within the HRV.

Table 20: Ponderosa Pine Potential Development (Acres) Into LOS Compared to HRV LOS			
Alternative 1 (No Action)	**Alternative 2 (Proposed Action)**	**Alternative 3**	**Late or Old Structural Stage (Historic Range of Variability)**
12,460 acres	16,040 acres	16,780 acres	10,800 – 32,400 acres

Cumulative Effects: The recent 18 fire and past harvest, pre-commercial thinning, and reforestation treatments were considered in the classification of structural stage and stand densities. Future construction (Frontage road, Sunriver Interchange, and Weigh Station) would increase the non-forest area, affecting less than one (1) percent of the forested portion of the planning area. Fuels reduction in association with the Weigh Station would decrease tree density within 100 feet immediately adjacent to the parking and inspection areas.

TREE DENSITY

Alternative 2 (Proposed Action) and Alternative 3

Direct and Indirect Effects: Alternative 2 (Proposed Action) would thin approximately 5,665 acres and Alternative 3 would thin approximately 6,630 acres (Table 21). Residual stocking following proposed thinning treatments would vary. Table 22, page 53 summarizes Group Regeneration.

Table 21: Thinning Treatments Grouped by Thinning Intensity				
Thinning Prescription[1]	**Alternative 2**		**Alternative 3**	
	Acres	**% of Total**	**Acres**	**% of Total**
Group Regeneration Harvest				
Group regeneration harvest – Deer habitat	185	3.3	325	4.9
Group regeneration harvest – OSU study	165	2.9	165	2.5
Total Group Regeneration Harvest	350	6.2	490	7.4
Stand Regeneration Harvest				
Mistletoe Reduction	330	5.8	100	1.5
Ponderosa pine restoration	60	1.1	0	0
Lodgepole pine regeneration	15	0.2	15	0.2
Total Stand Regeneration Harvest	405	7.1	115	1.7
Thin to Wide Spacing				
Thin to low stocking levels	2,780	49.1	1,475	22.2
Thin to low stocking levels – OSU Study	235	4.2	235	3.6
Uneven-aged regeneration harvest – OSU Study	175	3.1	175	2.6
Total Thin to Wide Spacing	3,190	56.4	1,885	28.4
Thin to moderate spacing				
Total Thin to moderate spacing	635	11.2	2,565	38.7
Thin to variable spacing				
Mistletoe	160	2.8	260	4.0
Goshawk	170	3.0	170	2.6
Scenic	20	0.3	25	0.4
Value	0	0	350	5.3
Total Thin to variable spacing	350	6.1	805	12.3
Sanitation Harvest				
Total Sanitation Harvest	50	0.9	50	0.7
Precommercial Thin				
Total Precommercial Thin	685	12.1	720	10.8
Total	**5,665**	**100**	**6,630**	**100**

[1]See discussion following Table 18, page 36 for description of thinning activities.

Table 22: Units Proposed for Group Regeneration						
Unit	**Alternative**	**Unit Size (Acres)**	**Prescription***	**Unit percent in openings**	**Number of Openings**	**Total Acres of Openings**
14	2	72	8	30 - 40%	2 - 4	22 - 29
21	2, 3	112	8	30 - 40%	3 - 7	34 - 44
259	2, 3	27	93	20 - 30%	1 - 2	5 - 8
262	2, 3	69	93	20 - 30%	4 - 5	14 - 21
267	2, 3	69	93	20 - 30%	4 - 5	14 - 21
442	3	211	8	30 - 40%	6 - 12	63 - 84

* Prescription 8: Improve big game forage; and Prescription 93: Create diversity of stand structure.

Standard and Guideline M7-3 states that 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. Table 23 summarizes by objective, the acres proposed for timber harvest in deer habitat.

Table 23: Thinning Within Deer Habitat (MA-7) By Treatment Objective.				
Objective[1] of proposed tree removal	**Alternative 2**		**Alternative 3**	
	Acres	**% of Total**	**Acres**	**% of Total**
Regenerate new cover stands				
Promote deer hiding cover and vertical stand diversity (WL-5)	343	27%	407	26%
Maintain tree vigor				
• Reduce risk of bark beetle outbreak (FH-1)	809	63%	1,035	66%
• Reduce dwarf mistletoe spread (FH-2)	49	4%	49	3%
Encourage desirable forage in deficient areas				
• Increase herbaceous and forb species (WL-6)	79	6%	79	5%
Create strategic fuel break (NF-9)	2	<1%	2	<1%
Total	1,282	100%	1,559	100%

[1] **Forest Plan objectives** = bold; Kelsey **Treatment Objectives** = regular type (subset of Forest Plan objectives).

Standard and Guideline M7-5 recommends retaining a crown cover greater than 40 percent with trees 30 feet tall. The standard recognizes that due to low site productivity, optimal thermal protection may need to be compromised somewhat in order to moderate the risk of future catastrophic pine beetle damage. It states canopy cover should be managed at the highest percentage that will maintain healthy stand conditions with a low risk of catastrophic damage due to insects or disease. It continues to state that the minimum canopy cover must be 40 percent.

In a Deschutes National Forest evaluation (1991) of the ability of ponderosa pine stands to provide dispersal habitat for the Northern Spotted Owl, the relationship between tree density, average tree diameter, and percent canopy cover was displayed for each plant group. The maximum stocking level that could be achieved before catastrophic insect epidemics become likely for a range of site indexes was also displayed. This analysis of how much canopy cover can be provided while retaining a low risk of bark beetle outbreak is applicable to assessing potential to provide deer thermal cover in ponderosa pine stands. In Kelsey deer habitat, ponderosa pine site index ranges from 70 to 90 (Barrett 1978). According to the Deschutes analysis, maximum canopy cover that could be retained on these sites while maintaining a low risk to bark beetle outbreak is 25 to 35% canopy cover.

Proposed thinning would generally retain the highest canopy cover that would maintain healthy stand conditions with a low risk of catastrophic damage to bark beetles. Canopy cover would, however, be reduced to less than 40 percent.

The greatest reduction in existing tree density would occur with group regeneration (Table 21, page 52 and Table 23). All trees less than 21 inches dbh would be cut to create openings of varying sizes. Prescription 8 would create

openings of 6 to 12 acres in size over 30 to 40 percent of the unit and planted with ponderosa pine seedlings. Prescription 93 would create openings of approximately 4 acres over approximately 20 to 30 percent of the treatment area and reforested through natural regeneration of ponderosa pine.

Stand regeneration harvest to eliminate dwarf mistletoe, restore ponderosa pine dominance, or regenerate lodgepole pine would result in substantial reductions in tree density. Low residual stocking would necessitate site planting or natural regeneration.

Thinning to wide spacing, approximately 30 to 40 feet (30 to 50 residual trees per acre), would substantially reduce stand density and increase the average individual tree and stand diameter. Time needed for trees to achieve diameters greater than or equal to 21 inches DBH would be shortened. Crown density would be reduced. Sufficient numbers of large trees would meet ponderosa pine old growth definitions within approximately 40 years. Approximately 10 percent less volume would be produced during the next 40 years than stands growing at optimal spacing. Bark beetle risk would remain low for approximately 50 years. Sufficient trees would remain to preclude the need for reforesting the site following harvest. Alternatives 2 (Proposed Action) and 3 are similar in the amount of wide thinning that would be done within the Monument. Proposed activities are similar and consistent with the goals of NNVM, which include allowing natural processes to function while reducing the need for re-entry with the use of mechanical equipment.

Tree density would be substantially reduced with wide thinning (Table 21, page 52). Following thinning, trees would be spaced approximately 30 to 40 feet (30 to 50 residual trees/acre). Sufficient trees would remain to preclude the need for reforestation following thinning. Reduced stand density would increase individual tree diameter growth and the time needed to achieve diameters common in late or old structure (greater than or equal to 21 inches DBH). Within approximately 40 years, sufficient number of large trees would be present to meet ponderosa pine old growth definitions (USDA Forest Service, 1993). Approximately 10 percent less volume would be produced during the next 40 years than in stands growing at optimal spacing. Bark beetle risk would remain low for approximately 40 years.

Alternative 2 proposes more acres (approximately 53 percent) of wide thinning than Alternative 3 (approximately 24 percent) (Table 21, page 52 and Table 24, Page 55). Alternative 3 would best meet the goal of utilizing site growth potential within General Forest by thinning both more total acres and thinning a lower percent to wide spacing. Within Newberry National Volcanic Monument and the Wild and Scenic River Corridor, over 90 percent of proposed thinning would be wide spacing (Refer to Official Record, Appendix E, for a comparison of the amount of wide thinning proposed by management allocation). Projections indicate stands of trees thinned to the higher densities would produce approximately the same amount (99 percent) of cubic foot volume than stands growing at optimal spacing that utilize site growth potential and minimize bark beetle risk. Thinned stands that retain higher densities would remain at low risk to bark beetle for approximately 20 years, approximately 30 years sooner than wide spaced thinning. Re-entry for thinning would be sooner and the potential for future soil compaction would be highest with Alternative 3.

Thinning to moderate to variable spacing (Table 24, page 55) approximately 20 to 35 feet (40 to 90 trees/acre), would result in light to moderate reductions in tree density. Individual tree growth would be less than with the wide thinning and would be increased over existing rates. Sufficient numbers of large trees would meet ponderosa pine LOS within approximately 50 years, approximately 10 years longer than thinning to a wide spacing. Stands thinned at this spacing would become at risk to bark beetle attack approximately 20 years before size requirements are met for LOS. Thinning to moderate spacing between trees, approximately 16 to 22 feet (90 to 170 trees/acre), would occur in plantations. Residual stocking would be highest following proposed pre-commercial thinning in plantations. Following thinning, trees would be spaced approximately 16 to 22 feet (90 to 170 trees/acre).

Table 24: Projected Stand Conditions Following Three (3) Proposed Thinning Treatments				
	Wide Thinning		Moderate to Variable Thinning	
	Average	Average Range	Average	Average Range
Measures of Stand Density				
Trees per Acre[1]	40	30 - 50	60	40 - 90
Spacing between Trees (Feet)	35	30 - 40	25	20 - 35
Basal Area (Square Feet/Acre)	45	30 - 70	60	40 - 70
Stand Density Index[1]	70	50 - 105	100	70 - 120
Canopy Cover[2] (Percent)	15%	10 – 20%	20%	15 – 30%
Crown Bulk Density (kg m^{-3})[1,3]	.038	.016 - .068	.033	.017 - .108
Other Stand Attributes				
Quadratic Mean Diameter (Inches)	15”	10 – 20”	13”	9 – 18”
Live Crown Ratio (Percent)	50%	40 – 60%	50%	40 – 60%

[1]**Trees per Acre** (>=21”dbh) present in ponderosa pine old growth (USDA Forest Service, 1993) stands: 18 to 40; **Stand Density Index** (Calculated for Kelsey Planning Area) when stands are at risk to bark beetle attack: >= 160; **Crown Bulk Density** below which crown fire spread would be very unlikely (Agee, 1996): **1)** High spread rate (1.35 m sec^{-1}): Bulk density (kg m^{-3}) < .037; **2)** Medium spread rate (0.67 m sec^{-1}): Bulk density (kg m^{-3}) < .074; **3)** Low spread rate (0.40 m sec^{-1}): Bulk density (kg m^{-3}) < .125

[2]**Canopy cover:** using Average trees per acre and quadratic mean diameter. A report accessing canopy cover in even-aged stands of ponderosa pine (Deschutes National Forest, 1991).

[3]**Crown bulk density**: using average trees per acre, diameter, height (70 feet) and live crown ratio to assess crown fire (Carlton, 1999).

STRUCTURAL STAGE

Group regeneration harvest **(**Table 21, page 52**)** would increase the amount of stand initiation structural stage. It is proposed primarily in portions of stands classified as understory reinitiation. Alternative 2 would create approximately 105 and Alternative 3 approximately 154 additional acres of the stand initiation structural stage and the acreage would remain within the HRV **(**Table 19, page 51).

Both alternatives propose vegetation treatments in units that contain late or old stand structure **(**Table 25, page 56**)**. Proposed treatments include timber harvest and natural fuels treatment. Proposed treatments would not change the existing late or old structural stage.

Within Newberry National Volcanic Monument, both Alternative 2 and 3 propose commercial harvest in two (2) stands. Stand densities and fuel loadings are currently high. Unit 87 (both alternatives) is within/adjacent to Benham Falls Day Use/Picnic Area. Thinning would primarily remove lodgepole pine from around large diameter ponderosa pine and smaller ponderosa pine to reduce the risk of losing large diameter trees to bark beetles and wildfire. Unit 66 (Alternative 2)/Unit 366 (Alternative 3) is located in the vicinity of Lava Cast Forest. Thinning would decrease stand density and increase dominance of ponderosa pine, being consistent with Monument Plan direction (EA Appendix A, pages 144 and 145). For these proposed treatments, Monument Plan direction is considered to take precidence over Interim Management Direction. Consistent wtih the intent of the Interim Wildlife Standard, proposed treatments would not result in the loss of late or old structure.

Within the Deschutes Wild and Scenic River allocation, Alternative 3 proposes to commercial thin in a portion of a ponderosa and lodgepole pine stand (Unit 205), classified as multi-story with large trees and susceptible to bark beetles. This late or old structural stage classification is based on the presence of lodgepole pine greater than or equal to 10 inches dbh. Proposed thinning would reduce stand stocking, favoring ponderosa pine as leave trees. The proposed removal of lodgepole pine change the structural classification from late or old structure to multi-story without large trees with ponderosa pine dominating. Proposed treatment is consistent with probable actions identified in the River Plan to protect and enhance vegetation, wildlife and scenic values. River Plan direction is considered to take precedence over Interim Management Direction that would not allow the use of commercial thinning.

Table 25: Units Proposed for Treatment that Contain Late or Old Stand Structure (LOS)						
Unit	**Unit Acres**	**Allocation[1]**	**Alternative**	**LOS Acres**	**Thinning**	**Natural Fuels [2]**
66	26	NNVM	2	8	Wide	MST/Underburn
366	26	NNVM	3	8	Wide	None
87	11	NNVM	2, 3	11	Selective	Underburn
136	213	DHB	2, 3	20	None	MST
205	5	WS1	3	5	Moderate	None

[1] Newberry National Volcanic Monument (NNVM), Deer Habitat (DHB), and Wild and Scenic (WS1).
[2] Mechanical Shrub Treatment (MST)

A small portion of proposed thinning would be done within stands classified as stem-exclusion closed canopy and multi-story without large trees. Thinning would decrease the amount of these structural stages, remaining within HRV. Treatments would increase understory reinitiation, further increasing this structural stage above HRV.

Natural disturbances potentially could change stand structure. Similar to the no action alternative, high intensity wildfires greater than 2,230 acres (Alternative 2 –Proposed Action) or 2,210 acres (Alternative 3) would put the amount of the stand initiation structural stage above the HRV. Potential for wildfires of this size would be reduced by proposed thinning, mechanical shrub treatment, and prescribed underburning. Alternatives 2 and 3 would have less potential than Alternative 1 (No Action) for large, stand replacing wildfires.

Thinning proposed in Alternatives 2 and 3 would increase the acreage of ponderosa pine stands with potential to develop into late or old structure **(**Table 16, Page 48**)**. With Alternative 2 there would be approximately a 30 percent increase over the existing condition. With Alternative 3, there would be an approximate 40 percent increase. Similar to the no action alternative, with no additional thinning in these stands, it would take a projected 50 to 60 years to meet the diameter requirement for late or old structure. With one (1) thinning (to maintain diameter growth rates and a low risk to bark beetle attack), LOS could be attained in approximately 35 to 45 years. The proportion of the landscape developing into LOS would be within the midrange of HRV **(**Table 20, Page 52**)**.

***Cumulative Effects*:** The recent 18 Fire, past harvest, precommercial thinning, and reforestation activities were considered in the classification of structural stage and stand densities. Construction activities of the Weigh and Safety Station along Highway 97 would increase the amount of non-forest area by less than one (1) percent of the forested portion of the planning area. The 18 Fire increased the amount of stand initiation by approximately 2,480 acres.

INSECTS

Bark Beetles – Existing Condition: Bark beetles most commonly causing tree mortality within the planning area are: mountain pine beetle (*Dendroctonus ponderosae* Hopkins), pine engraver beetle (*Ips pini*), western pine beetle (*Dendroctonus brevicomis*), red turpentine beetle (*Dendroctonus valens*), and the fir engraver beetle (*Scolytus ventralis* LeConte). Insect and disease surveys from 1992 to 2001 detected primarily scattered patches of mountain pine beetle mortality. The greatest concentration was occurring in the southern portion of the planning area, approximately one-half of this in NNVM. The last large-scale mortality occurred in 1989, also in the southern portion of the planning area. Mortality from the fir engraver beetle and the western pine beetle was also detected.

A stand is considered imminently susceptible to insect attack when tree stocking exceeds certain levels and is likely to experience significant change in structure or character as a result of insect attack in the near future (USDA Forest Service, 1996). In the planning area, ponderosa pine stands that have 120 to 160 or greater trees per acre (trees spaced 16 to 20 feet apart) and are 10 inches in diameter at 4.5 feet above ground level are considered imminently susceptible to bark beetle. Refer to page 10 of the Silviculture Report in the Official Record for the methods used to determine imminent susceptibility to bark beetle risk.

Table 26 and Table 27 display existing beetle risk within the planning area. Approximately 40 percent is imminently susceptible to bark beetle attack. Excluding lava and cinder (10,288 acres, 22 percent) approximately 52 percent is imminently susceptible to bark beetle attack.

Table 26: Percent of Acres Imminently Susceptible to Bark Beetle (Post-Treatment)			
Alternative	**Acres**	**Percent of Planning Area**	**Percent of Forested Area (35,879 acres)**
1 (No Action)	17,141	37%	48%
2 (Proposed Action)	13,555	29%	38%
3	12,710	28%	35%

Table 27: Acres Imminently Susceptible To Bark Beetle By Management Allocation– Post-Treatment				
Management Allocation	**Allocation Acres**	**Acres and Percent (%) Imminently Susceptible To Bark Beetle**		
		Alternative 1	**Alternative 2**	**Alternative 3**
General Forest (GFO) (% Allocation)	5,206	3,394 (65%)	2,497 (48%)	2,049 (39%)
Deer Habitat (DHB) (% Allocation)	13,582	4,492 (33%)	3,821 (28%)	3,686 (27%)
Scenic Views (SV) (% Allocation)	8,467	4,404 (52%)	2,848 (34%)	2,646 (31%)
Old Growth (OGR) (% of Allocation)	254	203 (80%)	203 (80%)	203 (80%)
Newberry National Volcanic Monument (NNVM) (Percent Forested Portion of Allocation)	17,611	4,263 (24%)	3,801 (22%)	3,795 (22%)
Percent Forested Area (7,852 acres)		54%	48%	48%
Deschutes River, Wild and Scenic (% Allocation)	474	366 (77%)	366 (77%)	312 (66%)
Other Ownership (% Allocation)	573	19 (3%)	19 (3%)	19 (3%)
% Forested Portion (60 acres)		32%	32%	32%
Planning Area Total	46,167	17,141	13,555	12,710
% Planning Area (46,167 acres)		37%	29%	28%
% Forested Area (35,879 acres)		48%	38%	35%

Alternative 1 (No Action)

Direct and Indirect Effects: There would be no change to the existing beetle risk within the Kelsey Planning Area. Approximately 37 percent of the planning area would remain imminently susceptible to bark beetle attack (Table 26). Approximately 10,288 acres, 22 percent of the planning area, is lava, rock, or cinder. Much of this is within NNVM. Excluding the areas of lava and cinder, approximately 48 percent of the planning area would remain imminently susceptible to bark beetle attack.

Endemic populations of bark beetles would continue to cause tree mortality throughout the planning area. Mountain pine beetle would continue to attack and kill larger diameter trees (greater than 8 inches dbh). Both ponderosa and lodgepole pine would be affected, with lodgepole pine greater than 9 inches dbh generally being attacked first. Western pine beetle and red turpentine beetle could also kill large diameter pines that are slow growing, lightning struck, or heavily infected with mistletoe. The fir engraver beetle would continue to attack and kill white fir. Mortality patterns would vary from isolated trees to clumps of both large and small diameter trees. Potential for beetle activity would be highest in those stands that are imminently susceptible to beetle attack. Scattered, incidental mortality from beetles would also occur in stands that are not imminently susceptible primarily due to stress induced by lightning strikes or high levels of mistletoe infection. Mortality from beetles would most likely occur in periods of both normal and below normal precipitation, with accelerated tree mortality rates possible during periods of low precipitation.

Potential for epidemic levels of mountain pine beetles to become established would be highest in the areas classified as imminently susceptible to beetle attack. If epidemic levels of mountain pine beetles become

established in these stands, up to 67 percent of the current basal area, mostly in the largest trees, could have expected mortality (Barrett, 1979).

Cumulative Effects: Fire and past management activities were considered in the classification of beetle risk. Reasonably foreseeable future actions within or adjacent to the project area would have no cumulative effect on beetle risk or potential for Pandora moth defoliation within the Planning Area.

Within the 18 Fire, where fire intensity was moderate or high, few live trees remain. In these areas of moderate to high intensity, beetle risk was classified as low. Where fire intensity was low, there was little change to the pre-fire stand condition. In these areas, no change was made to the original beetle classification. The majority of the fire burned at moderate to high intensity. Within much of this area, there is low risk that bark beetles would substantially change stand structure or character. There is high potential that bark beetles would find suitable habitat in trees killed and injured by the fire that would serve as breeding areas. In approximately two (2) years, beetles could fly into the adjoining forest and attack trees within approximately one (1) mile of the fire perimeter. The greatest risk for tree mortality would be within areas classified as imminently susceptible to beetle attack.

Alternative 2 (Proposed Action) and Alternative 3

Direct and Indirect Effects: As with the no action alternative, endemic beetle populations would continue to operate across the landscape. Scattered, incidental tree mortality from beetles would occur in stands not imminently susceptible, primarily resulting from stress caused by lightning strikes or mistletoe. The potential for epidemic beetle populations would be highest in remaining imminently susceptible stands.

Thinning and underburning are proposed in Alternatives 2 and 3 with potential to affect susceptibility to bark beetle. Other proposed vegetation treatments, such as the mowing of shrubs, would have no effect on susceptibility to bark beetle. Thinning activities would reduce susceptible forested acres (18,643 acres) in Alternative 2 (Proposed Action) by approximately 3,900 acres (21 percent) and in Alternative 3 by approximately 5,025 acres (27 percent). Depending on thinning intensity, thinned stands would remain at low risk to bark beetle attack for 20 to 50 years. Stands thinned to wide spacing (25 to 35 feet) would remain at low risk for approximately 40 to 50 years. Approximately one-half (50 percent) of proposed thinning in Alternative 2 would be done to wide spacing. Approximately one-quarter (25 percent) of proposed thinning in Alternative 3 would be done to wide spacing.

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

Thinning, underburning, or mowing would reduce natural fuels (Table 28**)**. The majority of trees within proposed burn units would incur some needle/crown and tree trunk scorch. Underburns would be initiated when conditions would most likely limit scorch to less than 50 percent of the existing live crown of dominant and co-dominant trees with little resulting mortality from increased beetle activity. Greatest potential for crown scorch would be in units where no mowing is proposed.

Table 28: Proposed Thinning and Underburning Acres

Treatment[1]	Alternative 2	Alternative 3
Thinning (Commercial and precommercial)	5,661 acres	6,633 acres
Underburn (Underburn, Underburn/MST, MST/Underburn)	1,909 acres	2,045 acres
Underburn following mechanical shrub treatment (MST/Underburn)	3,426 acres	5,112 acres

[1]Mechanical Shrub Treatment (MST)

Following proposed underburns, attacks by a variety of bark beetles could increase. Turpentine beetle attacks would not be expected to kill the trees but would make trees more susceptible to other insects. Increase in attacks by the pine engraver beetle, the western pine beetle, and the mountain pine beetle could occur. The pine engraver beetle can be the most significant mortality agent following an underburn. Beetle damage could continue up to 1 to 2 years. Increase in beetle activity would not be expected to expand into unburned stands. Within the burns, undamaged trees would generally not be susceptible to insect damage (A. Eglitis, Zone Entomologist, 1999, personal communication).

Cumulative Effects: The 18 Fire, past harvest, pre-commercial thinning, and reforestation treatments were considered in the classification of beetle risk. Reasonably foreseeable future actions within or adjacent to the project area will have no cumulative effect on beetle risk within the Planning Area. Beetles will likely move from within the 18 Fire to the adjoining forest outside the fire perimeter. The Lava Cast planning area would be analyzed for potential treatments that would likely reduce the risk of spread of insect infestations into the Kelsey planning area. Treatments within Kelsey would reduce the risk of an infestation that would begin elsewhere. Thinning treatments proposed adjacent to the western boundary of the 18 Fire would likely not be implemented soon enough to reduce risk of mortality from beetle attack.

DEFOLIATORS

Existing Condition: The following insects could defoliate trees within the Kelsey Planning area: Pandora moth (*Coloradia pandora*) and the western spruce budworm (*Choristoneura occidentalis* Freeman). Within the planning area, pandora moth populations are currently at endemic levels. Little defoliation is occurring. In the past, pandora moths have caused extensive tree defoliation within the planning area. The last large scale defoliation recorded in the Forest Insect and Disease Aerial Detection Survey was in 1994. Extensive defoliation was also mapped in 1992 and 1990. The western spruce budworm (*Choristoneura occidentalis* Freeman) has not been active on the east side of the Bend/Fort Rock Ranger District or within this planning area. White fir, a preferred species of the spruce budworm, is a relatively small component of the district and this planning area and insufficient to provide habitat to support an outbreak.

Alternative 1 (No Action)

Direct and Indirect Effects: At endemic population levels, defoliation from Pandora moth would be scarce and would result in little mortality. Epidemic populations have occurred at intervals of approximately 20 to 30 years. If this pattern holds, the next outbreak could occur within the next 10 to 20 years.

Defoliation would likely be heavy and widespread (similar to what occurred in 1990 to 1994). Defoliated trees would be weakened and susceptible to bark beetle attack, particularly turpentine beetle. While defoliation would occur across the landscape, trees of low vigor would be least likely to survive. Indirect mortality as result of defoliation would be highest within areas classified as imminently susceptible to beetle attack. These patterns of mortality were observed in the planning area during the last outbreak of pandora moth. Historically, outbreaks continue for 6 to 8 years (Personal communication, 2002, A. Eglitis, Entomologist).

Alternative 2 (Proposed Action) and Alternative 3

Direct, Indirect Effects, and Cumulative Effects: Proposed natural fuels treatments would have no direct effect on the potential for trees to be defoliated by the Pandora moth. Proposed thinning activities would improve tree vigor. Vigorous trees would more likely recover from defoliation than trees of poor vigor. The risk of mortality resulting from a future Pandora moth outbreak would be lowest with Alternative 3, which proposes the greatest amount of thinning.

DISEASE

Existing Condition: Dwarf mistletoe, both ponderosa pine (*Arceuthobium campylopodum*) and lodgepole pine (*Arceuthobium americanum*), is the most widespread disease in the planning area. Infection is generally light, with

some locations where infection levels are moderate to heavy. Height and diameter growth, wood strength, and seed production and viability are reduced. Tree mortality, flammability, wood knot size, and susceptibility to insect attack, particularly bark beetles are increased (Hawksworth, 1978). Infected branches provide ladder fuels to live tree crowns, increasing dry, dead aerial fuels in decadent stands and mistletoe slash increases the amount of natural ground fuels (Koonce and Roth, 1980).

Western gall rust fungus (*Endocronartium harknessii)* is common to the planning area. It occurs primarily on lodgepole pine, but is also found on ponderosa pine. This rust damages trees by: 1) killing seedlings, 2) producing branch galls so numerous that larger trees may be killed or their growth diminished by loss of branches, and 3) producing trunk cankers that can reduce the strength of the tree and increase the likelihood of wind breakage (USDA, Forest Service 1978).

Armellaria root rot, caused by the fungus (*Armellaria mellea*) has potential to be within the planning area. Its hosts include ponderosa and lodgepole pine. Historically, this disease infected fire-scarred, over mature, stressed, damaged, or weakened ponderosa pine (Hessburg et al, 1994). Infection results in growth loss, root and butt rot, uprooting and tree killing (USDA Forest Service, Undated). Brown cubical butt rot, caused by the fungus (*Phaeolus schweinitzii*) also has the potential to be within the planning area. It can occur in both ponderosa and lodgepole pine. It is common in old-growth trees, particularly those with fire scars (USDA Forest Service, Undated). It frequently causes breakage or windthrow in trees with trunk rot. This disease can also kill young trees.

Alternative 1 (No Action)

Direct and Indirect Effects: In single-story stands, dwarf mistletoe would continue to spread in and between tree crowns increasing in severity over time. Within multi-story stands, crowns of shorter trees would continue to be exposed to mistletoe seeds from taller, infected trees. The upper crowns of understory trees would rarely remain free of dwarf mistletoe, and reduction in tree growth would almost be certain (Parameter, 1978). Without thinning, pruning, or a high intensity wildfire, infection would continue indefinitely, reducing stand growth and increasing tree mortality. Mortality patterns would vary from isolated trees to clumps of trees. Dense stands of ponderosa pine could allow Armellaria root disease to increase (Hessburg et. al., 1994).

Cumulative Effects: Ponderosa pine trees infected with dwarf mistletoe have recently been pruned around Lava River Cave. With the no action alternative, no additional thinning would be done in these pruned areas. Dense stocking around pruned trees would reduce potential for pruned trees to increase in vigor.

Alternative 2 (Proposed Action) and Alternative 3

Direct, Indirect, and Cumulative Effects: Proposed thinning has the greatest potential to reduce the amount of disease present within stands. Thinning would generally leave trees with the least amount of mistletoe, gall rust and other diseases. Regardless of level of dwarf mistletoe infection or presence of other diseases, all trees greater than or equal to 21 inches dbh would be retained.

Alternative 2 proposes the most acres of stand regeneration treatment (331 acres) to reduce dwarf mistletoe infection (Table 29, page 61). Alternative 3 proposes to regenerate 102 acres. All trees less than 21 inches dbh with moderate to high levels of dwarf mistletoe infection would be removed. Residual trees with dwarf mistletoe infection would be pruned. Ponderosa pine would be planted where minimum tree stocking requirements are not met following stand regeneration treatment activities. Treatment units would be large enough, separately or in combination with adjacent stands, to minimize potential for mistletoe to spread in from adjacent mistletoe infected trees. With proposed stand regeneration, mistletoe would be essentially eliminated.

Approximately 10 percent more thinning **(**Table 29, page 61**)** is proposed with Alternative 3 than with Alternative 2. While Alternative 3 proposes more thinning, it proposes approximately 36 percent less thinning to wide spacing

(Table 29**)**. While all thinning would reduce the amount of mistletoe, wide thinning would be more effective in reducing the spread of mistletoe between trees. Wide thinning would generally be wider than the normal dispersal distance for dwarf mistletoe seed. Thinning would improve tree vigor, which could reduce mortality caused by Armillaria root rot.

Openings of 4 to 12 acres in size would be created and reforested to increase structural diversity. Hawksworth and Johnson (1989) recommend openings be no less than 20 acres to minimize the spread of mistletoe into openings from adjacent stands. The spread of mistletoe into openings would be minimized by not planting within 65 feet of the edge of an opening or pruning trees adjacent to openings.

Table 29: Proposed Treatment Acres Reducing Dwarf Mistletoe

Thinning Prescription *	Alternative 2 (Proposed Action)	Alternative 3
Stand Regeneration Harvest: Mistletoe Reduction	330	102
Thin to Wide Spacing	3,016	1,713
Thin to moderate stocking levels	634	2,566
Total Acres	**3,980**	**4,381**

Underburning has the potential to burn into the crowns of some of the more severely mistletoe infected trees. With underburns being relatively low intensity, there would be little overall reduction of mistletoe throughout the stands. Proposed underburning could increase the incidence of stem decay and butt rot. Fire scars could serve as entry points for Armellaria root rot and brown cubical butt rot.

Some recent pruning has occurred around Lava River Cave. Proposed thinning in these stands would further reduce the amount of mistletoe present. Thinning would remove trees too heavily infected with mistletoe to be selected for pruning. Proposed thinning would make more water and nutrients available to residual trees, improving tree vigor. Thinning, in combination with pruning, would further increase potential for survival of existing large trees.

Summary of Stand Density Reduction and Seed Production/Ponderosa Pine Regeneration

The opening of the crown by thinning combined with proposed underburning will create conditions favorable for the germination of ponderosa pine seed. Ponderosa pine seed production is not regularly periodic in the Pacific Northwest (Barrett, 1979). On the average, adequate seed crops can be expected every 4 to 5 years (Barrett, 1979). Soil moisture depletion around residual overstory trees will limit establishing ponderosa pine seedling height growth. McDonald (1976) found that ponderosa pine seed trees inhibit growth of ponderosa pine seedlings. In answering the question of how far the inhibitory effects extend, McDonald writes "theoretically, it would extend a length equal to the radius of crown or root extension". For the sites evaluated by McDonald, the crown radii of the ponderosa pine seed trees did not exceed 15 feet. Root radius was unknown, but McDonald cites another study that attributed slight soil moisture depletion at 40 feet to the presence of roots from study tree. McDonald found the inhibitory effect of individual ponderosa pine seed trees extends outward at least 40 feet, but may not extend much further. Following proposed thinning, average diameter of residual trees is projected to average 13 to 15 inches dbh (Silviculturist Report, Official Record, Page 30). An analysis of Deschutes 1993 to 1996 CVS Plot data (L. Werner 2003) found an average crown diameter of 14 feet for ponderosa pine 14 inches dbh. Average crown radius would be 7 feet. Ponderosa pine root spread can range from 1.2 to 5.4 times the crown radius (Hall 1987). Roots of residual trees would be expected to extend approximately 10 to 40 feet. Depending on the thinning prescription, stocking following proposed thinning will average 40 to 60 trees per acre. Assuming a radius of 2 times the crown radius, roots would extend to approximately 55 to 85 percent of the site. Assuming a radius of 3 times the crown radius, roots would extend to 127 to 191 percent of the site. While ponderosa pine regeneration would occur within the next 10 to 15 years, establishing seedlings would not be expected to be numerous enough or grow tall enough to contribute significantly to fuel loadings.

WILDLIFE

INTRODUCTION

The Kelsey project area includes mule deer summer range, spring/fall transitional range, and winter range. Summer and transitional range is generally within General Forest (MA-8), while the winter range is designated as Deer Habitat (MA-7). Winter range habitat units (**WRHU**, Figure 8, page 68) are areas in the biological winter range of mule deer (area utilized by deer during the winter regardless of Forest Plan management allocation) ranging from 15,000 to 20,000 acres. The 18 Fire burned within the Deer Habitat and General Forest along the easternmost portion of the project area. Besides the Deer Habitat management allocation, the biological winter range (area actually utilized by deer during winter time) includes areas designated by the Forest Plan as Old Growth and Scenic Views. Included within the biological winter range are portions of NNVM, the Wild and Scenic corridor, and Ryan Ranch Key Elk Area. Substantial numbers of deer utilize these areas during late fall, winter, and early spring periods. They migrate from higher elevation summering areas located south and west of the project area in late fall and then return to summering areas during early spring. Elk are also known to regularly utilize the area, with the greatest amount of use occurring during winter months along the Deschutes River in the Key Elk Area. Potential calving habitat is found in the Key Elk Area in dense stands of lodgepole pine adjacent to the Deschutes River. Mountain lion, bobcat, and black bears are known to inhabit the area. Other predators include a variety of raptors, coyote, American marten, and badger. Table 30 lists wildlife ecological indicator species and those designated as species of concern (SOC). Each species potentially represents a community of animals that have specific requirements, many of the requirements overlapping with other species. The following species listed in Table 30 are known or suspected to occur in the area. Further discussion of species and effects pages 63-84.

Table 30: Selected Wildlife Species Summary – Kelsey Planning Area

Species	Occurrence*	Management Indicator Species	FWS Species of Concern	ODFW Sensitive Species	Ecological Indictor Species and Special Habitat Requirements**
Cooper's hawk (NTMB)	U	X			
Northern goshawk (NTMB)	U	X	X	X	X (1)
Sharp-shinned hawk (NTMB)	S	X			(4)
Red-tailed hawk (NTMB)	C	X			
Golden eagle	U	X			(6)
Osprey (NTMB)	C	X			
Great Gray Owl	S	X		X	X (1, 4-LPP,PP, 5)
Flammulated owl (NTMB)	S			X	X (1,2, 4, 5-interspersed grassy openings and thickets)
Northern pygmy- owl	S			X	(2, 7-open forests, edges)
Lewis's woodpecker (NTMB)	N	X			X (2-large snags, 7-burns)
White-headed woodpecker	U (declining, local extirpations, BBS)	X		X	X (1-PP, 2, 7-sugar pine foraging, large LOS patches)
Black-backed woodpecker	S	X		X	X (1-LPP, 7-burns)
Williamson's sapsucker (NTMB)	S (declining, BBS)	X		X	X (2-large snags, 7-higher elevations)
Pygmy nuthatch	S			X	X (1-PP, 2, 7-large trees)
Brown creeper	S (declining BBS)				X (1-MC, 7-large trees)
White-breasted nuthatch	C				X (1-PP, 2)
Gray flycatcher (NTMB)	U				X (3)
Green-tailed towhee (NTMB)	U				X (3)
Olive-sided flycatcher (NTMB)	U (declining, BBS)		X	X	X (1, 2, 7 –burns, clearings, edges w/ conifers)
Hermit thrush	U				X (1-MC, 7-dense, multi-canopy conifers)
Golden-crowned kinglet (NTMB)	U (declining BBS)				X (1-MC, 3)
Chipping sparrow (NTMB)	U (declining, BBS)				X (7- open understory

Table 30: Selected Wildlife Species Summary – Kelsey Planning Area					
Species	**Occurrence***	**Management Indicator Species**	**FWS Species of Concern**	**ODFW Sensitive Species**	**Ecological Indictor Species and Special Habitat Requirements****
					w/regenerating pines)
Sage thrasher	U				X (7-sage and mt. Mahogany)
Mountain bluebird (NTMB)	C				X (2, 7- burns, openings)
Vesper sparrow (NTMB)	U				X (7-dry meadows, openings)
Rock wren	U				X (7-talus, rock)
Rocky Mt. Elk	C	X			(7-grass, shrubs winter range)
Mule deer	C	X			(7-shrubs winter range)
American marten	S	X		X	X (1-MC, LPP, 7-CWM concentrations)
Townsend's big-eared bat (Pacific western)	S	X	X	X	(3-foraging, 6-caves)
Western small-footed myotis	S		X	X	(3-foraging, 6, 7-bark of trees)
Long-eared myotis	S		X	X	(6, 7-open forest, bark of trees)
Long-legged myotis	S		X	X	(6, 7-bark of trees)
Fringed myotis	S		X	X	(6)
Pallid bat	S			X	(6, 7-roosts in trees)
Silver-haired bat	S			X	(2-cavities, 7-forages in forest, bark of trees)
Northern sagebrush lizard	S		X		X (3, 6-rock outcrops)

***Occurrence:** **C** = common, **U** = uncommon, **R** = rare, **N** = not expected to occur in the project area, **S** = suspected but not confirmed, i.e. potential habitat available, **Extirpations** = no longer present, **BBC** = Breeding Bird Survey.
**** Special habitat requirements codes:** **1** = late and old successional forest (LOS), **2** = snags, **3** = mature shrubs, **4** = dense conifers for nesting/foraging, **5** = meadows or grassy openings for foraging, **6** = special/unique habitats (rock, cliffs, caves, etc.), **7** = other, noted. **Abbreviations: LPP** = lodgepole pine, **PP** = ponderosa pine, **MC** = mixed conifer, **NTMB** = neotropical migrant bird, **CWM** = coarse woody materials (logs and limbs > 3" in diameter).

HIDING AND THERMAL COVER

Existing Condition: Hiding cover is defined as vegetation capable of hiding 90 percent of a standing adult deer or elk from view of a human at a distance equal to or less than 200 feet (Thomas, 1979). Hiding cover provides security to big game and protection from predators, including reducing vulnerability to hunting and poaching pressure. Hiding cover (Figure 7, page 64) is generally well distributed throughout the summer and winter ranges (Deer Habitat and WRHUs) but there are areas where cover stands are either larger or smaller than what is considered to receive maximum use by big game.

Thermal Cover is defined as cover used by big game to moderate cold weather conditions and to assist in maintaining a constant body temperature (Thomas, 1979). Crown cover greater than 40 percent with trees 30 feet tall is recommended for thermal cover on the Deschutes National Forest. Optimal thermal cover conditions have been compromised somewhat due to low site productivity for tree growth and insect-pest infestations that have killed or severely damaged tree stands. Refer to Figure 8, page 65 for existing thermal cover.

Ideally, hiding and thermal cover stands would be in close proximity to foraging areas and would make up approximately 40 percent of the land area (Thomas 1979). The optimum distance between cover stands for maximum use by big game is thought to be approximately 1,200 feet with stand sizes ranging from 6 to 26 acres (Thomas, 1979). Table 31 (Page 66) displays the existing amount (acres) of cover and the ratio of cover to foraging habitat and applicable Forest Plan standards and guidelines.

The existing amount of thermal cover is below objective levels of 30 percent cover due in large part to the 18 Fire. Some thermal cover stands are larger than desired or considered optimal particularly in the northern portion of the allocation. Distances between thermal cover stands

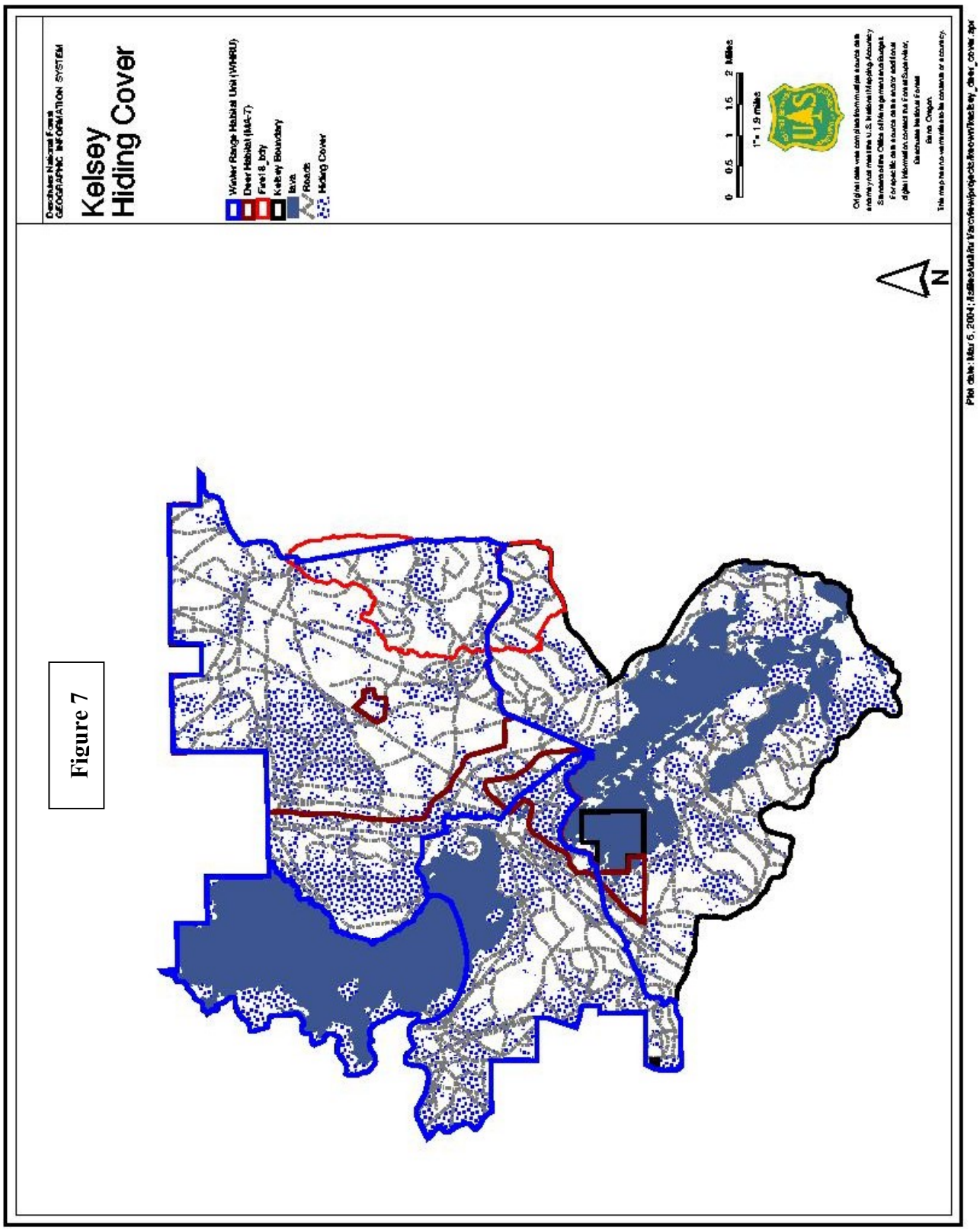
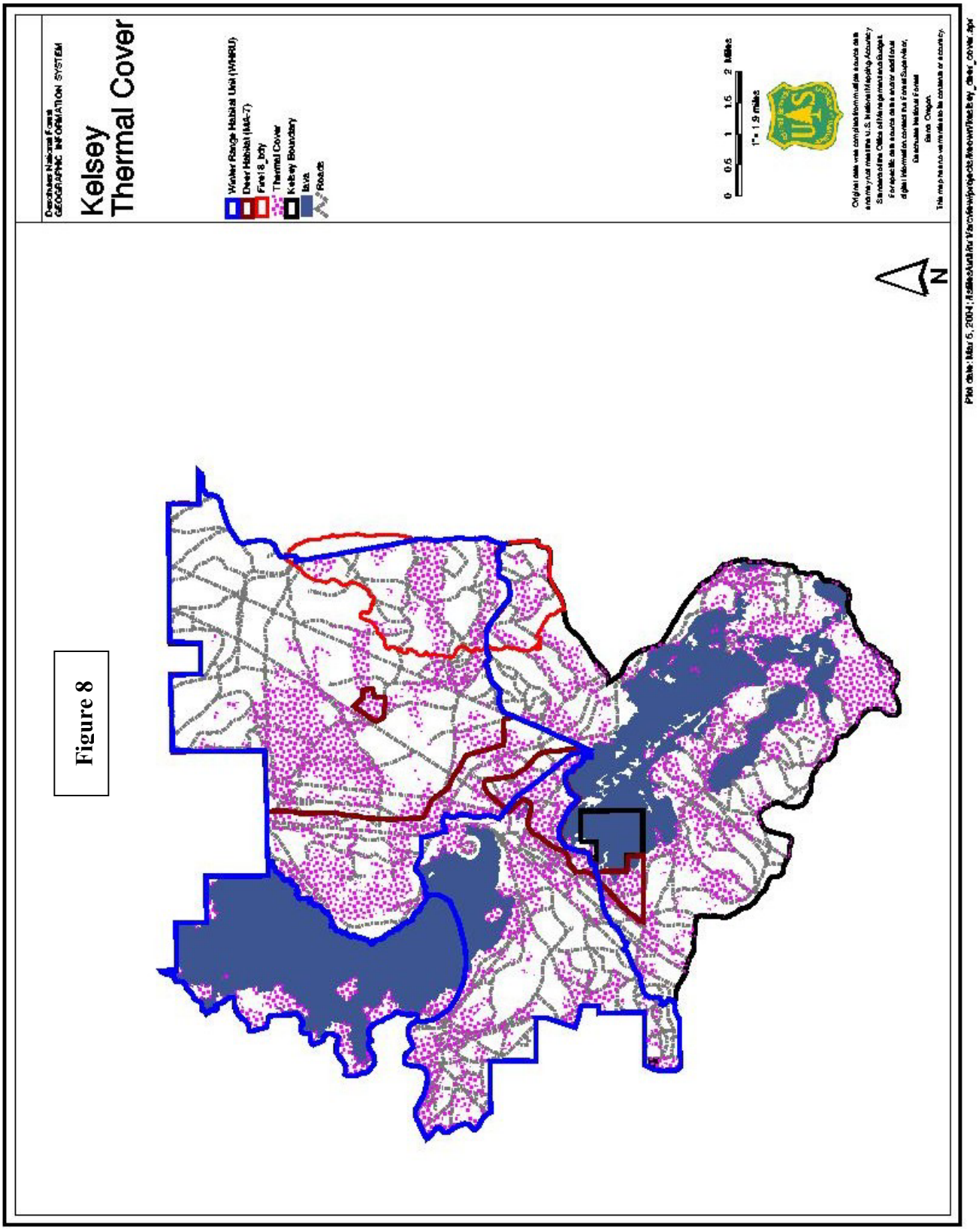

Deschutes National Forest
GEOGRAPHIC INFORMATION SYSTEM
Kelsey
Hiding Cover
Winter Range Habitat Unit (WHRU)
Deer Habitat (MA-7)
Fire18_poly
Kelsey Boundary
Elk
Roads
Hiding Cover
0 0.5 1 1.5 2 Miles
1" = 1.9 miles
N

Figure 7


Deschutes National Forest
GEOGRAPHIC INFORMATION SYSTEM
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Thermal Cover
Winter Range Habitat Unit (WHBU)
Deer Habitat (MA-7)
Forest_bdy
Thermal Cover
Kelsey Boundary
lava
Roads
0 0.5 1 1.5 2 Miles
1" = 1.9 miles
N

Figure 8

exceed 1,200 feet in many areas of the northern and eastern portions of Deer Habitat. Distribution of thermal cover in the Key Elk Area (KEA) closely matches the distribution of hiding cover.

Table 31: Existing Condition of Hiding and Thermal Cover by Forest Plan Management Allocation.

	*Hiding Cover – Acres (percent)	Hiding Cover	*Thermal Cover Acres (percent)	Thermal Cover
Kelsey Planning Area (46,050 acres – lava = 35,352 acres)	12,202 (35%)	NA		
Summer Range** (15,084 acres)	6,174 (40%)	30% (S&G)^	NA	NA
Deer Habitat (15,664 acres)	3,989 (25%)	10% (G&O)^	3,727 (24%)	30% (G&O)
Green Mt. Winter Range Habitat Unit***	5,158 (30%)	30% (DC)^	4,904 (29%)	30% (DC)
Lava River Winter Range Habitat Unit***	2,882 (26%)	30% (DC)	2,664 (24%)	30% (DC)
Key Elk Area in Kelsey (4,604 acres)	1,599 (35%)	30% - Ryan Ranch Key Elk Area (S&G)	1,262 (27%)	20% - Ryan Ranch Key Elk Area (S&G)
Key Elk Area overall (21,462 acres)	9,104 (42%)		8,020 (37%)	

***Hiding cover** is evaluated in deer summer range (areas outside the Deer Habitat management allocation, Forest Plan direction). Estimates of the amount of hiding cover within the Kelsey project area were derived from field inventory and satellite imagery (ISAT); **Thermal cover** is evaluated in the Deer Habitat and the Key Elk Area management allocations. Estimates of the amount of thermal cover were derived from field inventory, satellite imagery (ISAT), and stands considered as high stocking.

****Summer Range:** includes all Forest Plan management allocations in the Kelsey project area except Deer Habitat. Deer Habitat is evaluated separately.

*****Winter Range Habitat Unit**: habitat units are areas in the biological winter range of mule deer (area utilized by deer during the winter regardless of Forest Plan management allocation) ranging from 15,000 to 20,000 acres where habitat conditions and the potential effects of management activities are evaluated.

^ **S&G =** Forest Plan Standard & Guideline; **G&O =** Goal & Objective; **DC =** Desired Condition

Summer Range: Hiding cover exceeds minimum guidelines, is generally well distributed, and currently approximates the ideal cover to forage ratio of 40:60. Stands north and west of Lava Butte and stands in the Monument are generally larger than what is considered optimum.

Deer Habitat: Overall, hiding cover exceeds minimum levels. There is a large stand of hiding cover in the western portion of Deer Habitat that is larger than considered optimum. Hiding cover is below desired for the Lava River WRHU. Thermal cover within Deer Habitat (MA-7) is below the Forest Plan minimum guideline. Thermal cover stands are generally larger than desired or considered optimal, particularly in the northern portion. Distances between stands exceed 1,200 feet in many areas, particularly in the north and east areas. Some Thermal cover levels are below the desired level within the Lava River WRHU (Table 28, page 63**)**.

Ryan Ranch Key Elk Area (KEA): Hiding cover exceeds minimum guidelines and is relatively well distributed throughout the KEA. The majority of hiding cover is found in lodgepole pine stands along the Deschutes River. Thermal cover exceeds minimum guidelines in the KEA. Distribution of thermal cover in the KEA closely matches the distribution of hiding cover.

Alternative 1 (No Action)

Direct and Indirect Effects: Current quantity, quality, and distribution of big game hiding and thermal cover would be maintained during the short-term. Long-term (greater than 20 years), hiding cover quality in some ponderosa pine stands would diminish with increasing site distances. Fallen, dead trees would provide visual screening, maintaining or improving hiding cover. Green leaf manzanita (*Arctostaphylos patula*) and snowbrush (*Ceanothus velutinus*), shrub species capable of attaining heights of 6 and 12 feet respectively, would provide hiding cover in some areas. Thermal cover quality and quantity is expected to remain nearly constant over the long-term. Hiding and thermal quality in mixed conifer and lodgepole pine stands would increase in quantity and quality (greater than 10-15 years). Regeneration of shade tolerant lodgepole pine and white fir in these stand types would provide visual screening for hiding cover and increased canopy cover for thermal cover. There would be an increased risk for habitat loss and associated human disturbance from insect infestations, disease pathogens, and wildfire.

Alternative 2 (Proposed Action) and Alternative 3

Direct and Indirect Effects: Both action alternatives would reduce hiding and thermal cover. The number of acres

that would be affected by each action alternative is similar (Table 32). Stand densities, shrubs, and down logs that provide visual screening and hiding cover would be reduced. In deer summer and winter habitat and the Key Elk Area, hiding cover would be most reduced with Alternative 2 (Proposed Action) and thermal cover would be most reduced with Alternative 3.

Deer Habitat Management Allocation: Although thermal cover would be reduced below desired (Table 32), the distribution and quality of foraging areas and cover stands would be improved. Treatments would provide a mosaic of forested conditions and thermal cover would be maintained immediately adjacent to foraging sites. The availability of a variety of plants would be maintained or improved.

Treatments would be located in areas of thermal cover that are larger than necessary to receive maximum use by deer. Both action alternatives would result in a better distribution and arrangement of cover and foraging areas than the current condition. The removal of thermal cover would enhance bitterbrush growth and vigor to provide the appropriate size and shape to receive optimum use by deer. Thermal cover stands would be maintained between foraging areas.

Deer hiding cover and vertical stand diversity would be promoted over approximately 30 to 40 percent of a 72-acre unit in which 6 to 12 acre openings would be created. All trees less than 21 inches DBH would be harvested and openings would be replanted with ponderosa pine seedlings. In the short-term, these areas would provide foraging areas. Over the long-term they would provide hiding and thermal cover. Alternative 3 would treat other areas that do not currently provide thermal cover to promote deer hiding cover and vertical stand diversity.

Table 32: Post Treatment Acres and Ratios of Hiding and Thermal Cover.

	Hiding Cover – Alternatives			Thermal Cover – Alternatives		
	1	**2**	**3**	**1**	**2**	**3**
Planning Area (46,050 acres)	12,202 (35:65)	9,762 (28:72)	9,942 (28:72)	NA		
Summer Range* (15,084 acres)	6,174 (41:59)	5,312 (35:65)	5,496 (36:64)	NA		
Deer Habitat (15,664 acres)	3,989 (25:75)	3,574 (23:77)	3,656 (23:77)	3,727 (24:76)	2,559 (16:84)	2,702 (17:83)
WRHU: Green Mountain	5,158 (30:70)	4,361 (25:75)	4,319 (25:75)	4,904 (29:71)	3,548 (21:79)	2,972 (18:82)
WRHU: Lava River	2,882 (26:74)	2,169 (19:71)	2,180 (19:71)	2,776 (25:75)	2,251 (20:80)	2,236 (20:80)
KEA: Kelsey (4,604 acres)	1,599 (35:65)	1,317 (29:71)	1,289 (28:72)	1,262 (27:73)	1,076 (23:77)	1,038 (22:78)
KEA: Overall (21,462 acres)	9,104 (42:58)	8,822 (41:59)	8,794 (41:59)	8,020 (37:63)	7,834 (36:64)	7,796 (36:64)

*Summer range includes all Forest Plan management allocations except Deer Habitat. Deer Habitat is evaluated separately.
WRHU = Winter Range Habitat Unit; **KEA** = Key Elk Area (Ryan Ranch)
Bold = Below minimum Forest Plan standards and guidelines.

Treatments would be expected to reduce overstory and understory tree density, simplify stand structure, and reduce canopy cover. Natural fuels treatments without harvest would not affect overstory tree density or canopy cover. The recruitment of thermal cover would be slowed over the long-term. Alternative 3 would provide slightly better security and areas of escapement in summer range, would retain several strategically located untreated stands to provide quality hiding cover in areas important for home range movements and migration, and would provide better security in winter range. Table 33 displays the number of acres that would be treated that would promote both thermal and hiding cover.

Table 33: Acres Proposed for Treatment to Promote Hiding and Thermal Cover.

	Alternative 2	**Alternative 3**
Acres with Primary Treatment Objective to Promote Hiding and Thermal Cover	327	381
Acres Planted to Provide Future Hiding and Thermal Cover	720	441
Total	1,047	822

Cumulative Effects: The 18 Fire reduced the overall levels of thermal and hiding cover. Areas with moderate to high fire intensities were considered as no longer providing hiding or thermal cover. Areas with low intensity, small areas toward the southern end of the fire boundary (approximately 100 acres), were considered as still being able to provide marginal thermal cover, but not hiding cover. Within Deer Habitat (MA-7 and Green Mt. WRHU), thermal cover was reduced below Forest Plan objectives. Proposed activities would further reduce these levels. The effectiveness and quality of Deer Habitat has been reduced through the proposed 18 Fire salvage, past wildfires, and the proximity to the wildland urban interface and human population centers. Proposed thinning activities would also reduce habitat effectiveness and quality for the short term (15-20 years). Long-term, structural diversity would improve hiding cover in units where trees are planted with trees and shrubs respond with increased growth. It would take 20 years or longer for thermal cover to improve. Both alternatives would close or decommission roads. Road closure/decommissioning would tend to mitigate the effect of habitat reduction from both the 18 Fire and from tree thinning treatments, through the reduction of inadvertent and intentional harassment.

OPEN ROAD DENSITY

Existing Condition: Table 34 displays the existing open road density and target open road density within the specified management allocations (desired based on Forest Plan standards and guidelines). Open road densities are above the desired Forest Plan Standards and Guidelines in all management allocations (Table 56, page 124).

Table 34: Open Road Density by Management Allocation

Management Allocation	System Road Density (mi/mi^2)*	Target Open Road Density (mi/mi^2)
General Forest (MA-8)	3.4	2.5 (Forest Plan WL-53)
Deer Habitat (MA-7)	5.0	1.0-2.5 (Forest Plan M7-22)
Ryan Ranch Key Elk Area	6.6	0.5-1.5 (Forest Plan WL-46)

***mi/mi^2** = miles per square mile

The higher than desired road density allows for increased habitat fragmentation, harassment, and fawning disturbance in both deer and key elk habitat. Ryan Ranch Key Elk Habitat includes portions of the Wild and Scenic management area and a portion of the General Forest management area. The Wild and Scenic portion of the Key Elk Habitat contains calving areas located near the Deschutes River.

The road system provides access within critical mule deer winter range, increasing human disturbance and reducing habitat effectiveness. Roads also provide access to the Key Elk Area. Secondary roads cause the greatest reduction of habitat effectiveness and amount of available habitat. Poaching mule deer is a common occurrence. Improved forest roads or highways allowing higher vehicle speeds pose the greatest risk to wildlife mortality. Road-associated noise has the potential to disrupt active northern goshawk and Cooper's hawk nests. Edge habitat is attractive to cowbirds, a parasitic nester that lays its eggs in other species nests. Jays and ravens that feed on the eggs of other species are also attracted to this habitat. Interior-forest nesting birds may be experiencing higher than normal impacts from nest parasitism and predation.

It is estimated that roads result in a reduction of approximately 935 acres (400 feet affected multiplied by 385 miles) of potential wildlife habitat. Habitat effectiveness is reduced over an estimated 18,678 acres. Estimates of acres affected do not include un-inventoried user-created roads.

Alternative 1 (No Action): The current open road density would be maintained, nearly double the Forest Plan desired density. A seasonal road closure in Deer Habitat would not occur. High levels of disturbance of wildlife, and increased vulnerability of big game to hunting and poaching would continue.

Alternative 2 (Proposed Action), and Alternative 3

Direct, Indirect, and Cumulative Effects: No new roads would be created. One temporary road (0.5 mile) would be constructed prior to vegetation activities and then closed and rehabilitated following those activities. Deer and

elk habitat effectiveness would be improved with a decrease in road density. Approximately 56 miles of roads would be closed or decommissioned under Alternative 2 and Alternative 3. Road density within deer habitat would be reduced further with a four-month seasonal closure, from December 1 – March 31 within the Green Mountain WRHU (Table 35). This seasonal closure would mitigate low thermal cover levels and would reduce the risk of deer/vehicle interactions during critical springtime foraging and fawning activities.

Table 35: Road Densities Under Each Action Alternative

	Alternative 1 (No Action)	Alternative 2 (Proposed Action)	Alternative 3 (Preferred)	Target Open Road Density
Deer Habitat (MA-7) *With Seasonal Closure*	5.0	4.6	4.6 *1.24*	1.0-2.5 (Forest Plan M7-22)
General Forest	3.4	3.0	3.0	2.5 (Forest Plan WL-53)
Ryan Ranch Key Elk Area	6.6	5.1	5.1	0.5-1.5 (Forest Plan WL-46)

The action alternatives reduce road densities toward Forest Plan target densities. The seasonal road closure would reduce Deer Habitat road densities to within target density. Road densities would be reduced but would remain above target densities in all other allocations. High road densities would continue to provide more than desired disturbance to wildlife, but proposed closures would improve habitat quality somewhat. Some wildlife species appear to tolerate more disturbance (e.g. red-tailed hawk) than others (e.g. northern goshawk).

SHRUB HABITATS

Existing Condition: Shrubs, primarily bitterbrush, provide critical mule deer winter forage. They also provide nesting and foraging habitat for shrub-associated species, such as the yellow pine chipmunk and golden mantle ground squirrel, and neotropical migrant birds, such as Brewer's sparrow, sagebrush sparrow, and green-tailed towhee (Paige & Ritter, 1999). Many of these species, particularly the seed-caching rodents, such as the yellow pine chipmunk, serve an important ecological role in the regeneration of shrub species (Vander Wall, 1994).

Eco-types represent groupings of soil and potential vegetation with similar site potentials, expected similar responses to treatments, and reflect similarities in: 1) site carrying capacity, 2) shrub recovery period, 3) plant succession following disturbances, and 4) potential for increases of undesirable plant species such as cheatgrass and rabbitbrush. The desired ratio is 1/3 early, 1/3 mid, and 1/3 late seral shrub habitat in each of the major eco-types within each WRHU. A diversity of productive grasses, forbs, shrubs, and tree age classes are necessary for the vitality, resiliency, and continuation of deer habitat. The planning area contains the Green Mountain and Lava River WHRUs. Table 36 describes the characteristics of each of the major eco-types. Shrub habitats are evaluated on a winter range habitat unit (WRHU) and ecological type (eco-type) basis, per guidance and recommendations from the Deschutes National Forest Integrated Natural Fuels Management Strategy (INFMS, 1998), a Memorandum of Understanding between Bend-Ft. Rock Ranger District and Oregon Department of Wildlife (MOU No. 01-MU-11060101-016, March 2001) and the Devil's Garden – Hole-in-the-Ground Winter Range Habitat Unit Analysis Process paper (2002). These documents also compliment the Forest Plan Standard and Guideline: "M7-14 Forage conditions will be maintained or improved with emphasis on increasing the variety of plants available for forage and a mixture of age classes for shrubs…" (page 4-114).

Table 36: Ecotype*, Plant Association Group (PAG), and Potential Productivity

Eco-type	Plant Association(s)**	Shrub and Grass Potential Productivity (% cover)	Tree Species Potential Productivity (% cover)
3	Ponderosa pine/bitterbrush/fescue Ponderosa pine/bitterbrush/needlegrass	Bitterbrush: trace-50% Idaho Fescue: 1-40% Squirreltail: 0-5% Western needlegrass: trace-6%	Ponderosa Pine: 5-60% Western juniper: 0-10% Mountain Mahogany: 0-10%
4	Ponderosa pine/bitterbrush-manzanita/needlegrass	Greenleaf Manzanita: 0-40% Bitterbrush: 2-43%	Ponderosa Pine: 5-50% Western Juniper: 0-5%

Table 36: Ecotype*, Plant Association Group (PAG), and Potential Productivity			
Eco-type	**Plant Association(s)****	**Shrub and Grass Potential Productivity (% cover)**	**Tree Species Potential Productivity (% cover)**
	Ponderosa pine/bitterbrush-manzanita/fescue Ponderosa pine/bitterbrush-snowbrush/needlegrass	Snowbrush: 3-50% Idaho Fescue: 1-23% Western Needlegrass: trace-5% Squirreltail: 1-10% Ross Sedge: 0-5%	Mountain. Mahogany: 0-20%
6	Lodgepole pine/bitterbrush/fescue	Bitterbrush: 0-25% Idaho Fescue: 5-30%	Lodgepole Pine: 35-60%

***Ecotypes** represent groupings of soil and potential vegetation mapping units (ecological units) found in the Natural Resources Conservation Service (NRCS), North Lake County Soil Vegetation Survey.
**Plant associations are defined by Volland, 1988, Plant Associations of the Central Oregon Pumice Zone.

Shrub habitats vary widely between ecotypes **(**Table 37**)**. Ecotypes 3 and 6 show a low abundance of mid-seral shrubs. Ecotype 4, under both WRHUs, approximates the desired level within each seral stage. The 18 Fire most impacted late seral shrubs within the Green Mountain WHRU by converting approximately 1,712 mid- and late-seral shrubs to an early seral stage. Table 37 displays the acres of early, mid and late seral shrub by WRHU and eco-type.

Table 37: Existing Condition – Shrub Seral Stage By Deer Winter Range Habitat Unit (WRHU) And Major Ecological Type (eco-type).					
	Green Mt. WRHU – 19,982 total acres		**Lava River WRHU – 8,651 total acres**		
Seral Stage	**Ecotype 3**	**Ecotype 4**	**Ecotype 3**	**Ecotype 4**	**Ecotype 6**
Early	2,972 (42%)	4,425 (34%)	1,849 (52%)	1,167 (36%)	139 (18%)
Mid	1,168 (16%)	4,366 (34%)	350 (10%)	1,034 (32%)	39 (05%)
Late	2,979 (42%)	4,062 (32%)	1,341 (38%)	1,048 (32%)	583 (77%)
Total	**7,119 acres**	**12,853 acres**	**3540 acres**	**3,249 acres**	**761 acres**

To quantify shrub seral stage within the WRHUs, past management activities were queried from the geographical information system (GIS) database. The following assumptions were made on the effects of various management activities and the length of time since completion on shrub seral stage (Management activities considered included: prescribed underburn, mechanical shrub treatment, seed tree harvest, clearcut harvest, final removal, overstory removal, partial removal, shelterwood harvest, commercial thinning, precommercial thinning, and wildfire): **Early Seral** – Management activities since 1990. Areas of commercial and precommercial thin were considered to have high tree stocking, limiting shrub growth through competition for light, water, and nutrients. **Mid Seral** – Management activities completed from 1970-1989. **Late Seral** – Management activities that were completed before 1970 and areas with no record of past management activity. .

Alternative 1 (No Action): Shrub habitats would continue to age, a greater proportion of shrubs moving into late seral. Mature shrubs would increase in abundance. As shrubs become decadent, the nutritional quality would decline. Natural regeneration of bitterbrush would occur that eventually would develop into winter forage. Grasses and forbs, high in nutritional quality during spring and early summer, would decrease in abundance and diversity with accumulation of litter, maturity of shrub habitats, and lack of disturbance. The risk of wildfire and the associated loss of critical mule deer winter forage would remain high or increase through time. The opportunity to reduce the risk of wildfire in critical mule deer winter range and the opportunity to improve the abundance of herbaceous forage would not occur.

Alternative 2 (Proposed Action) and Alternative 3
Direct and Indirect Effects: Natural fuels treatments would convert treated areas to early seral conditions. Treatments would reduce the amount of mule deer winter forage and shrub habitat for small mammals and birds. Spring and early summer mechanical shrub treatment and prescribed underburning should not result in mortality of nesting small mammals and birds with implementation of mitigations, pages 33 and 34. The action alternatives would treat nearly the same acreage and have similar effects to shrub habitats. Tables 38 and 39, page 71display post treatment shrub seral stage acreages and percentages by eco-type in the WRHUs. The desired condition is a ratio of 1/3 early seral, 1/3 mid seral, and 1/3 late seral shrub habitat.

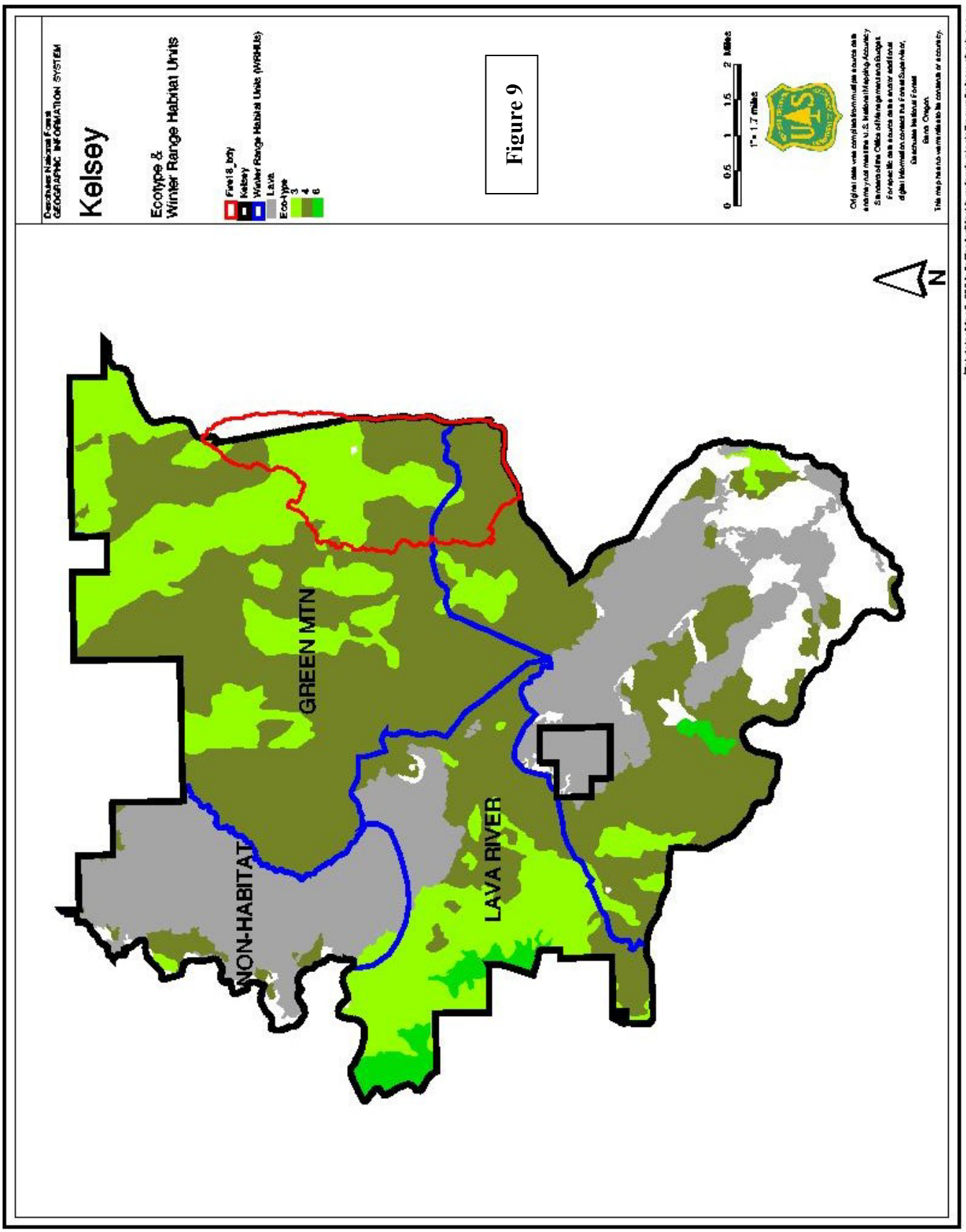
Table 38: Post Treatment Shrub Seral Stage by Ecotype – Green Mountain Winter Range Habitat Unit						
Green Mountain WRHU – 19,982 total acres						
Seral Stage	Eco-type 3 – 7,119 acres			Eco-type 4 – 12,853 acres		
	No Action	Proposed Action	Alternative 3	No Action	Proposed Action	Alternative 3
Early	2,972 (42%)	4,368(61%)	4,308(61%)	4,425(34%)	6,839(53%)	6,969(54%)
Mid	1,168 (16%)	812(11%)	869(12%)	4,366(34%)	2,799(22%)	2,665(21%)
Late	2,979 (42%)	1,939(27%)	1,942(27%)	4,062(32%)	3,215(25%)	3,212(25%)

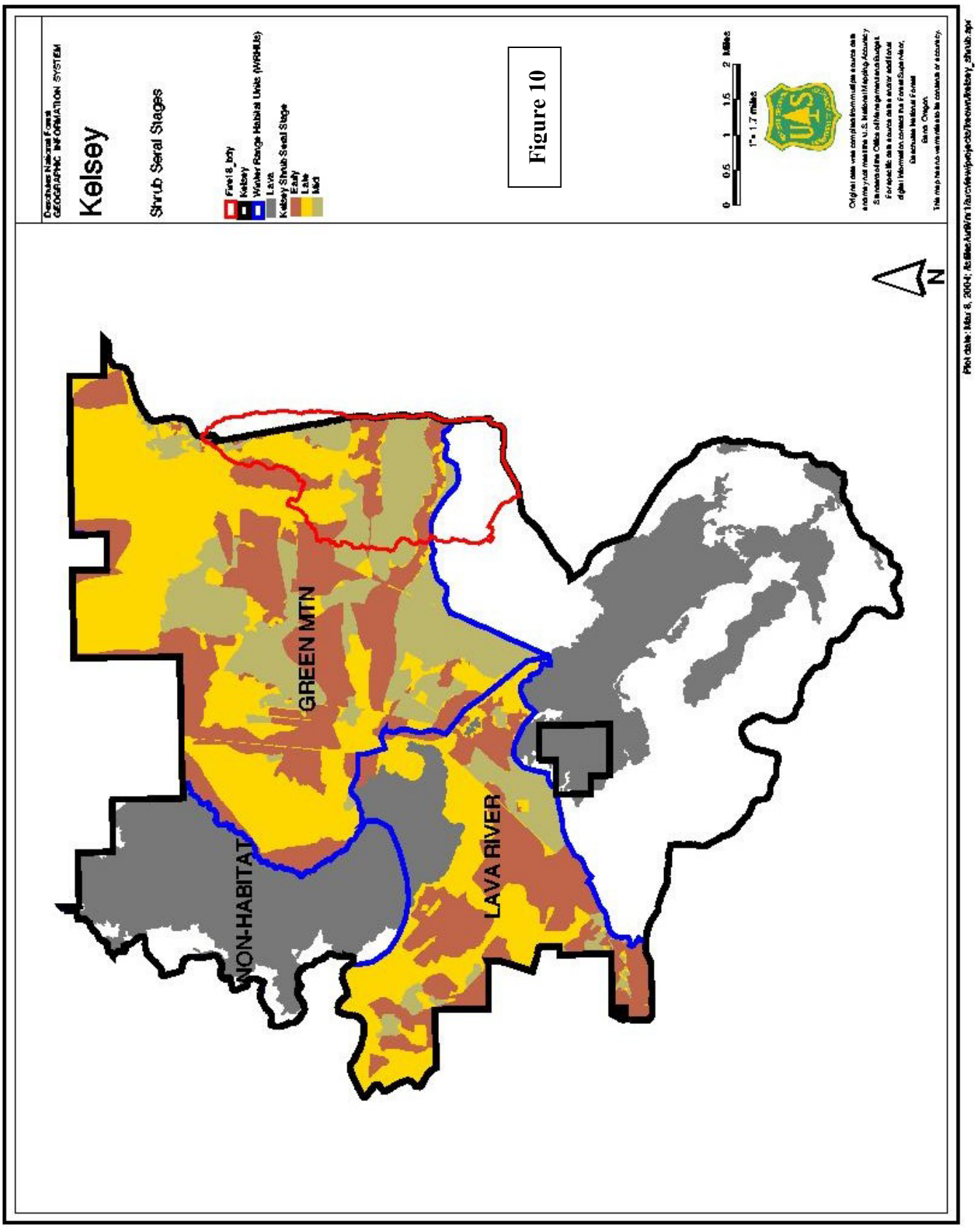
Table 39: Post Treatment Shrub Seral Stage by Ecotype – Lava River Winter Range Habitat Unit									
Lava River WRHU – 8,651 total acres									
Seral Stage	Eco-type 3 – 3,540 acres			Eco-type 4 – 3,249 acres			Eco-type 6 – 761 acres		
	No Action	Proposed Action	Alternative 3	No Action	Proposed Action	Alternative 3	No Action	Proposed Action	Alternative 3
Early	1849(52%)	2199(62%)	2200(62%)	1167(36%)	1627(50%)	1768(54%)	139(18%)	202(27%)	218(29%)
Mid	350(10%)	207 (6%)	221 (6%)	1034(32%)	832(26%)	709(22%)	39 (5%)	55 (7%)	38 (5%)
Late	1341(38%)	1118(32%)	1119(32%)	1048(32%)	790(24%)	772(24%)	583(77%)	504(66%)	505(66%)

Natural Fuels treatments in eco-type 3 would increase the amount of shrubs in the early seral stage post treatment. Mid seral shrub habitat is below the desired level and would be reduced further. Natural fuels treatments would reduce the amount of late seral shrub within eco-type 3 to approximately 1/3, the desired ratio. Natural fuels treatments would result in approximately half of eco-type 4 being early seral. Early seral conditions would provide poor winter forage (abundance, availability, and quality) because above snow forage would be reduced in treated areas. Both mid and late seral shrubs would be below the desired condition. Mule deer would be expected to primarily utilize mature shrubs in untreated areas until treated areas have bitterbrush available above snow level. Natural fuels treatments in Eco-type 3, particularly prescribed underburning, would be expected to stimulate growth of green leaf manzanita, a non-palatable forage species. Bitterbrush would be expected to regenerate but be subordinate to manzanita. The length of time necessary for bitterbrush to regenerate in eco-type 4 would be less than in eco-type 3 due to more productive soils and higher amounts of precipitation in this eco-type. Natural fuels treatments in eco-types 3 and 6 would promote herbaceous species production. Treated areas would be dominated by Idaho fescue and would be expected to benefit elk. The risk of wildfire and introduction and spread of noxious weeds would be reduced in mule deer winter range.

Maintaining 30 to 50 percent of individual treatment units as untreated would provide a well-distributed shrub population. The dominance of early-seral shrubs would likely be a long-lasting effect. Habitat for species dependent on late-seral shrubs and winter forage would be reduced.

Cumulative Effects: Proposed treatments, reasonably foreseeable projects, and past projects would trend toward more early seral conditions. This is particularly true in the lower elevations, the most important mule deer winter habitat, along the forest boundary and adjacent to the urban interface. More than 20 years from now, the best quality habitat for late-seral shrub dependent species, will be found away from the wildland-urban interface, in the areas where the shrubs have grown back and allowed to mature. Areas that have not or would not be thinned or have mechanical shrub treatments would still present a risk for wildfire, increasing to high risk over time, with potential to reduce quality shrub habitat.


Deschutes National Forest
GEOGRAPHIC INFORMATION SYSTEM
Kelsey
Ecotype &
Winter Range Habitat Units
Forest_boy
Kelsey
Winter Range Habitat Units (WRHUs)
Lava
Eco-type
3
4
6
Figure 9
0 0.5 1 1.5 2 Miles
1" = 1.7 miles
N
GREEN MTN
LAVA RIVER
NON-HABITAT


Deschutes National Forest
GEOGRAPHIC INFORMATION SYSTEM
Kelsey
Shrub Seral Stages
Fire18_bdy
Kelsey
Wolter Range Habitat Units (WRHUs)
Lava
Kelsey Shrub Seral Stage
Early
Late
Mid
Figure 10
0 0.5 1 1.5 2 Miles
1" = 1.7 miles
N
NON-HABITAT
GREEN MTN
LAVA RIVER

LATE AND OLD STRUCTURE FOREST HABITAT (LOS)

Existing Condition: The amount of late and old structure forest habitat is limited due to extensive timber harvest in the early to mid part of the 20th century. Single- and multi-story LOS are below the Historical Range of Variability (HRV). Low amounts of this habitat limit the abundance of LOS associated wildlife species in the area, such as the northern goshawk, flammulated owl, white-headed woodpecker, pygmy nuthatch, white-breasted nuthatch, and brown creeper. Table 40 displays the amount of LOS habitat in the Kelsey project area by structural stage, tree species, and selected LOS associated wildlife species.

Table 40: Acres of Late and Old Structure Habitat Structural Stage, Plant Association Group, and Associated Wildlife Species

Plant Association Group (PAG)	Acres	Selected LOS Associated Wildlife Species
Lodgepole Pine Dry Multi-story with Large Trees	144	Northern Goshawk, Northern Pygmy Owl, Great Gray Owl, Black-backed Woodpecker, American Marten
Ponderosa Pine Dry Multi-story with Large Trees	160	Cooper's Hawk, Northern Goshawk, Flammulated Owl, Great Gray Owl, Sharp-shinned Hawk, Williamson's Sapsucker, Pygmy Nuthatch, Brown Creeper, Hermit Thrush, White-breasted Nuthatch, Golden-crowned Kinglet
Ponderosa Pine Dry Single-story with Large Trees	0	Flammulated Owl, Lewis's Woodpecker, White-headed Woodpecker, Pygmy Nuthatch, White-breasted Nuthatch
Total Acres	304: Less than one (1) percent of the planning area is represented	

Alternative 1 (No Action): LOS habitats would continue to age and mature. Earlier structural stage stands would also continue to mature, moving these stands towards LOS habitat. High tree densities in many of these would retard tree growth and tree diameter, increasing the amount of time to attain large diameter trees. This high density, canopy-to-canopy stands would continue to be at an increased risk to insects, disease, and wildfire with potential loss of LOS. Connectivity of these stands to other LOS stands outside of the planning area would also be at risk. Current levels of connectivity would be maintained given no major disturbance events occur.

Alternative 2 (Proposed Action) and Alternative 3

Direct and Indirect Effects: A combination of commercial harvest, pre-commercial thinning and natural fuels treatments would reduce stand complexity and density on similar acreage (Table 41). This would include the removal of subordinate trees and seedlings and saplings, creating more open stand conditions. These stands would continue to meet criteria for structural stage 6 (multi-story with large trees) and would provide suitable habitat for many LOS associated species. Those species associated with more open stand conditions, including the flammulated owl, pygmy nuthatch, and white-breasted nuthatch would particularly benefit. These stands would provide foraging habitat of the Cooper's hawk and northern goshawk, not dense stand conditions that are preferred for nesting. Tree crowns and understory trees would mature and develop into more suitable nesting habitat for the goshawk and Cooper's hawk.

Increased tree growth would more quickly provide large diameter trees and multiple canopied stands; reduce risk of loss to wildfire by reducing ground and ladder fuels; reduce risk of mortality from insects by reducing stand density; and provide larger diameter snags and CWM suitable for a greater variety of cavity and down wood dependent wildlife. There would be an undesirable reduction in the recruitment of snags and coarse woody material (CWM).

Table 41: Acres of Proposed Treatment in Stands Classified as Late and Old Structure

	Alternative 1 (No Action)	Alternative 2 (Proposed Action)	Alternative 3
Commercial Harvest, Precommercial Thin, and Natural Fuels Treatment within LOS – Acres	0	20	22
Natural Fuels Treatment Only within LOS	0	56	55

Table 41: Acres of Proposed Treatment in Stands Classified as Late and Old Structure			
	Alternative 1 (No Action)	**Alternative 2 (Proposed Action)**	**Alternative 3**
Treatment in LOS – Acres	0	76	77
LOS in the Kelsey Project Area Treated – Percent	0	25%	25%

Cumulative Effects: Short-term (20 years), much of the project area will have little LOS habitat due to management actions and potential natural events, though it would continue to increase. Long-term (20 years) the abundance of wildlife species associated with LOS habitats would be expected to increase within the planning area. LOS areas are expected to be more resilient to major events (wildfire, insects) because of the managed stands around them and an overall decrease in fuel loading within the whole area. Those wildlife species that would benefit most, long-term, are those associated with old-growth ponderosa pine. Table 42 displays the number of acres treated that would promote LOS habitat.

Table 42: Acres of Proposed Treatment that would Promote Late and Old Structure			
	Alternative 1 (No Action)	**Alternative 2 (Proposed Action)**	**Alternative 3**
Promote Multi-Story LOS – Treatment* Acres	0	410	395
Promote Single-Story LOS – Treatment** Acres	0	1,495	1,530
Total Treatment Acres to Promote LOS	0	1,905	1,920

***Treatment Objective:** Accelerate development of multi-story late or old structure LOS.
****Treatment Objectives: 1)** Accelerate development of single-story late or old structure; **2)** Maintain/accelerate development of ponderosa pine old growth; **3)** promote open, park-like stands.

OLD GROWTH MANAGEMENT AREAS (OGMA)

Existing Condition: Three (3) OGMAs, totaling approximately 467 acres, are within the planning area. The distribution and minimum size of the OGMAs are based on the habitat requirements of old growth associated management indicator species (MIS). Representative MIS species are: northern goshawk – ponderosa pine forest type; American marten – mixed conifer forest type; and northern three-toed or black-backed woodpecker – lodgepole pine forest type. These OGMAs are classified as multi-storied with large trees but are not providing an old-tree environment or a unique representation of landscape ecology. They contribute to the biodiversity of the forest by providing habitat for other wildlife species, big game hiding and thermal cover, and dead tree habitat for numerous species of primary cavity excavators and secondary cavity users. There is a minor amount of suitable nesting habitat for the northern goshawk.

Alternative 1 (No Action), Alternative 2 (Proposed Action), and Alternative 3

Direct and Indirect Effects: No treatments are proposed within the OGMAs located within the planning area. OGMAs would continue to age and mature. Earlier structural stage stands would also mature, moving these stands towards LOS habitat. High tree densities in many ponderosa pine stands would retard tree growth, increasing the time needed to attain large tree (greater than 21 inches DBH) diameters and old growth characteristics, and maintain a continued risk of natural disturbances, likely resulting in loss OGMA habitats. Mortality would increase the number of snags and CWM. Small diameter habitats (approximately 7-12 inches dbh) would be less suitable for cavity dependent wildlife than large diameter material. These habitats would provide hiding and thermal cover for big game, nesting habitat for the Cooper's hawk, and foraging and nesting habitats of numerous species of primary and secondary cavity nesters. Multi-storied ponderosa pine stands would provide high quality nesting habitat for the northern goshawk and, over time, would provide habitat for other old growth associated wildlife species such as the flammulated owl, northern pygmy owl, pygmy nuthatch, white-breasted nuthatch, brown creeper, and hermit thrush. Suitable habitat for the black-backed woodpecker, American marten, and a small amount (currently 14 acres) of suitable nesting habitat of the northern goshawk would continue. Habitat diversity would contribute to providing hiding and thermal cover for big game and suitable snag and CWM habitat for numerous other wildlife species.

Although the proposed activities would have no direct effects to any of the OGMAs, they would indirectly, in the long-term, help in establishing a wider system of such LOS habitats. Proposed activities would reduce the risk of wildfire spreading from adjacent areas into two (2) OGMAs and associated habitat. The greater the amount of treatment adjacent to the OGMA, the lower the risk of wildfire.

LATE AND OLD STRUCTURE (LOS) CONNECTIVITY

Existing Condition: Maintaining connectivity between habitats, particularly LOS habitat, including OGMAs, is believed to be important for numerous wildlife species, allowing free movement, interaction of adults, and dispersal of young. A minimum of two connections between late and old structure stands and each OGMA is required, including those outside of the planning area boundary. Connectivity corridors should be those in which: 1) medium to large diameter trees are common; 2) canopy closures are within the top one-third of site potential; and 3) stand widths should be at least 400 feet wide at their narrowest point. If stands meeting this description are not available then the next best stands should be used for connections. The length of corridors between LOS stands and OGMAs should be as short as possible. Seventeen (17) LOS corridors were identified in the project area.

Many of the big game travel/movement corridors meet hiding cover definitions and are the same as the LOS connectivity corridors. These corridors are some of the densest stands presently available. Treatments have been designed to retain cover patches within units (Mitigations, page 34) or treatments would occur in stands without appropriate cover.

The 18 Fire, burned through nine (9) corridors mapped within the fire boundary. Three (3) were LOS, the other six (6) big game travel corridors. Two corridors in the south fire area (one (1) in LOS condition and the other a big game travel corridor), although burned, were not completely destroyed. These two connections, reduced in quality, are the remaining corridors across the 18 Fire area. These corridors are considered the best available habitat rather than forest immediately adjacent but outside of the fire perimeter.

Alternative 1 (No Action)

Direct and Indirect Effects: Connectivity corridors would not be designated. The current levels of connectivity would be maintained in the absence of natural disturbances. Travel and movement of big game would be less effective presenting more risk of harassment from human activity. Refer to discussion of LOS, page 70.

Alternative 2 (Proposed Action) and Alternative 3

Direct and Indirect Effects: Both action alternatives propose treatments within LOS connective corridors. The units and acres affected by each of the action alternatives are nearly the same but the treatment prescriptions and resultant effect on corridors varies. Treatment prescriptions within corridors can be broken into two categories: 1) prescriptions that are consistent with the Eastside Screens. These treatments would reduce canopy cover to the lower end of the top one-third of site potential and maintain connectivity, and 2) prescriptions that are inconsistent with the Eastside Screen direction for maintaining connectivity, requiring mitigation measures to be consistent with management direction and provide for connectivity.

Prescriptions consistent with Eastside Screens would thin stands to stocking levels to maximize stand growth while reducing the risk of bark beetles for the next 20 years. Thinned stands would retain approximately 45 to 100 trees per acre with an average dbh of approximately 13 inches and retain approximately 20 percent canopy cover. Treated stands would continue to provide suitable connective habitat for wildlife species associated with LOS ponderosa pine. As trees develop more full crowns and larger diameters, connective habitat would improve and provide suitable breeding habitat.

Prescriptions inconsistent with Eastside Screens would have low stocking levels to maximize tree growth and reduce the risk of bark beetles for at least 30 years. Canopy cover would be estimated to be approximately 10

percent less than the upper third of site potential. Canopy closures would be estimated to be at the lower end of the top one-third of site potential within approximately ten (10) years **(**Mitigation LOS-1, page 35**)**.

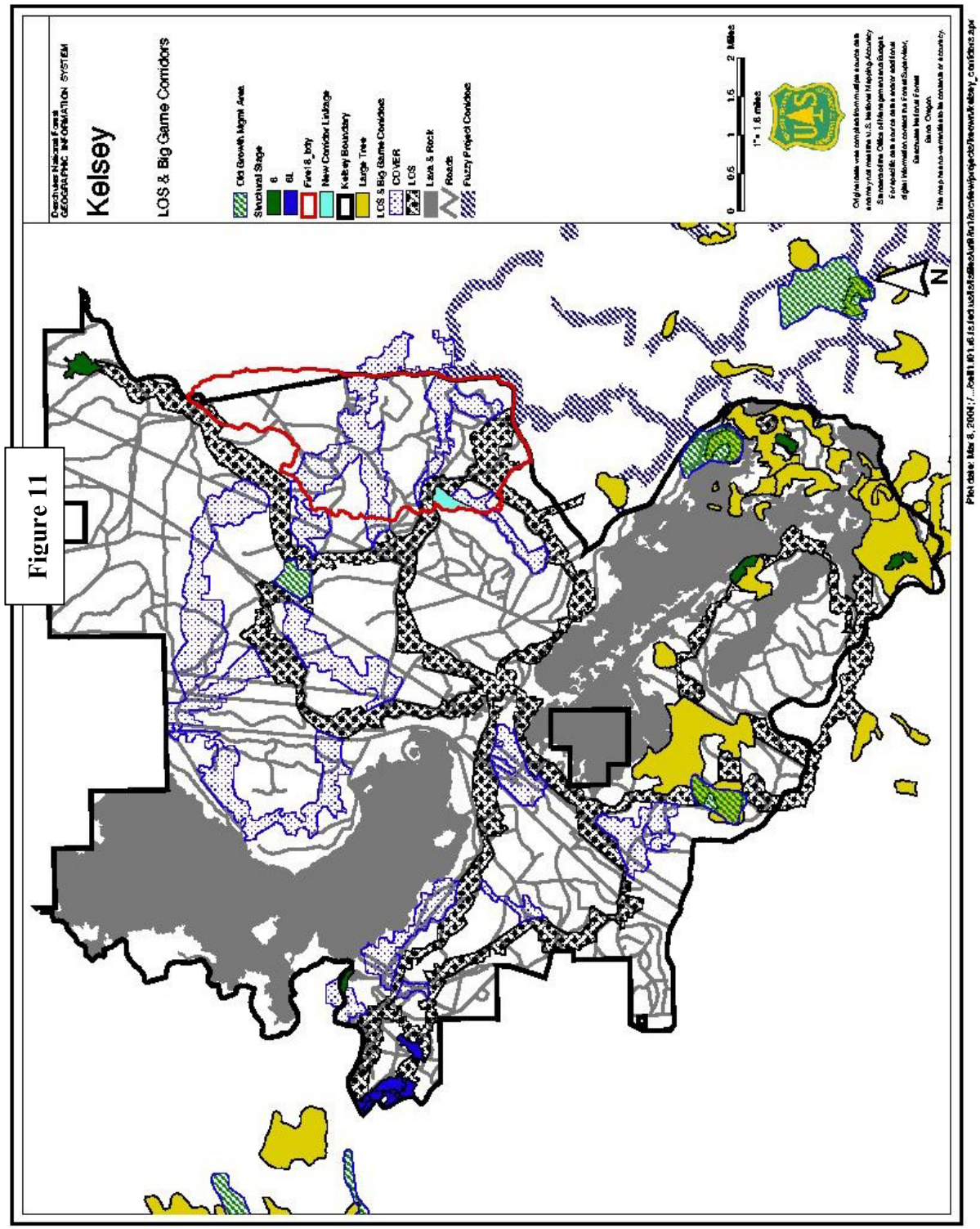


Figure 11

Table 43 displays units that within LOS corridors, and the prescription by each alternative. **Bolded rows** are inconsistent with Eastside Screens direction for connectivity; some of these of units are part of the same corridor. Total number of corridors in which connectivity is disrupted includes those corridors that were affected by the 18 Fire (Figure 11, page 77).

Table 43: Commercial Thinning Units within LOS Corridors

Proposed Action		Alternative 3	
Unit	**Prescription (Rx)***	**Unit**	**Prescription (Rx)***
23	**2**	**23**	**2**
26	**6**	**26**	**6**
69	**2**	**102**	**2**
102	**2**	121	1
121	1	122	1
122	1	126	1
126	1	127	1
127	1	203	1
		367	1
		369 **	**1**
7 Connectivity Corridors Disrupted (includes 3 LOS corridors from 18 fire)		7 Connectivity Corridors Disrupted (includes 3 LOS corridors from 18 fire)	

***Rx Description: Rx 1 =** Thin to stocking levels that maximize stand growth while maintaining low to moderate beetle risk for the next 20 years; 35-100 trees per acre at 23-30 foot spacing post treatment. **Rx 2 =** Thin to stocking levels that maximize individual tree growth while maintaining more than minimum stocking levels and low beetle risk for at least the next 30 years; 35-50 trees per acre at 30-35 foot spacing post treatment. **Rx 6 =** Remove ponderosa pine with low to moderate to high levels of dwarf mistletoe. Thin where need to reduce risk to bark beetles for the next 20 years. Plant areas that are less than minimally stocked. Prune mistletoe infected trees within 65 of planted trees.
** The existing tree density is already within the upper one-third of the site potential (definition to retain as a corridor). Presciption 1 (Rx 1) would drop it below this level.

Unit 69 (Alternative 2) and Unit 26 (Alternatives 2 and 3) break up connectivity towards the south and west, and Units 23 and 102 break up connectivity in the middle. The effects of this are that remnant LOS habitats or cover patches are isolated and less effective. Alternative 2 has more units that break connectivity and require mitigation measures than Alternative 3 (Mitigation LOS-1, page 35). The 18 Fire broke connectivity in the northeastern portion of the planning area (Figure 11, page 77). It is expected that connectivity of marginal quality will return in approximately 10 years and quality connections in approximately 40 years.

SNAGS, COARSE WOODY MATERIAL (CWM), AND GREEN TREE REPLACEMENT (GTR)

Existing Condition: Selected wildlife species known or suspected to occur in the planning area utilizing these habitats include the flammulated owl, northern pygmy owl, white-headed woodpecker, black-backed woodpecker, Williamson's sapsucker, pygmy nuthatch, brown creeper, white-breasted nuthatch, mountain bluebird, American marten, western small-footed myotis, long-eared myotis, long-legged myotis, pallid bat, and silver-haired bat.

A snag is defined as a dead tree over 10 inches in dbh and taller than 10 feet. Coarse Woody Material (CWM) is considered to be dead and down material greater than 8-10 inches diameter at the small end. Desired conditions of snag and CWM habitat were determined using DecAID (Decayed Wood Management Advisor; Marcot, et. al. 2002 preprint). The DecAID Advisor helps determine snag and log levels best suited for the management area and associated wildlife species. Densities are given in the form of wildlife species tolerance levels at the 30 percent, 50 percent, and 80 percent levels (An 80 percent tolerance level means that 80 percent of a wildlife species dependent on snags or logs will use an area containing these levels). The DecAID advisory gives downed log (CWM) recommendations in terms of size and percent of area covered by downed material.

Using the studies and information within DecAID, it is entirely expected and realized within this analysis area that distribution of snags will be clumpy (i.e. some areas have no snags while others have many snags). Since most of the project area falls within the small/medium tree types, the clumps of snags would be small (2-5/acre) with the majority of these snags being less than 20 inches dbh. The large tree type would have more of the larger snags.

The, primarily, large blocks of young, single-story (50 to 80 years) ponderosa pine have low numbers of snags and down woody debris. Wildlife species associated with historical large, single-story (late and old structure) ponderosa pine habitat, are probably less abundant than prior to logging and suppression of wildfire.

The current average levels in each of the habitat types are below the desired densities for large snags (Table 44). As a result of the 18 Fire, the ponderosa pine/Douglas-fir, small/medium tree habitat type is probably closer or even exceeding the desired levels, but these snags are all in one area. The expected clumping is exaggerated within the fire.

Table 44: Desired And Existing Average Snag Density (Snags Per Acre) And Size By Habitat Type

Habitat Type*	Average Snags Per Acre Greater than or equal to 10" dbh	Average Snags Per Acre Greater than or equal to 20" dbh
Ponderosa Pine/Douglas Fir - Small/Medium trees		
50% tolerance level	1.6	1.1
Existing Condition	1.4	0.09
Ponderosa Pine/Douglas Fir - Small/Medium trees		
80% tolerance level**	4.8	2.5
Existing Condition	7.57	1.12
Ponderosa Pine/Douglas Fir - Large Trees		
50% tolerance level***	2.9	3.6
Existing Condition	1.4	0.09
Lodgepole Pine****		
Eastside Screens	1.21	0.59 (greater than 12")
Existing	2.15	0.06

* Habitat type determined using DecAID and the plant association groups within the project area. PPDF = Ponderosa Pine/Douglas-fir. Small/Medium trees refers to the average tree diameter size throughout the type, generally less than 20" dbh. "Large Tree" are areas where the average diameter is 20" or larger.

** The 80 percent tolerance level was chosen to take into account the mixed conifer plant association group. Mixed conifer stands within the project area reflect a higher moisture regime and better capability to support higher snag levels.

*** This habitat type includes all associations with large trees (structure stages 6, 6L), even mixed conifer-dry associations, because of the capability to support larger diameter snags.

**** The DecAID analysis process does not have recommendations or data summaries for lodgepole pine types as of this project date. Data presented in this table reflect what was originally presented for the Kelsey project area. Screens = Revised Interim Management Direction,

Using the DecAID analysis and background information, all PPDF acres has coarse woody material, mostly greater than 5 inches dbh. Very few large concentrations and few large pieces are present (Table 45).

Table 45: Existing and Desired Coarse Woody Material (CWM) By Habitat Type*

Habitat Type	Tolerance Level (Percent)	Desired Percent Cover of CWM
Ponderosa Pine/Douglas Fir – Small/Medium	50%	1 to 2
Ponderosa Pine/Douglas Fir – Small/Medium (mixed conifer)	80%	3
Ponderosa Pine/Douglas Fir – Large	50%	1.8
	Ponderosa Pine/Douglas Fir – Existing: 1.4	
Lodgepole Pine		No data
Existing:		0.36-2.3

	Screens target: 15 to 20 pieces per acre greater than 8" dbh
	Existing: approximately 13 pieces per acre greater than 8" dbh

*Existing levels are estimates. DecAID uses a percent cover figure whereas sources of data for the existing conditions came in lineal feet and cubic feet measurements. Exact measurements of what currently exists have probably suffered in the reconciling of the different measurement units. Marcot, et. al. 2002 explains the rationale for using percent cover as the desired measurement for CWM levels.

Table 46: Log Density Per Acre To Meet Target Log Cover Percentage For 50 Percent Tolerance Level Within Ponderosa Pine/Douglas-Fir Small To Medium Trees* Habitat Type

Number of Logs	Log Length	Log Diameter	Percent Log Cover Per Acre
4	20 to 40 feet	5 to 10 inches	0.2
8	20 to 40 feet	10 to 20 inches	0.8
4	20 to 40 feet	20 to 40 inches	0.5
Total: 16			**1.5**

*The larger the logs left, the greater the individual log's percent cover. To attain the higher percent covers (e.g. 80 percent tolerance level and ponderosa pine /Douglas-fir large tree) add to the number of logs in each size class.

Summarizing Table 45, page 79 and Table 46, CWM is below levels as indicated by DecAID in the mixed conifer (80 percent tolerance level) and large tree types. The amount in the Ponderosa Pine/Douglas Fir small/medium tree, characterizing a majority of the project area, is within the desired level. CWM in the Lodgepole pine habitat type is below desired levels. Large quantities of CWM less than 9.1 inches dbh exist. Considering only logs greater than 9.1 inches dbh, CWM standards are not met. This may be attributed to the average stand diameter of most lodgepole pine stands being less than 9.1 inches.

Green tree replacements are trees retained or managed through time to provide snag or coarse woody material habitat at some point in the future. All tree removal activities are required to maintain green tree replacement of greater than 21 inches dbh, or the representative dbh of the overstory layer if less than 21 inches, at 100 percent potential population levels of primary cavity excavators. Units within the Kelsey planning area are fully stocked and green tree replacements are above the recommended management levels.

Alternative 1 (No Action)

Direct and Indirect Effects: Snag, CWM and green tree replacement habitats would be maintained in the current condition. Snag and CWM habitat would remain above desired levels within lodgepole pine dry and mixed conifer PAGs, and below desired levels in the ponderosa pine dry PAG during the short-term (less than 10-15 years). Natural disturbances would recruit snag and CWM habitat, increasing the density of these habitats; particularly in high tree density stands. High tree density in many of the ponderosa pine stands would retard the development of large diameter (less than 21 inches dbh) trees and future snags.

Alternative 2 (Proposed Action) and Alternative 3

Direct and Indirect Effects: The alternatives do not propose commercial harvest or salvage of snags or CWM. Commercial harvest activities would not affect snags or CWM habitats, except for falling snags that pose a hazard to human safety. Commercial harvest would affect GTR by reducing the number of trees, but units would remain fully stocked, exceeding levels recommended in the Deschutes National Forest Wildlife Tree and Log Implementation Strategy. Precommercial thinning would not reduce the number of GTRs in treated units below management levels.

Prescribed underburning in the ponderosa pine and mixed conifer PAGs would have direct effects to snags and CWM, reducing the amount of CWM by length and diameter reduction or overall abundance. A high intensity burn could reduce the number of existing snags, but could result in large diameter green tree (less than 15 inches dbh) mortality, supplementing snag numbers in the short-term and CWM over the long-term. The exact number of snags and CWM lost to or recruited from prescribed fire is unknown. Mitigations (page 35) and burn objectives and would reduce the loss of snags and CWM. Incidental mortality of GTRs may occur. Post-treatment GTRs would

exceed minimum management requirements. Mechanical shrub treatments would have no direct effects to snags or CWM.

Thinning activities would reduce the risk of mistletoe infection, insect mortality, and wildfire and would decrease available trees for snag recruitment and CWM. Alternative 3 would treat the greatest number of acres, having the greatest effect on snags, CWM, and GTRs by leaving fewer trees for recruitment. Alternative 2 (Proposed Action) would treat fewer acres but more acres with activities to reduce bark beetle risk for the greatest amount of time (30 years) and mistletoe occurrence. With fewer residual trees, the recruitment of snags and CWM would decrease. GTRs would have faster growth and larger diameters. Prescribed underburning and mechanical shrub treatment would reduce fire risk and maintain habitats over the long-term.

Cumulative Effects: Proposed, past, and foreseeable treatments, including continued fuels treatments within the wildland/urban interface, would reduce the amount and recruitment of snags and CWM. Reduced tree competition would accelerate tree growth, providing future large diameter snags and CWM.

Salvage efforts within the boundary of the 18 Fire will decrease the amount of new snags and logs available to wildlife. Salvage will decrease the initial increase in snags and logs created by the wildfire. The remaining snags would be immediately available and may stand long enough to provide some level of increased snag habitat through time throughout the whole project area. As snags fall and become CWM, snags will be created elsewhere through natural agents.

RAPTORS

Existing Condition: Several known raptor nest sites are within the Kelsey planning area. Species that are known to occur, or that would likely nest within the area, include the Cooper's hawk, northern goshawk, red-tailed hawk, osprey, and golden eagle and there are active, or recently active, nests for the golden eagle. Other species with potential habitat that are suspected to occur include the sharp-shinned hawk, flammulated owl, northern pygmy owl, and great gray owl. Surveys of potential northern goshawk habitat were conducted in 1998, 2000, and 2001. A more localized survey was conducted for northern goshawks near the High Desert Museum in 1996. Surveys for great gray owls were conducted in 2000 in potential habitat along the Deschutes River. No great gray owls were reported.

Nest stands consisting of 30 acres of suitable nesting habitat and 400 acres post fledgling areas have been identified for northern goshawk sites. The post fledgling areas incorporate suitable alternate and future replacement nest stands. Potential nesting habitat, of the northern goshawk, Cooper's hawk, sharp-shinned hawk, and great gray owl having specialized habitat preferences, was identified using satellite imagery and timber stand exam data. Based on each of the species habitat preferences and Forest Plan standards and guidelines Table 47 summarizes the existing condition of nesting habitat in the Kelsey project area.

Table 47: Existing Condition of Potential Nesting Habitat for Selected Raptor Species

Species	Acres of Potential Nesting Habitat in the Kelsey Planning Area	Acres of Habitat Meeting the Forest Plan Definition*
Northern Goshawk	2,283	1,531
Cooper's Hawk	2,740	1,383
Sharp-shinned Hawk	915	606
Great Gray Owl	236	---

*Forest Plan definitions for each species are as follows: **Northern goshawk** – mean canopy cover of 60 percent or greater, tree density of at least 195 trees per acre, stand age of 100 years or more (Forest Plan WL-9); **Cooper's Hawk** – mean canopy cover of 60 percent or greater, tree density of at least 365 trees per acre, stand age of 50 to 80 years (Forest Plan WL-17); **Sharp-shinned Hawk** – mean canopy cover of 65 percent or greater, tree density of at least 475 trees per acre, stand age 40 to 60 years (Forest Plan WL-25); **Great Gray Owl** – lodgepole pine dominated overstory, overstory tree density of 67 trees per acre for trees greater than 12 inches diameter at breast height, canopy cover of 60 percent (50 to 70 percent), distance to nearest meadow 440 (63-1,070) feet (Forest Plan WL-31).

Alternative 1 (No Action)

Direct and Indirect Effects: There would be no immediate change to raptors, habitat, or known nesting sites. Current management and recreational activities and natural processes could continue to negatively affect raptor habitat and the use of habitat. Human use in areas of nesting and foraging habitat could disturb raptor species and preclude them from using those areas. The risk of natural disturbances would likely continue to increase without reductions in forest density and natural fuels.

Alternative 2 (Proposed Action) and Alternative 3

Direct and Indirect Effects: Given adherence to the identified mitigation measures **(**Mitigations, page 28, Nest-1, Nest-2, Nest-3, Nest-4**)**, neither, the Alternative 2 nor Alternative 3 would have any direct effects to raptor species or known nesting sites (Table 48). Treatments are not proposed in known nest stands and seasonal restrictions would prevent disturbance during the breeding seasons of various raptors. Potential nesting habitat of the Cooper's hawk, northern goshawk, sharp-shinned hawk, and great gray owl would be affected. Treated stands would have reduced stand density and simplified stand structure that would not provide the preferred characteristics for nesting, primarily mistletoe infected trees, which are often selected as nest sites. Except for sharp-shinned hawk habitat, Alternative 3 would treat slightly more acres of potential nesting habitat than Alternative 2 (Proposed Action). The difference would not be substantial and treated stands would continue to provide foraging habitat.

Table 48: Direct Effects to Potential Nesting Habitat of Selected Raptor Species

Species	Great Gray Owl			Northern Goshawk			Cooper's Hawk			Sharp-shinned Hawk		
Alternative	1	2	3	1	2	3	1	2	3	1	2	3
Potential Nesting Habitat: Acres	236	230	205	2,283	1,944	1,944	2,740	2,363	2,352	915	768	778
Potential Nesting Habitat Degraded or Eliminated*: Acres	0	6	31	0	397	402	0	456	467	0	167	157
Potential Nesting Habitat degraded or eliminated: Percent	0%	3%	13 %	0%	17%	18%	0%	17%	17%	0%	18%	17%
Nesting Habitat: Acres	---	NA	NA	1,531	1,248	1,244	1,383	1,137	1,153	606	463	522
Nesting Habitat Degraded or Eliminated*: Acres	0			0	283	287	0	246	230	0	143	84
Nesting Habitat Degraded or Eliminated*: Percent		NA	NA	0%	18%	19%	0%	18%	17%	0%	24%	14%

*Degraded or Eliminated = selective harvest (HSL), commercial thin (HTH), seed tree harvest (HCR), partial removal (HPR), and pre-commercial thin. Does not include these harvest types where the objective is to maintain or enhance goshawk habitat (Forest Plan WL-4).

Commercial harvest and precommercial thinning would create more open stand conditions. This would allow greater maneuverability, visibility, and access to prey. Treatments would promote greater plant diversity that provides habitat for: 1) a wide variety of birds, the primary prey of the northern goshawk and Cooper's and sharp-shinned hawks and 2) small mammals, the primary prey of the red-tailed hawk. Increased tree growth would provide future larger diameter snags that could be utilized by the flammulated owl and northern pygmy owl for nesting. Given adherence to mitigations measures, neither, the Proposed Action or Alternative 3 would have any direct effects to raptor species or known nesting sites.

Cumulative Effects: Foreseeable treatments would provide a downward trend in the amount of dense stands that have potential for nesting use by the northern goshawk, Cooper's hawk, sharp-shinned hawk, and great gray owl. There would be a trend towards increasing open stand conditions that are more suitable as foraging habitat for the red-tailed hawk, flammulated owl, and northern pygmy owl.

ASPEN STANDS

Existing Condition: Aspen is unique and highly valuable as wildlife habitat, providing forage and cover for big game, forage for a variety of birds, and habitat for cavity nesters. Aspen is limited in distribution, abundance, and reproduction from the lack of fire, competition with conifers, and big game and stock browsing. Small stands,

generally less than ¼ acre, or individual trees occur in lava flows or outcroppings. There is one approximate 5-acre stand.

Aspen treatments (Unit 281, 5 acres) would underburn, cut all conifers less than 10 inches dbh, hand pile slash, and construct a buck/pole fence to surround the 5 acres. Proposed treatment to increase aspen stocking would reduce amount of conifer (ponderosa and lodgepole pine) understory stocking. Proposed underburn would stimulate sprouting of aspen.

Alternative 1 (No Action) and Alternative 2 (Proposed Action)
Direct and Indirect Effects: Without treatment of the 5-acre aspen stand, trees would continue to mature and have smaller diameters. Competition with conifers would result in a gradual decrease in aspen distribution and size without treatment or natural disturbance.

Alternative 3
Direct and Indirect Effects: Treatments would have positive effects to aspen and its function as unique habitat within the area. The stand would be expected to mature, including larger diameter aspen trees providing habitat diversity for a variety of animals, particularly songbirds. Fencing would protect new seedlings and growth from foraging by big game and any potential grazing by livestock. Without removing young conifers and burning to stimulate new growth, in conjunction with the fencing, this unique habitat feature on the landscape would continue to degrade and ultimately be lost. There would be no cumulative effects to the aspen stand.

LAVA ROCK OUTCROPPINGS, WATER SOURCES, AND CAVES
Existing Condition: Lava rock outcroppings and flows are scattered throughout the project area, providing unique habitat for a variety of wildlife species. Selected wildlife species known or suspected to utilize these habitats include the rock wren, American marten, Townsend's big-eared bat, pallid bat, western small-footed myotis, long-eared myotis, long-legged myotis, fringed myotis, and northern sagebrush lizard (Table 30, page 62).

One fenced, 600-gallon wildlife guzzler is located within the planning area. Guzzlers collect precipitation and are designed to provide water for primarily big game, with birds and other wildlife also benefiting. The Deschutes River provides the only free flowing water and riparian habitat within the planning area.

Two caves are located within the planning area, Lava River Cave and Bessie Butte Pit. Lava River Cave is used for hibernation for small numbers (less than 5 at any one time) of Townsend's big-eared bats. There are no records of bats in the Bessie Butte Pit.

Alternative 1 (No Action), Alternative 2 (Proposed Action), and Alternative 3: None of the alternatives would have direct, indirect, or cumulative effects to lava rock outcroppings, water developments, or caves. All unique habitats will be avoided through various mitigations.

ECOLOGICAL INDICATOR SPECIES/ HABITATS AND SPECIES OF CONCERN
Existing Condition: Table 49 (page 84) summarizes what is currently known about the occurrences of the various ecological indicator species and those of concern (Management Indicator Species, Fish and Wildlife Species of Concern and Oregon Department of Fish and Wildlife Sensitive Species). The habitat limitations to snag, log, and LOS/large tree dependent species are mainly due to the historic and more recent harvest practices; increasing stand densities that increase the stress among trees and potentially leads to epidemic insect attacks across large areas and/or catastrophic fire; and, a lack of low-intensity fire that would help create snags and naturally thin stands without killing the whole canopy. Habitat limitations to species dependent upon openings created by fire, structural diversity, and those dependent on shrub or meadows mainly is due to the lack of low intensity fire that would have naturally thinned the trees and maintained existing openings.

Alternative 2 (Proposed Action) and Alternative 3 (Preferred Alternative)
Direct and Indirect Effects: Table 49 summarizes the effects to Ecological Indicator Species as discussed within different habitats.

Table 49: Summary Of Effects To Ecological Indicator Species

Habitat	Species Associated	Effects Summary
LOS, Forest	Goshawk, great gray owl, flammulated owl, white-headed woodpecker, black-backed woodpecker, pygmy nuthatch, brown creeper, white-breasted nuthatch, olive-sided flycatcher, hermit thrush, golden-crowned kinglet, red-tailed hawk, chipping sparrow	Habitat will decrease until stands respond to treatments. Species that depend on ponderosa pine old growth will especially benefit.
Snags	Pygmy owl, Williamson's sapsucker, long-eared myotis, long-legged myotis, small-footed myotis, pallid bat, silver-haired bat	Short-term loss of recruitment. Long-term, larger diameter snags will be recruited as the stands respond to the treatment. Mitigation emphasizes leaving what snags currently exist.
Logs	Marten	Similar to snags, there will be low recruitment of new log habitat. In the long-term, larger logs will be recruited as stands respond to treatment, grow bigger, die and fall over (>30 years). Mitigation emphasizes leaving what currently exists.
Shrubs, Openings	Gray flycatcher, green-tailed towhee, big-eared bat, small-footed myotis, sagebrush lizard, sage thrasher, mountain bluebird, vesper sparrow, other bats (foraging)	Late-seral shrub dependent species will lose habitat. Openings will be maintained providing foraging areas for bats. Mitigation provides for slightly more shrub habitat through retention of 30-50 percent of the unit.
Talus, Rock	Bats (caves), rock wren, fringed myotis, golden eagle	No effects anticipated to these habitats
Aquatic, Riparian	Osprey, great blue heron, waterfowl	No direct effects to these habitats. Some cover lost near riparian area under Alternative 3

HYDROLOGY AND FISHERIES

Existing Condition: The planning area is within the Pilot Butte (approximately 147,000 acres) and Newberry (approximately 70,900 acres) 5th-field Watersheds. The planning area covers approximately 46,050 acres and includes part of nine 6th-field subwatersheds. The Kiwa Subwatershed has been designated as an A2 subwatershed, which is critical for maintaining quality red band trout habitat. Recommended management direction in A2 subwatersheds includes watershed restoration, noxious weed treatments, prescribed fire, thinning, and road restoration.

Existing channels are predominately old ephemeral channels that flow only during high precipitation events, rarely joining perennial flow primarily because of high soil infiltration rates. The planning areas western boundary borders the perennial flowing Deschutes River. The hydrology of the Deschutes River is a combination of spring-fed base flow, augmented by spring runoff from melted snow, and modified by the presence of Wickiup Dam, located upstream approximately 40 miles, which regulates the flow of the River. Generally, summer flows from the dam are greater than normal due to irrigation demand, while winter flows are less than normal. The presence of Wickiup Dam and the associated irrigation canals have reduced the natural variability of flow within this system.

The Federal Wild and Scenic River and State Scenic Waterway Act established an overriding goal to protect and enhance the Outstandingly Remarkable Values (**ORV**) for which the river was designated. The fisheries resource is regarded as an ORV in Segment 4 because of the trophy brown trout (*Salmo trutta*) fishery. Redband trout (*Oncorhyncus mykiss gairdneri*), listed on the Regional Foresters Sensitive Species List and by the State of Oregon, may occur within this portion of the river. The redband trout historically inhabited the entire Upper Deschutes River system. There are no: 1) known threatened, endangered, proposed, or candidate fish species listed by the U.S. Fish and Wildlife Service within the planning area; 2) proposed critical habitat for bull trout; or 3) essential fish habitat (EFH) for chinook salmon.

The planning area includes lands adjacent to the east bank of the Deschutes River from the north boundary of Sunriver to the southern urban growth boundary of Bend (approximately 11 miles), over 400 acres within the RHCA (east riverbank only). There are approximately four (4) lineal miles of the Deschutes River and 145 acres of Riparian Habitat Conservation Area (**RHCA**) within the planning area from the north boundary of Sunriver to Benham Falls Day Use area where proposed treatments would be implemented.

RHCAs are areas that riparian-dependent resources receive primary emphasis, and management activities are subject to specific standards and guidelines. RHCAs include riparian corridors, wetlands, intermittent streams, and other areas that help maintain the integrity of aquatic ecosystems by 1) influencing the delivery of coarse sediment, organic matter, and woody debris to streams, 2) providing root strength for channel stability, 3) shading the stream, 4) protecting water quality, and 5) providing a network of uninterrupted habitats to serve as connectors for migrating species. RHCA widths are based on site-potential tree heights and may be adjusted during site-specific project analysis where rationale for appropriate widths is presented in the decision making process.

The riparian zone width is variable, mostly narrow (5-10 feet). There are areas of sedge and willows that extend over 50 feet wide from rivers edge in some areas. The vegetation community quickly transforms into drier upland types consisting of lodgepole or ponderosa pine and bitterbrush. In other areas, loose rock/large boulder slopes separate the river from the uplands.

The primary source of hydrologic disturbance along the River is from compaction of soils due to user-created roads and recreational sites. Riparian conditions vary from good to poor and limit proper hydrologic function, depending upon the degree of conifer encroachment, recreational use (dispersed and developed), and road use.

This portion of the river is included on the Oregon Department of Environmental Quality (ODEQ) list of water quality impaired streams (303(d) list). The parameters for which it is listed are temperature (September 1-June 1), chlorophyll a, dissolved oxygen, sedimentation, and turbidity. The riparian vegetation is generally in an undisturbed condition, except where dispersed recreation sites have encroached. An extensive network of official and unofficial roads, and abundant dispersed campsites are located adjacent to the river. Compacted soils are associated with roads and dispersed sites and some have channeled sediments into the river. Riverbanks have been trampled at some sites. Bacteria, nitrogen, and phosphorus may be being introduced into the river from unsanitary waste disposal practices at these dispersed campsites.

Wickiup Dam, located approximately 45 miles upriver from Benham Falls, regulates flows of the Deschutes River to meet downstream irrigation needs. The flow regime was historically very stable, with a mean flow of approximately 1190 cubic feet per second (**cfs**) and an annual range from approximately 1000–1600 cfs measured at Benham Falls. Large flood events were uncommon. The river now experiences a large swing in flow with storage practices for irrigation needs. Flows range from approximately 700 cfs to 2500 cfs as measured at Benham Falls. During drought years flows may be substantially less during the winter. During the summer flows may be above 3000 cfs.

Log drives down the river in the 1930s damaged riverbanks and reduced instream large wood that fish depend on for cover from predators and as velocity breaks for resting. The endpoint for the river log drives was near the Benham Falls footbridge. There is excellent fish hiding cover at this site due to the large accumulation of instream wood. The remainder of the river within the project area is lacking in instream wood. Historically, abundant large ponderosa pines up to 4 feet dbh were likely found within the channel to provide fish habitat.

The flow regime from Wickiup Dam, private land development, and recreational use are other actions in the watershed adversely effect redband habitat and populations through changes in flow, increased sedimentation of substrates, increased turbidity, and decreased dissolved oxygen. Restoration projects undertaken on federal, state, and private land on areas upriver of the Kelsey Planning area have improved upstream fish habitat and water quality. A project was completed in within the Kelsey planning area during the spring of 2003, placing approximately 150 trees along the shore for fish habitat improvement. More instream large wood restoration and riverbank stabilization projects are foreseeable upriver of the planning area.

HYDROLOGY

Alternative 1 (No Action)

Direct and Indirect Effects: This alternative would not protect or enhance watershed health. Management activities would continue as are presently occurring. Without vegetation treatments, high-intensity, stand replacement wildfires could remove all or most riparian and upland vegetation. This could contribute large amounts of sediment to the Deschutes River, increase water yields, remove shading vegetation, and damage riparian function. Increased water yields and sediment delivery from wildfire could cause channel and stream bank erosion. Specific roads within the Deschutes RHCA would continue to distribute sediment to the river. Increased stream temperature and sediment could adversely affect aquatic species.

Alternative 2 (Proposed Action) and Alternative 3

Direct and Indirect Effects: Alternative 2 (Proposed Action) would treat approximately 9,930 acres by thinning, fuels treatments, or thinning and fuels treatments. Alternative 3 would treat approximately 11,250 acres, approximately 13 percent more than Alternative 2. Proposed activities would reduce the risk of water quality degradation to the Deschutes River resulting from 1) high-intensity, stand replacement wildfire and 2) widespread tree mortality resulting from insect infestations and disease vectors.

Alternative 2 would incorporate non-mechanized (hand) vegetation treatments in four (4) units (78, 84, 85, and 87) across approximately 11 acres within the RHCA. Alternative 3 would treat nine (9) units (78, 87, and 200 to 206) and approximately 25 acres within the RHCA.

A 100-foot buffer from the waters edge, on the lower terrace, would be maintained and promote and enhance the following Riparian Management Objectives (**RMOs**) (Appendix G, Hydrology, page 197):

1. Stream channel integrity, channel processes, and the sediment regime (including the elements of timing, volume, and character of sediment input and transport) under which the riparian and aquatic ecosystems developed;
2. Instream flows to support healthy riparian and aquatic habitats, the stability and effective function of stream channels, and the ability to route flood discharges;
3. Natural timing and variability of the water table elevation in meadows and wetlands;
4. Diversity and productivity of native and desired non-native plant communities in riparian zones;
5. Riparian vegetation, to:
    a. Provide an amount and distribution of large woody debris characteristic of natural aquatic and riparian ecosystems;
    b. Provide adequate summer and winter thermal regulation within the riparian and aquatic zones;
    c. Help achieve rates of surface erosion, bank erosion, and channel migration characteristic of those under which the communities developed.
6. Riparian and aquatic habitats necessary to foster the unique genetic fish stocks that evolved with the specific geo-climatic region; and
7. Habitat to support populations of well-distributed native and desired non-native plant, vertebrate, and invertebrate populations that contribute to the viability of riparian-dependent communities.

Thinning and fuels reduction would occur within unit 87, but would be restricted to non-conventional methodology, such as horse or all terrain vehicle (**ATV**) logging to reduce soil impacts that would occur with conventional logging methods. These units currently are dense and at high risk to mountain pine beetle mortality. Treatments within the RHCAs would reduce the risk for watershed degradation from wildfire, and tree mortality from insect vectors and mistletoe.

Temporary roads needed for treatments would be closed and decommissioned. Approximately 0.6 miles of system road and 1 mile of non-system roads within the RHCA would be closed or decommissioned. Alternative 3 would obliterate 0.25 miles less of non-system roads. Two dispersed campsites would be closed, rehabilitated, and relocated.

In the short-term (less than 10 years) Alternative 3 provides more potential for overland flow and sediment delivery into the Deschutes River than in Alternative 2 resulting from more proposed treatment acres. Gentle slopes, highly permeable soils, and mitigations **(**page 31**)** in both action alternatives would protect any adverse effects to watershed health from sedimentation. There would be no measurable adverse effects to bank stability, width/depth ratio, or stream temperature within the RHCA. All proposed management activities would meet the required Standards and Guidelines and selected Best Management Practices (BMPs) in both the short-term (less than 10 years) and long-term (greater than 10 years). Both action alternatives would benefit watershed health.

Cumulative Effects: Continued recreation use could affect hydrological processes. Motorized recreation within the Wild and Scenic River corridor would continue to allow standing water within the road rather than percolation into the adjacent, less compacted soils, particularly on rutted roads. Other roads, identified at this time as not needed for frequent administrative use through the roads analysis, could be closed or decommissioned following analysis of motorized or other recreational access. Future road closures or decommissioning, including user created roads, would likely improve the RHCA and protect the River from increased sedimentation. Present use of dispersed recreation sites, day and overnight use, would continue to degrade adjacent stream banks within the

riparian area. Road closures/decommissioning could reduce use of dispersed sites. Future closure or rehabilitation of dispersed recreation sites would decrease access through the RHCA, improving streambank integrity.

FISHERIES

Alternative 1 (No Action)

Direct and Indirect Effects: This alternative may impact individuals (redband trout) or habitat **(MEIH)** as a result of no vegetative treatments. There would not be a loss of population viability or create a significant trend toward federal listing. Overall, the No Action alternative does not protect and enhance the fisheries Outstandingly Remarkable Value identified in the Wild and Scenic River Plan.

No management activities would occur within riparian habitat other than custodial activities such as fire suppression and road maintenance. The long-term risk of a high intensity and large scale wildfire that could occur within riparian habitat would continue and forest health within riparian habitat would decline with increases in insect populations above endemic levels. Adverse effects to redband habitat and populations would occur from such factors as potential increased sediment delivery, loss of tree shade and increased water temperatures, and loss of future instream large wood recruitment. Instream large woody material that provides hiding cover for fish, reduces velocities to provide microhabitats, and provides habitat and a food source for aquatic macroinveretebrates would continue to be less than desired for redband trout habitat. There would be a short term benefit of increased large wood recruitment to the river in the event of a large forest disturbance adjacent to the river.

Alternative 2 (Proposed Action) and Alternative 3

Direct and Indirect Effects: Vegetation and fuels treatments would provide short- and long-term benefits for redband trout and associated habitat. The 303(d) parameters for which the river is listed would not be further degraded as provided in the following discussion. This alternative is consistent with ICBEMP science and NNVM objectives and standards and guidelines.

Sediment flow into the river, as a result of the Proposed Actions, would be immeasurable due to flat to very gentle slopes, highly permeable soils, and mitigation measures. There would be no measurable reduction of river tree shade due to the small acreages proposed for treatment within the RHCA, the size of the trees to be thinned, a 100 foot buffer, and gentle slopes that slope away from the river. Any incidental reductions in tree shade would not result in any measurable increases in water temperatures. Management activities would not be expected to result in any changes to peak flow of the river.

The proposed activities would protect and enhance the fisheries ORV in the short-term (less than 10 years), reducing the potential for adverse effects to fish habitat within and downriver from the planning area over the long-term. Thinning and fuels activities within one (1) mile of the river and within the RHCA would reduce the high intensity wildfire risk and the potential for insect damage. Thinning activities within the RHCA would reduce ponderosa pine competition that would result in healthier and larger trees that would provide shade, riverbank stability, and future instream large wood.

Riparian and upland vegetation would be protected and improved over the long-term (greater than 10 years). Other areas within the RHCA and the Wild and Scenic River corridor would continue to be at long-term risk for a high intensity, stand replacement wildfire or damage from insect vectors would remain. These areas of higher stand densities are being retained for key elk fawning and thermal and hiding cover. A high-intensity wildfire within these areas could disrupt fish habitat.

Within the RHCA, approximately 0.6 miles of system and 1 mile of non-system roads would be closed or decommissioned and two (2) dispersed campsites would be closed, rehabilitated, and relocated. These activities would provide long-term benefits to fish and fish habitat by improving riparian and upland vegetation conditions and reducing overland flow of sediments. During the obliteration of roads and the closure, there would be a

temporary potential for overland flow of sediments into the Deschutes River which would be reduced with implementation of mitigation measures (page 36).

Although the Kelsey Project area is located greater than 50 miles upriver of bull trout populations, the proposed activities under all action alternatives were evaluated for consistency with the Project Design Criteria of the 2003-2006 Programmatic Biological Assessment. The proposed activities are consistent with the exceptions of Criteria C.1 and Criteria E.1. Ground-based machines would operate within the RHCA of the Deschutes River under the action alternatives (Criteria C.1). The Equivalent Harvest Area (EHA) would be increased in watersheds already greater than 25 percent EHA (Criteria E.1). Despite these two (2) criteria not being met, the Biological Evaluation determined there would be no effect to proposed critical habitat for bull trout or EFH for chinook salmon habitat. This is due to the distance of the nearest population, several dams near Bend, and sediment transport. The proposed activities would not prevent attainment of the Riparian Management Objectives listed in the Inland Native Fish Strategy (INFISH). Proposed activities are designed to promote large woody debris and shade to meet long-term Riparian Management Objectives.

Although the Upper Deschutes 4th field watershed (17070301) is mapped by the National Marine Fisheries Service as Essential Fish Habitat for chinook salmon, there are no present or historical records of chinook populations above Big Falls on the Deschutes River, over 50 miles downriver from the project area. There would be no effects to Essential Fish Habitat or proposed critical bull trout habitat from implementation of either action alternative.

Cumulative Effects: There would be little potential for proposed activites to be additive to any adverse effects occurring upriver. The proposed thinning activities may not be substantial enough to improve and protect redband habitat in the long-term. Activities to improve large wood fish habitat have recently occurred through implementation of the Kelsey Fish Habitat Improvement Categorical Exclusion. Other instream large wood restoration and riverbank stabilization projects using bio-engineering techniques are anticipated. The cumulative past and future instream fish habitat improvement projects would have beneficial effects to fish habitat.

Table 50: Riparian Habitat Conservation Area (RHCA) Summary

Alternative	Acres Treated In RHCA	% RHCA Acres From Benham Falls To Sunriver	% Total RHCA Acres Within Project Area
1 (No Action)	0	0	0
2 (Proposed Action)	11	8	3
3	25	19	7

SOILS

The soil resource may be directly, indirectly, and cumulatively affected within each of the activity areas proposed within the project area. An activity area is defined as "the total area of ground impacted activity, and is a feasible unit for sampling and evaluating" (FSM 2520 and Forest Plan, page 4-71). For this project proposal, activity area boundaries are considered to be the smallest identified area where the potential effects of different management practices would occur. Thus, the discussion of soil effects and soil quality standards will be focused on the units proposed for mechanical fuel treatments (such as piling and mulching), mechanical shrub treatments and areas planned for prescribed underburning.

The proposed vegetation and fuel reduction treatments are related actions that would occur to achieve a purpose and need that is not associated with timber production. A qualitative assessment of soil effects was conducted by comparing existing conditions to the anticipated conditions that would result from implementing the action alternatives.

The Regional supplement to the Forest Service Manual (FSM 2520, R-6 Supplement No. 2500-98-1) provides policy for planning and implementing management practices which maintain or improve soil and water quality. This Regional guidance is consistent with Forest Plan interpretations for standards and guidelines SL-3 and SL-4 that limit the extent of detrimental soil conditions in previously managed areas (Final Forest Plan Interpretation, 1996).

PROJECT DESCRIPTION

The proposed actions include vegetation and fuel treatments on approximately 9,750 across the planning area that addresses forest conditions within the planning area. The proposed action would authorize commercial harvest and fuel reduction treatments to expedite the establishment and restoration of forest health, and reduce the potential for high-severity fires in the future due to heavy fuel loadings from fallen fire-killed trees. Mechanical harvest would likely be accomplished using modern, track-mounted machines equipped with a felling head (harvester shear), and felled trees would be whole-tree yarded to designated skid-trail networks and transported to landings using grapple skidders. Mechanical harvesters would only be allowed to make a limited number of equipment passes on any site-specific area. Skidders would be restricted to designated skid trails at all times. Main skid trails would be spaced approximately 100 feet apart on average. Most of the slash generated from harvest activities would be machine piled and burned on log landings and/or main skid trails. Dead trees (snags) and down woody material would be retained in a mosaic of varying densities across the landscape.

There would be no new construction of roads that would remain as classified system roads. Approximately 0.5 miles of temporary road would be constructed to allow access to one activity areas, but this road would be obliterated and return to its natural state upon completion of harvest activities. Roads management inside the planning area would close approximately 56 miles of the 250 miles of road identified because they are no longer needed for long-term access. Soil restoration treatments (subsoiling) would also be applied to primary skid trails and log landings to reduce cumulative levels of detrimentally compacted soil within the proposed activity areas.

BACKGROUND

The long-term sustainability of forest ecosystems depends on the productivity and hydrologic functioning of soils. Ground-disturbing management activities directly affect soil properties, which may adversely change the natural capability of soils and their potential responses to use and management. A detrimental soil condition often occurs where heavy equipment or logs displace soil surface layers or reduce soil porosity through compaction. Indirect effects from these impacts include increased runoff and accelerated soil erosion. Detrimental disturbances reduce the soils ability to supply nutrients, moisture, and air that support soil microorganisms and the growth of vegetation. The biological productivity of soils relates to the amount of surface organic matter and coarse woody debris retained or removed from affected sites.

Past management activities have affected the soil resource within the project area. The proposed harvest and associated activities may cause cumulative increases in detrimental conditions by increasing compaction and soil displacement, reducing effective ground cover, and increasing the potential for accelerated erosion. The following indicators will be used to compare the alternatives.

INDICATORS

- The extent of detrimental soil conditions within individual activity areas proposed for mechanical treatments.
- The amount of coarse woody debris (CWD) and surface organic matter that would be retained to provide ground cover protection and a long-term source of nutrients on treated sites.
- The probable success in project design and implementation of management requirements and mitigation measures that would be applied to minimize adverse impacts to soil productivity

MANAGEMENT DIRECTION

The Deschutes Land and Resource Management Plan (Forest Plan) specifies that management activities are prescribed to promote maintenance or enhancement of soil productivity by leaving a minimum of 80 percent of an activity area, in a condition of acceptable productivity potential following land management activities (Forest Plan page 4-70, SL-1 and SL-3). This is accomplished by following Forest-wide standards and guidelines to ensure that soils are managed to provide sustained yields of managed vegetation without impairment of the productivity of the land. Standard and Guideline (SL-4) directs the use of rehabilitation measures when the cumulative impacts of management activities are expected to cause damage exceeding soil quality standards and guidelines on more than 20 percent of an activity area. Standard and Guideline (SL-5) limits the use of mechanical equipment in sensitive soil areas. Operations will be restricted to existing logging facilities (such as skid trails, landings) and roads, whenever feasible. Standard and Guideline (SL-6) provides ground cover objectives to minimize accelerated erosion rates on disturbed sites with unprotected soils.

Forest Plan Management Areas MA-7, MA-8, and MA-9 do not contain specific standards and guidelines for the soil resource in this area. No actions are proposed in MA-9 (Scenic Views). Forest-wide standards and guidelines apply to the proposed management activities in MA-7 and MA-8.

The Pacific Northwest Region developed soil quality standards and guidelines that limit detrimental soil disturbances associated with management activities (FSM 2520, R-6 Supplement No. 2500-98-1). This Regional guidance supplements Forest Plan standards and guidelines, which are designed to protect or maintain soil productivity. Detrimental soil impacts are those that meet the criteria described in the Soil Quality Standards listed below.

- Detrimental Compaction: in volcanic ash/pumice soils is an increase in soil bulk density of 20 percent, or more, over the undisturbed level.
- Detrimental Puddling: when the depth of ruts or imprints is six inches or more.
- Detrimental Displacement: the removal of more than 50 percent of the A horizon from an area greater than 100 square feet, which is at least 5 feet in width.
- Detrimental Surface Erosion: requires visual evidence of surface loss in areas greater than 100 square feet, rills or gullies and/or water quality degradation from sediment or nutrient enrichment.

The Regional supplement to the Forest Service Manual (FSM 2520, R-6 Supplement No. 2500-98-1) provides policy for planning and implementing management practices which maintain or improve soil quality. An emphasis is placed on protection over restoration. The following excerpt is taken from FSM 2520.3:

"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 activity areas where less than 20 percent detrimental soil impacts exist from prior activities, the cumulative amount of detrimentally disturbed soil must not exceed the 20 percent limit following project implementation and restoration.
- In activity areas where more than 20 percent detrimental soil conditions exist from prior activities, the cumulative detrimental effects from project implementation and restoration must, at a minimum, not exceed the conditions prior to the planned activity and should move conditions toward a net improvement in soil quality".

This Regional policy is consistent with the Forest Plan interpretation of Forest-wide standards and guidelines SL-3 and Sl-4, which is filed in the Deschutes National Forest Supervisor's Office (Final Interpretations, Document 96-01, Soil Productivity, 1996).

TARGET LANDSCAPE CONDITION

The primary goal for managing the soil resource is to maintain or enhance soil conditions at acceptable levels without impairment of the productivity of the land. The extent of detrimental soil disturbances is minimized through the application of management requirements and mitigation measures designed to minimize, avoid or eliminate potentially significant impacts, or rectifying impacts in site-specific areas by restoring the affected environment. The land effectively takes in and distributes water, and erosion rates are controlled to near-natural levels. The biological productivity of soils is ensured by management prescriptions that retain adequate supplies of surface organic matter and coarse woody debris without compromising fuel management objectives and the risk of soil damage from large-scale stand replacement wildfire.

SCOPE OF THE ANALYSIS

The soil resource may be directly, indirectly, and cumulatively affected within each of the activity areas proposed within the project area. An activity area is defined as "the total area of ground impacted activity, and is a feasible unit for sampling and evaluating" (FSM 2520 and Forest Plan, page 4-71). For this project proposal, activity area boundaries are considered to be the smallest identified area where the potential effects of different management practices would occur. Thus, the discussion of soil effects and soil quality standards will be focused on the units proposed for silvicultural treatments. The activity areas range from approximately 1 acre to 405 acres in size.

Quantitative analyses and professional judgment were used to evaluate the proposed activities by comparing existing conditions to the anticipated conditions, which would result from implementing the action alternatives. The temporal scope of the analysis is defined as short-term effects being changes to soil properties that would generally revert to pre-existing conditions within 5 years or less, and long-term effects as those that would substantially remain for 5 years or longer. This analysis also considered the effectiveness and probable success of implementing the management requirements, mitigation measures, and Best Management Practices (BMPs), which are designed to avoid, minimize or reduce potentially adverse impacts to soil productivity.

EXISTING CONDITION

Landscape Characteristics

The planning area covers approximately 46,181 acres in the Newberry Volcano physiographic area, where essentially all landforms, rocks, and soil are products from volcanic events that occurred over various time periods. Elevation ranges from approximately 3,900 feet to 6,000 feet. Approximately 75 percent of the planning area is comprised of gently sloping plains and uneven lava flows that lie below and surround cinder cones and younger lava flows. Twenty five percent of the project area consists of lava flows that have naturally low soil quality. Dominant landforms have average slope gradients that range from 0 to 15 percent with occasional, short steep pitches up to 30 percent associated with the rough edges of lava flows. Bessie, Luna, and Klawhop are cinder cones with butte escarpments and smooth convex slopes that range from 30 to 70 percent.

Mean annual precipitation varies across the landscape due to changes in elevation, but it generally ranges from about 10 to 20 inches. Precipitation patterns are primarily influenced by Pacific Ocean fronts that move inland from the west during the wet season months of November through March. Approximately two-thirds of the total precipitation occurs during the late fall and winter. Much of the winter precipitation falling above 4,000 feet accumulates as snowpack that melts during the spring and early summer months. Brief thundershowers usually provide light summer rainfall from late June through mid-October.

The project area includes portions of the Arnold, Coyote Springs, Kelsey Butte, Kiwa, , Lava Cast Forest, Lava Butte and the Little Deschutes subwatersheds. Most of the water yielded from these lands is delivered to streams as deep seepage and subsurface flows. There are no intermittent, or ephemeral stream channels within the majority of the project area. The Deschutes River forms a portion of the western boundary of the planning area.

The project area contains 29 landtype units (Table 47) based on similarities in landforms, geology, and climatic conditions that influence defined patterns of soil and vegetation (Soil Resource Inventory, Larsen, 1976). The biophysical characteristics of these landtype units can be interpreted to identify hazards, suitabilities, and productivity potentials for natural resource planning and management.

The dominant landtypes within the project area exhibit high water infiltration rates and are classified as well to excessively drained. Surface soils are pumiceous loamy sands and sands. Permeability is very rapid in surface soils and moderate to rapid in the buried soils. Some of theses soils have a water table that can be encountered within two to five feet from the surface. Underlined bedrock in the planning area is mostly basalts and andesites that have a high to moderate capacity to store water and a low to moderate rate of water transmission unless storage capacity is exceeded. Table 51 displays the Soil Resource Inventory mapping (SRI) units that occur in the Kelsey project area and their key interpretation.

Table 51: Mapping Units and Interpretations

Mapping Unit	Percent Slope	Natural Stability	Erosion Potential	Compaction Potential	Displacement Potential	Sedimentation Yield Potential
*01**	*0-30*	*Very Stable*	*N/A*	*N/A*	*N/A*	*N/A*
*09**	*25-70*	*Stable*	*Low*	*Moderate*	*High*	*Variable*
*11**	*0-30*	*Very Stable*	*Low*	*Low*	*Low*	*N/A*
*14**	*25-80*	*Stable*	*Moderate*	*Low*	*High*	*Low to Moderate*
*15**	*0-10*	*Very Stable*	*Low*	*Low to Moderate*	*Low to Moderate*	*Low*
43	0-5	Very Stable	Low to Moderate	High	Low to Moderate	Low
63	0-10	Very Stable	Low	Low to Moderate	Low	Low
64	0-30	Very Stable	Low to Moderate	Low	Moderate	Low
65	0-30	Very Stable	Low to Moderate	Low	Moderate	Low
66	0-30	Very Stable	Low to Moderate	Low	Moderate	Low to Moderate
*68**	*30-60*	*Very Stable To Stable*	*Moderate*	*Low*	*High*	*Low to Moderate*
6A	0-30	Very Stable	Low	Moderate to Low	Low to Moderate	Low
6B	0-30	Very Stable	Low	Low	Moderate	Low
*6Gfrost**	*0-30*	*Very Stable*	*Low*	*Moderate*	*Moderate to Low*	*Low*
6J	0-20	Very Stable	Low	Low	Low to Moderate	Low
70	0-30	Very Stable	Low	Low to Moderate	Low to Moderate	Low
72	0-20	Very Stable	Low	Low to Moderate	Low to Moderate	Low
74	0-30	Very Stable	Low	Low	Low	Low
76	0-30	Very Stable	Low	Low	Low	Low
*80**	*25-70*	*Stable*	*Moderate*	*Low*	*Low*	*Low to Moderate*
*81**	*25-70*	*Stable*	*Moderate*	*Low*	*Low*	*Low to Moderate*
LD	0-30	Very Stable	Low	Low	Low	Low

Table 51: Mapping Units and Interpretations						
Mapping Unit	**Percent Slope**	**Natural Stability**	**Erosion Potential**	**Compaction Potential**	**Displacement Potential**	**Sedimentation Yield Potential**
LE	0-30	Very Stable	Low to Moderate	Low	Moderate	Low
*LG**	*0-80*	*Stable*	*Low to Moderate*	*Moderate to Low*	*Low to Moderate*	*Low to Moderate*
*LK**	*0-60*	*Very Stable*	*Low to Moderate*	*Low*	*Moderate to High*	*Low to Moderate*
LU	0-20	Very Stable	Low	Low to Moderate	Low to Moderate	Low
LX	0-30	Very Stable	Low to Moderate	Low	Low to Moderate	Low
WE	0-5	Very Stable	Low to Moderate	Low to Moderate	Low to Moderate	Low
XD	0-30	Very Stable	Low	Low to Moderate	Low to Moderate	Low

** Sensitive Soils (Total = 15,050 acres): 1,9,11,14,LG = Rough, uneven lava flows (12,345 acres); 15,6G = Depressions, flats (1,040 acres); 68,80,81,LK = Cinder cones (1,665 acres).*

The more productive soils (ash deposits) are commonly found on north and east aspects, and toe slopes, swales and depressions. Dominant soils are moderately deep (20 to 40 inches) to deep with loamy-sand textures that readily drain excess moisture over much of the project area. The underlying residual soils and bedrock materials have a moderate capacity to store water. The deep soils (40 inches or more in depth) associated with these landscape positions commonly reflect areas of dense vegetation. The less productive soils (cindery soil materials) are commonly found on south and west aspects and on basalt ridges and side-slopes of buttes and cinder cones. Approximately 15 percent of the project area is comprised of landtypes that contain shallow soils (less than 20 inches) and areas of exposed bedrock that generally produce surface runoff only during high intensity storms.

The sandy textures of these ash-influenced soils have high infiltration and percolation rates that account for low amounts of overland flow and natural erosion on undisturbed sites with adequate ground cover protection. Surface erosion by water is generally not a concern because dominant landtypes have gentle slopes and low-to-moderate erosion hazard ratings. The moderately deep and deep soils on Bessie and Luna buttes have a moderate erosion hazard. Exposed soils on the steep slopes (greater than 30 percent) of these landforms are much more susceptible to accelerated erosion during high-intensity rainfall events.

Soils derived from Mazama ash tend to be non-cohesive (loose) and they have very little structural development due to the young geologic age of the volcanic parent materials. Dominant soils have naturally low bulk densities and low compaction potential. However, mechanical disturbances can reduce soil porosity to levels that limit vegetative growth, especially where there is a lack of woody debris and surface organic matter to help cushion the weight distribution of ground-based equipment. Due to the absence of rock fragments on the surface and within soil profiles, these soils are well suited for tillage treatments (subsoiling) that loosen compacted soil layers and improve the soils ability to supply nutrients, moisture, and air that support vegetative growth and biotic habitat for soil organisms. The sandy-textured surface layers are also easily displaced by equipment operations, especially during dry moisture conditions. The maneuvering of equipment is most likely to cause soil displacement damage on the steeper landforms.

Land Suitability And Inherent Soil Productivity

The suitable lands database for the Deschutes National Forest Forest Plan identifies areas of land which are considered to be suitable for timber production using criteria affecting reforestation potential (FSH 2409.13). This data was developed to designate a broad-scale timber base area for forest-wide planning purposes. Project level planning requires that lands proposed for harvest have their suitability verified based on the criteria outlined in the Forest Service 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 to resource values from management activities.

The productivity of forest soils can be measured as the Cubic Foot Site Class (Mean Annual Increment in cubic feet/year) for primary tree species growing on undisturbed or minimally disturbed sites. These volume indices

provide valuable baseline information regarding soil productivity potential for each soil type in the Deschutes SRI (Soil Resource Inventory, Larsen, 1976). On the Deschutes National Forest, site classes range from Very Low (Site Class 7) to High (Site Class 4). Soil types having Site Class 7 are considered unsuited for forest production because the mean annual increment is generally less than 20 cubic feet per year.

Dominant landtypes within the Kelsey project area generally have moderate productivity ratings. All activity areas proposed for timber harvest and fuel reduction treatments meet the criteria for suitability that would allow them to be regenerated or resist irreversible resource damage.

Sensitive Soil Types

Criteria for identifying sensitive soils to management are listed in the (Deschutes Forest Plan, Appendix 14, Objective 5). These criteria include slopes over 30 percent, frost pockets, seasonal or year-long high water tables, extremely rocky areas, and soils that have high or severe erosion hazard ratings.

Sensitive soils within the Kelsey project area include: 1) soils on slopes greater than 30 percent, 2) soils associated with frost pockets in cold air drainages, and 3) soils that occur in localized areas of rocky lava flows. There are no potentially wet soils with high water tables or sensitive soils with high erosion hazard ratings.

Approximately 33 percent (15,046 ac) of the project area contains landtypes with localized areas of sensitive soils (Table 51, pages 93-94). Only portions of these landtypes contain localized areas with sensitive soils. Figure 12, page 101 shows locations of the sensitive soils on steep slopes (greater than 30 percent). Approximately 24 percent of total Kelsey planning area (11,120 acres) is lava flows, primarily within Newberry National Volcanic Monument.

Erosional Processes

Inherent erosion potential (Table 51, page 93) is a relative rating for surface erosion based on the ability of the soil to take in water, resistance of the soil surface to the impact of rainfall and water movement, and the effect of topography or slope gradient. The rating for surface erosion potential assumes that the surface cover of vegetation or litter has been disturbed or destroyed and bare surface soils are exposed to the elements of erosion. The following ratings are intended for planning purposes to indicate relative potential erosion hazards.

- **Low:** Soils are generally on gentle to moderate slopes with no appreciable hazard for erosion.
- **Moderate:** Some loss of surface materials can be expected, but soils are sufficiently resistant to erosion to permit limited and temporary exposure of bare soil during development or use.
- **High:** Considerable loss of surface materials can be expected. Unprotected soils will erode sufficiently to severely damage productivity.

On undisturbed sites with gentle slopes, surface erosion occurs at naturally low rates. Vegetation and layers of organic litter protect these soils. Accelerated erosion is usually associated with disturbances that have reduced vegetative cover, displaced organic surface layers, or reduced soil porosity through compaction. Exposed soils on the steeper landtypes within the project area have moderate erosion hazards and these areas are much more susceptible to accelerated soil erosion during high-intensity rainfall events. Due to the lack of structural development, volcanic ash-influenced soils are easily eroded where water becomes channeled on disturbed sites such as road surfaces, skid trails, water-bar outlets, and road drainage structures.

There are no sensitive soils with high erosion hazards within the project area. Dominant soils consist of moderately deep and deep soils on gentle slopes with low hazards for water erosion.

Forest Plan standard and guideline SL-6 (page 4-70 and 4-71) provides ground cover objectives to minimize accelerated erosion rates on disturbed sites with unprotected soils (Table 52, page 96). Effective ground cover includes all living or dead herbaceous or woody materials and rock fragments greater than three-forths of an inch in

diameter in contact with the ground surface, including tree or shrub seedlings, grass, forbs, litter, and woody biomass. Effective ground cover is measured as a percent of natural conditions for representative soils and landtypes. In order to minimize soil erosion by water or wind, the following ground cover objectives should be met within the first two years after completion of ground-disturbing management activities.

Table 52: Minimum Ground Cover Objectives to Minimize Soil Erosion By Water and Wind

Surface Soil Erosion Potential (Deschutes Soil Resource Inventory)	Minimum Effective Ground Cover (Percent of Natural)	
	1st Year	2nd Year
Low	20 - 30	31 – 45
Moderate	31 – 45	46 – 60
High	46 – 60	61 – 75
Severe	61 - 75	76 – 90

At the present time, adequate soil cover currently exists to control erosion on the dominant soils and landforms that were affected in the Kelsey project area. Therefore, accelerated erosion is not expected to have any long-term adverse effects to soil productivity during the recovery period.

There are no natural or management-related landslides known to exist within the project area. The high permeability of the ash-influenced soil materials generally precludes the buildup of hydraulic pressures that could trigger landslides. There are no seeps or springs on steep slopes and dominant landtypes do not meet criteria for landslide prone terrain.

Detrimental Soil Disturbance

During the 1920s, logging left a scattered overstory of seed trees to provide natural regeneration. Over the past 70 to 80 years, it is expected that natural processes (such as root penetration, frost heave, rodent activity, freeze-thaw and wetting-drying cycles) have gradually restored soil porosity in compacted areas, while the establishment of native vegetation and accumulation of organic matter has improved areas of past soil displacement.

Based on more recent harvest history, various thinning treatments, intermediate harvest, and regeneration harvest occurred within the project area between 1979 and 1992. Temporary roads, log landings, and primary skid trails were constructed and used to access individual harvest units of past timber sales. Research studies and local soil monitoring have shown that soil compaction and soil displacement account for the majority of detrimental soil conditions resulting from ground-based logging operations (Deschutes N.F., Soil Monitoring Reports; Page-Dumroese, 1993; Geist, 1989; Powers, 1999).

Past use of ground-based logging equipment has disturbed soils in portions of approximately 15,550 acres within the project area. Research has shown that the detrimental effects of soil compaction generally require more than 3 to 5 equipment passes over the same piece of ground (McNabb, Froehlich, 1983). Where only 1 or 2 equipment passes occurred, soil compaction was shallow (2 to 4 inches) and the bulk density increases did not qualify as a detrimental soil condition. It is expected that soils in these areas have returned to undisturbed density levels in the short-term (less than 5 years) through natural processes (i.e., root penetration, frost heave, rodent activity, freeze-thaw and wetting/drying cycles).

Some long-term adverse effects to soil productivity still exist where surface organic layers were displaced and/or multiple equipment passes caused deep compaction. The establishment of ground cover vegetation and accumulation of organic matter has been improving areas of past soil displacement. Decaying wood on the forest floor is critical for maintaining the soils ability to retain moisture and provide both short and long-term nutrient supplies for the growth of vegetation. Mycorrhizal fungi and soil organisms depend upon the continuing input of woody debris and fine organic matter. A balance between management practices and ensuring adequate amounts of

coarse woody debris (CWD) is an important goal for maintaining long-term soil productivity. Using mycorrhizal fungi as a bio-indicator of productive forest soils, research studies were used to develop conservative recommendations for leaving sufficient CWD following management activities (Graham et al. 1994, Brown et al. 2003). A minimum of 5 to 10 tons per acre of coarse woody debris (greater than 3 inches in diameter) should be retained on dry, ponderosa pine sites to maintain soil productivity. The upper limit of this range seems appropriate in areas where most of the partially decomposed CWD and forest litter has been consumed by fire (Brown et al. 2003). A sufficient number of standing dead snags and live trees (if available) should also be retained for future recruitment of organic matter.

Conserving surface litter (organic materials such as leaves, twigs and branches less than 3 inches in diameter) is also important for protecting mineral soil from erosion, buffering the effects of soil compaction, and supplying nutrients that support the growth of vegetation and native populations of soil organisms. Surface litter also provides on-site moisture retention.

The primary sources of detrimental soil conditions from past management are associated with existing roads and ground-based logging facilities, which would be used to access portions of the proposed activities areas in Alternatives 2 and 3. In Alternative 2 proposed activity areas (units) there is currently 8.5 percent (865 acres) in detrimental soil conditions from past management activities. In Alternative 3 proposed activity areas (units) there is currently 8 percent (934 acres) in detrimental soil conditions from past management activities. The difference between Alternative 3 and 4 amount of detrimental soils is that Alternative 4 treat more acres than Alternative 2.

The Kelsey project area contains approximately 250 miles (1,061 acres) of open system roads. Roads detrimentally disturb soil properties and convert the soil resource to a non-productive condition (approximately 25 percent of the project area). Most of these roads are native surfaced. Some roads or segments of these existing roads cross through portions of activity areas that are proposed for treatment. Most of the precipitation that falls on compacted road surfaces is transmitted as surface runoff, and roads are primary sources of accelerated surface erosion. The roads analysis identified several segments of local system road, which are recommended for long-term closures and road decommissioning (obliteration) treatments. Some local system roads are currently closed to public use. Some of these roads or segments of these roads may be re-opened to provide necessary access during proposed activities and then closed or decommissioned following unit activities. Segments of roads to be used for hauling logs have been identified for reconstruction prior to hauling activities. Estimates for ground disturbance have been factored in the individual activities areas in Table 53, page 107 and Table 54, page 110.

Approximately 3.6 miles (4.2 acres) of user created roads have and 42 miles (25 acres) of cross-country OHV trails that have been identified within the project area, representing less than one (1) percent of the planning area. The estimates for individual units are factored in the total existing detrimental soils in the proposed activities. As the surrounding area populations increases user created roads will also increase removing productive land from the land base. Creation of dispersed campsites is a concern in this area to soil quality particularly or the removal of dead and down wood in and around undeveloped campgrounds, areas of dispersed recreation and from illegal fuel wood gathering is resulting in areas having deficits to maintain long-term site productivity. Another potential concern to soil quality in this area would be due to person caused fires. The concern is along the rapidly growing urban interface that have the potential to burn at an intensity and severity that can damage soil quality (not only from the actual heat generated but also in the removal of biomass.

The extent of detrimental soil conditions associated with non-motorized recreation use is relatively minor. Impacts from dispersed recreation activities are usually found along existing roads and trails. User-created trails typically occur where vegetation has been cleared on or adjacent to old skid trail networks of past harvest areas. There are approximately 90 dispersed recreation site (5.6 acres), 37,383 feet of recreation trails (4.2 acres) this represents lass than one percent of the Kelsey project area. The small amount of disturbed soil does not increase the percentage of

detrimental soil conditions in this activity area. Recreational use is expected to have a negligible effect on overall site productivity and detrimental soil conditions within the individual activity areas proposed for this project.

The project area contains portions of two (2) grazing allotments, one vacant since 1990 and the other vacant since 1996. Livestock impacts to the soil resource are found mainly in localized areas of concentrated use, such as around water developments, salt licks, bedding areas, and major travel routes. The majority of detrimental soil conditions are confined to relatively small areas (about 1.0 acre) around water developments needed to manage livestock. Salt licks are commonly placed in the immediate vicinity of water sets and these sites are commonly used as bedding areas, especially where scattered trees exist to provide shade. Although there are three water sets within the project area, only one occurs within a proposed activity area. Approximately one acre of disturbed soil is estimated for this water set and it is included the estimated percentages of detrimental soil conditions.

ENVIRONMENTAL EFFECTS

The potential for detrimental changes to soil physical properties was quantitatively analyzed by the extent (surface area) of temporary roads, log landings, and designated skid trail systems that would likely be used to facilitate yarding activities within each of the proposed activity areas. Professional judgment was used to evaluate changes in the amount and composition of coarse woody debris and surface organic matter that provides surface cover, habitat for soil biological activity, and a nutrient reservoir for maintaining soil productivity.

Alternative 1

Direct and Indirect Effects

SENSITIVE SOILS: Under Alternative 1 (No Action), the management activities proposed in this document would not take place. No additional land would be removed from production to build permanent roads or logging facilities for harvest operations. This alternative would defer opportunities for road decommissioning treatments that would reclaim and stabilize detrimentally compacted soil committed to local system roads, which are no longer needed for long-term access. The current extent of detrimental soil conditions would likely remain unchanged for an extended period of time.

Disturbed soils would continue to recover naturally from the effects of past management activities. The Bessie Grazing Allotment is currently inactive, but livestock could resume grazing in portions of the project area following the recovery of herbaceous vegetation. Livestock grazing within the proposed activity areas would be delayed until at least the fall of 2005. A temporary closure would prevent inappropriate access off classified roads in the project area. At the present time, adequate soil cover currently exists to control erosion rates within tolerable limits.

Soil productivity would not change appreciably unless future catastrophic wildfires cause intense soil heating that results in detrimental changes to soil properties. The No Action Alternative would defer fuel reduction opportunities at this time. If a large amount of fuel is present during a future wildfire, soil temperatures can remain high for long duration and excessive soil heating would be expected to produce large changes in soil chemical, physical, and biological properties (DeBano, 1991).

COARSE WOODY DEBRIS (CWD) AND SURFACE ORGANIC MATTER: As previously described under Existing Condition of the Soil Resource, the amount of coarse woody debris will gradually increase as diseased trees fall to the ground over time. Short-term increases in available nutrients would benefit ground-cover vegetation that will eventually provide new sources of surface organic matter.

In the long-term diseased trees will become heavy fuel loadings that increase the burn hazard to an unacceptable level. The larger diameter snags (greater than 17 inches) may stand for 10 to 20 years, depending on the rate of decay and local wind conditions. High-to-extreme fire hazard and potential for excessive soil heating exists when downed woody debris exceeds 30 to 40 tons per acre (Brown et al., 2003).

Commercial harvest and whole-tree yarding can affect soil productivity through the removal of nutrients in the form of tree boles, limbs and branches. Although these forest management practices remove potential sources of future CWD, ground-based harvest activities also recruit CWD to the forest floor through breakage of limbs and tops and toppling of some trees during felling and skidding operations. Many of the smaller-diameter dead trees (less than 10 inches) and logging slash created from unusable stemwood would accelerate the accumulation of woody debris where these materials may be currently deficient. This would expedite decomposition processes and input of organic materials into the soil surface. These materials would also provide additional soil cover that improves the soils ability to resist surface erosion. The removal of tree boles would have little or no effect on nutrient cycling processes during the recovery period. Most of the tree's short-term nutrient supply is stored in the leaves (needles), branches, and roots. Available nutrients stored in fine organic matter and soil surface layers will benefit the recovery of ground cover vegetation that will eventually provide new sources of surface organic matter.

Activities Common to Alternative 2 (Proposed Action) and Alternative 3
Approximately 24 miles of roads would be re-constructed. Some currently closed roads would be opened to provide necessary access and these roads would be re-closed following harvest activities. An additional 27.9 miles of local system road, which are currently open, would be closed again following project activities. Road decommissioning (obliteration) treatments would be applied to approximately 7.3 miles of local system roads, which are recommended for removal from the transportation system.

The development and use of log landings and skid trail systems are the primary sources of physical disturbance that would result in adverse changes to soil productivity. Mechanical harvest and yarding systems would likely be accomplished using ground-based machines equipped with a felling head (harvester shear). Feller bunchers with a 24 ft. boom (17 foot effective reach) are one of the most common harvester machines used in this geographic area. It is expected that similar equipment would be used in proposed activity areas for this project. Felled trees would be whole-tree yarded to main skid trail networks and rubber-tired grapple machines would then transport the bunched trees to landings for processing and loading.

Fuel reduction treatments would include whole tree yarding, underburning and hand piling and mechanical mowing. Much of the unusable stemwood and tops would likely be machine piled and burned on log landings. Soil restoration treatments would be implemented to reduce the amount of detrimentally disturbed soil committed to log landings following these post-harvest activities. The proposed activities include prescribed underburning, hand treatments and mechanical mowing for reducing fuels.

Alternative 2 (Proposed Action)
Direct and Indirect Effects
DETRIMENTAL SOIL DISTURBANCE: Under Alternative 2, there will be harvest on 475 acres of sensitive soils. The development and use of log landings, and skid trail systems are the primary sources of physical disturbance that would result in adverse changes to soil productivity. The majority of soil impacts would occur on and adjacent to these heavy-use areas where multiple equipment passes typically cause detrimental soil compaction. Mitigation would be applied to avoid or minimize the extent of soil disturbance in random locations between main skid trails and away from log landings. Although the removal of trees would have no affect on evapotranspiration rates, logging slash and fallen dead trees would provide additional ground cover that would improve the soils ability to resist surface erosion.

The amount of disturbed area associated logging landings and skid trails would be limited to the minimum necessary to achieve management objectives. Since there is overlap with previously managed areas, opportunities to reuse existing skid trail networks and log landings utilized. Estimated total of approximately 575 acres of soil would be removed from production for designated skid trails and log landings within the proposed (unit) activity areas proposed for ground-based harvest. Table 53, page 107 displays existing and predicted amounts of detrimental soil conditions in acres and percentages for each of the activity areas proposed under Alternative 2.

Reforestation would be accomplished 279 acres in activity areas by using hand tools to plant tree seedlings. Shallow excavations and scalping to prepare sites for planting would not disturb large enough areas to qualify as a detrimental soil condition (FSM 2520, R-6 Supplement). These trees would increase water infiltration into the soil as root systems develop, and they would also provide some additional cover to reduce raindrop impacts on exposed mineral soil.

The following conclusions summarize the potential increases in detrimental soil conditions associated with temporary roads and logging facilities that would be needed to facilitate yarding operations in each of the activity areas.

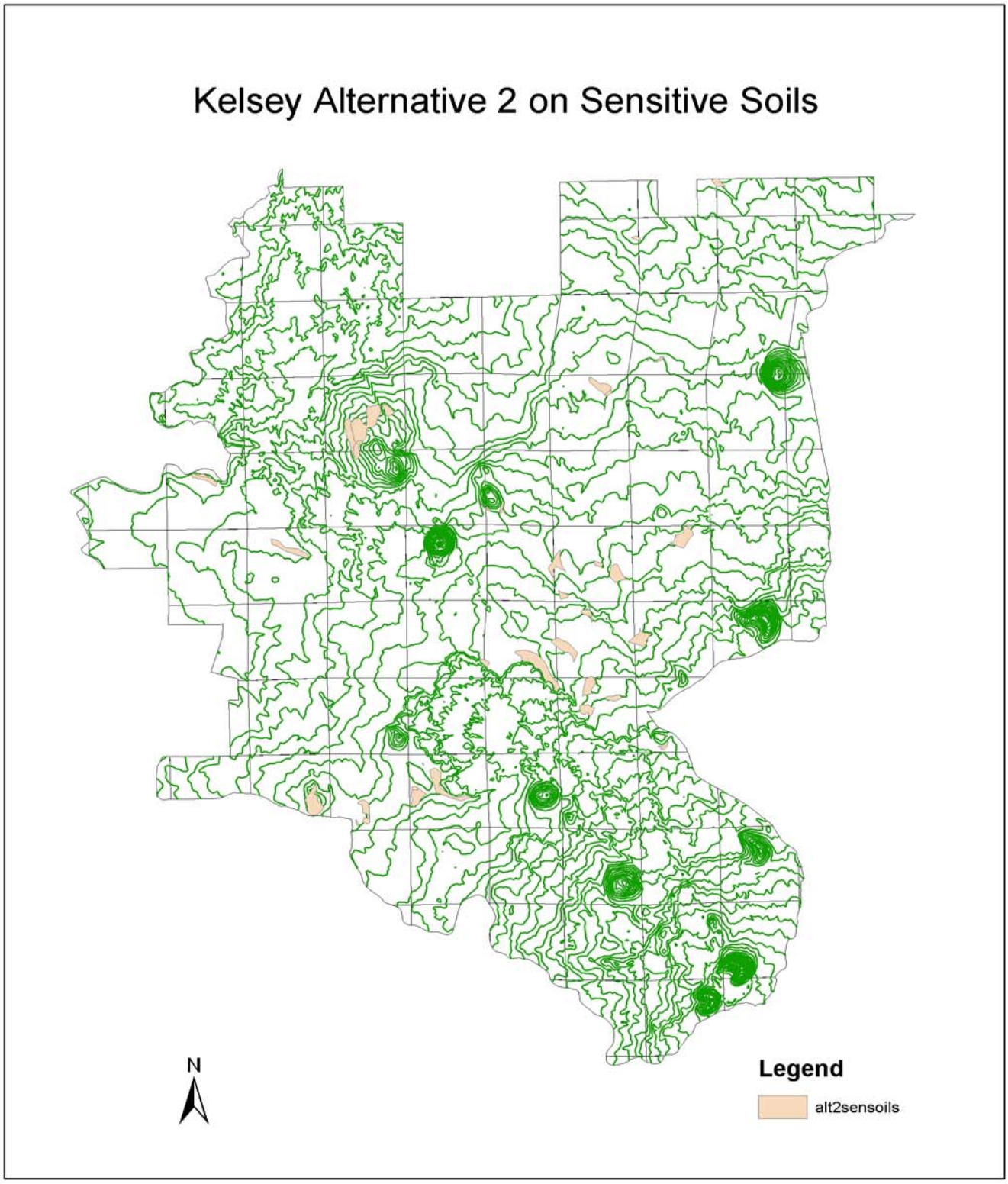
Under Alternative 2, it is estimated that existing roads and management facilities within the proposed activity areas currently impact 865 acres of soil. There will be an increase to the total acres of detrimental soils impacts in Alternative 2 of 575 acres. Soil compaction would account for the majority of these impacts and the total amount of detrimental soil conditions would be approximately 1440 acres prior to soil restoration activities. Subsoiling treatments would be applied to rehabilitate approximately 69 acres of detrimentally compacted soil within portions of the activity areas. Approximately 104 acres of soil restoration treatments would be applied to specific units (see Table 53, page 107 for units).

Based on these disturbed area estimates, the percentages of detrimental soil conditions following implementation of project and restoration activities would increase above existing conditions by approximately 8.5 to 14.1 percent in each of the proposed activity areas. None of these activity areas would exceed the Forest Plan standard the Region 6 or Deschutes National Forest Forest Plan standards and guidelines. Therefore, the proposed actions comply with Forest Plan standards and guidelines SL-3 and SL-4, and Regional policy (FSM 2520, R-6 Supplement No. 2500-98-1) for maintaining soil productivity.

SENSITIVE SOILS: Sensitive soils within the project area include: 1) soils on slopes greater than 30 percent, 2) soils associated with frost pockets in cold air drainages, and 3) soils that occur in localized areas of rocky lava flows. There are no potentially wet soils with high water tables or sensitive soils with high erosion hazard ratings that would require special mitigation. There are steep soil in the following activities areas (units) 7, 8, 14, 20, 21, 22, 23, 48, 84, 87, 106, 109, 110, 127, 129, 135, 137, and145. Figure 11, page 97 shows locations of the proposed activity areas and their proximity to sensitive soils on steep slopes (greater than 30 percent) on the located the Kelsey planning area. In order to avoid soil displacement damage, special requirement will be applied to these units that have sensitive soils with steep slopes.

The potential for successful regeneration is limited by properties such as soil depth, soil fertility, and temperature extremes on low productivity sites such as frost pockets, cold air drainages, and localized areas of rocky lava flows. These sites may require replanting in order to achieve adequate stocking levels in a desired amount of time. Modified harvest prescriptions or other, less intensive treatments are management options that do not apply to reforestation objectives in areas affected by stand-replacement wildfires. The following activity (unit) areas have the potential to be frost packet that may require replanting activities: 13, 20, 21, 22, 25, 45, 47, 58, 60, 61, 82, 102, and 127.

Figure 12


Kelsey Alternative 2 on Sensitive Soils
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Legend
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COARSE WOODY DEBRIS (CWD) AND SURFACE ORGANIC MATTER: The indicator for CWD and surface organic matter was evaluated qualitatively based on the probable success of implementing appropriate design elements and Best Management Practices (BMPs) that address adequate retention of woody debris and organic matter to meet soil productivity and wildlife habitat objectives (see Wildlife Section). A minimum amount of 5 to 10 tons per acre of CWD is recommended to ensure desirable biological benefits for maintaining soil productivity without creating an unacceptable fire hazard for a potential high-severity reburn (Brown et al., 2003). Under Alternative 2, harvest operations would be expected to accelerate the accumulation of woody debris. Existing sources of woody debris would be retained on-site and protected from disturbance to the extent possible. Enough fallen trees and other organic materials would likely be available after harvest activities to meet this recommended guideline in the short-term.

Coarse woody debris (greater than 3 inches in diameter) is needed for biological activity and long-term nutrient cycling. Small woody material and surface litter (such as leaves, twigs, and branches less than 3 inches in diameter) are needed for erosion control and short-term nutrient cycling.

Commercial harvest and whole-tree yarding can affect soil productivity through the removal of nutrients in the form of tree boles, limbs and branches. Although these forest management practices remove potential sources of future CWD, ground-based harvest activities also recruit CWD to the forest floor through breakage of limbs and tops and toppling of some trees during felling and skidding operations. Many of the smaller-diameter dead trees (less than 10 inches) and logging slash created from unusable stemwood would accelerate the accumulation of woody debris. This would expedite decomposition processes and input of organic materials into the soil surface. These materials would also provide additional soil cover that improves the soils ability to resist surface erosion. The removal of tree boles would have little or no effect on nutrient cycling processes during the short-term. Most of the tree's short-term nutrient supply is stored in the leaves (needles), branches, and roots.

On undisturbed sites, woody materials (less than 10 inches in diameter) are expected to fall to the ground within 3 to 5 years. The larger residual trees that remain following harvest would become future sources of CWD. This would provide only localized benefits within this large activity area. Over the next 10 to 20 years, the amount of CWD after harvest is predicted to average an acceptable range of 15 to 20 tons per acre within each of the proposed activity areas.

Experience and logic suggest that less intensive future wildfires would result in areas where some of the hazardous fuels are removed through management treatments as opposed to not treating n areas where heavy fuels were allowed to accumulate with no treatment. All other conditions being equal, the lower the fuel loading, the lower the fire intensity and burn severity. Alternative 2 would result in a lower risk for future wildfires than Alternatives 1.

Alternative 3

Direct and Indirect Effects

DETRIMENTAL SOIL DISTURBANCE: Under Alternative 3, there harvest on 393 acres of sensitive soils. The development and use of log landings, and skid trail systems are the primary sources of physical disturbance that would result in adverse changes to soil productivity. The majority of soil impacts would occur on and adjacent to these heavy-use areas where multiple equipment passes typically cause detrimental soil compaction. Mitigation would be applied to avoid or minimize the extent of soil disturbance in random locations between main skid trails and away from log landings. Although the removal of trees would have no affect on evapotranspiration rates, logging slash and fallen dead trees would provide additional ground cover that would improve the soils ability to resist surface erosion.

The amount of disturbed area associated logging landings and skid trails would be limited to the minimum necessary to achieve management objectives. Since there is overlap with previously managed areas, opportunities to reuse existing skid trail networks and log landings utilized. As previously described under Important

Interactions, an estimated total of approximately 525 acres of soil would be removed from production for designated skid trails and log landings within the proposed (unit) activity areas proposed for ground-based harvest. Table 4 displays existing and predicted amounts of detrimental soil conditions in acres and percentages for each of the activity areas proposed under Alternative 3.

Reforestation would be accomplished 212 acres in activity areas by using hand tools to plant tree seedlings. Shallow excavations and scalping to prepare sites for planting would not disturb large enough areas to qualify as a detrimental soil condition (FSM 2520, R-6 Supplement). These trees would increase water infiltration into the soil as root systems develop, and they would also provide some additional cover to reduce raindrop impacts on exposed mineral soil.

The following conclusions summarize the potential increases in detrimental soil conditions associated with temporary roads and logging facilities that would be needed to facilitate yarding operations in each of the eight activity areas.

Under Alternative 3, existing roads and management facilities within the proposed activity areas currently impact an estimated total of approximately 934 acres of soil. There will be an increase to the total acres of detrimental soils impacts in Alternative 2 of 525 acres. Soil compaction would account for the majority of these impacts and the total amount of detrimental soil conditions would be approximately 1459 acres prior to soil restoration activities. Subsoiling treatments would be applied to rehabilitate approximately 122 acres of detrimentally compacted soil within portions of the activity areas (Table 54, page 110).

Based on these disturbed area estimates, the percentages of detrimental soil conditions following implementation of project and restoration activities would increase above existing conditions by approximately 8 to 12.4 percent in each of the proposed activity areas. None of these activity areas would exceed the Forest Plan standard the Region 6 or Forest Plan standards and guidelines. Therefore, the proposed actions comply with Forest Plan standards and guidelines SL-3 and SL-4, and Regional policy (FSM 2520, R-6 Supplement No. 2500-98-1) for maintaining soil productivity. One-half (0.5) mile of temporary road construction into units 232 and 233 would occur. This temporary road would be closed and rehabilitated following activity completion. Approximately 104 acres of soil restoration treatments would be applied to specific units (see Table 54, page 110 for units) and on 0.5 miles of temporary roads in units 232 and 233 following post-harvest activities.

SENSITIVE SOILS: Sensitive soils within the project area include: 1) soils on slopes greater than 30 percent, 2) soils associated with frost pockets in cold air drainages, and 3) soils that occur in localized areas of rocky lava flows. There are no potentially wet soils with high water tables or sensitive soils with high erosion hazard ratings that would require special mitigation. There are steep soils in the following activities areas (units) 11, 20, 21, 22, 23, 48, 84, 87, 127, 129, 200, 201, 213, 218, 229, 232, 233, 307, 308, and 314. Map 2 in the appendix shows locations of the proposed activity areas and their proximity to sensitive soils on steep slopes (greater than 30 percent) on the located the Kelsey planning area. In order to avoid soil displacement damage, special requirement will be applied to these units that have sensitive soils with steep slopes.

The potential for successful regeneration is limited by properties such as soil depth, soil fertility, and temperature extremes on low productivity sites such as frost pockets, cold air drainages, and localized areas of rocky lava flows. These sites may require replanting in order to achieve adequate stocking levels in a desired amount of time. Modified harvest prescriptions or other, less intensive treatments are management options that do not apply to reforestation objectives in areas affected by stand-replacement wildfires. The following activity (unit) areas have the potential to be frost packet that may require replanting activities: 20, 21, 22, 45, 61, 102, 127, 218, 219, 313, 347, and 360.

COARSE WOODY DEBRIS (CWD) AND SURFACE ORGANIC MATTER: The indicator for CWD and surface organic matter was evaluated qualitatively based on the probable success of implementing appropriate design elements and Best Management Practices (BMPs) that address adequate retention of woody debris and organic matter to meet soil productivity and wildlife habitat objectives (see Wildlife Section). A minimum amount of 5 to 10 tons per acre of CWD is recommended to ensure desirable biological benefits for maintaining soil productivity without creating an unacceptable fire hazard for a potential high-severity reburn (Brown et al., 2003). Under Alternative 2, harvest operations would be expected to accelerate the accumulation of woody debris. Existing sources of woody debris would be retained on-site and protected from disturbance to the extent possible. Enough fallen trees and other organic materials would likely be available after harvest activities to meet this recommended guideline in the short-term.

Coarse woody debris (greater than 3 inches in diameter) is needed for biological activity and long-term nutrient cycling. Small woody material and surface litter (such as leaves, twigs, and branches less than 3 inches in diameter) are needed for erosion control and short-term nutrient cycling.

Commercial harvest and whole-tree yarding can affect soil productivity through the removal of nutrients in the form of tree boles, limbs and branches. Although these forest management practices remove potential sources of future CWD, ground-based harvest activities also recruit CWD to the forest floor through breakage of limbs and tops and toppling of some trees during felling and skidding operations. Many of the smaller-diameter dead trees (less than 10 inches) and logging slash created from unusable stemwood would accelerate the accumulation of woody debris. This would expedite decomposition processes and input of organic materials into the soil surface. These materials would also provide additional soil cover that improves the soils ability to resist surface erosion. The removal of tree boles would have little or no effect on nutrient cycling processes during the short-term. Most of the tree's short-term nutrient supply is stored in the leaves (needles), branches, and roots.

On undisturbed sites, woody materials (less than 10 inches in diameter) are expected to fall to the ground within 3 to 5 years. The larger residual trees that remain following harvest would become future sources of CWD. This would provide only localized benefits within this large activity area. Over the next 10 to 20 years, the amount of CWD after harvest is predicted to average an acceptable range of 15 to 20 tons per acre within each of the proposed activity areas.

Experience and logic suggest that less intensive future wildfires would result in areas where some of the hazardous fuels are removed through management treatments as opposed to not treating n areas where heavy fuels were allowed to accumulate with no treatment. All other conditions being equal, the lower the fuel loading, the lower the fire intensity and burn severity. Therefore, implementation of Alternative 3 would result in a lower risk for future wildfires than Alternatives 1 or 2.

Ground-disturbing management activities vary in their intensity of site disturbance. Implementation of Alternative 3 would result in the greatest extent of physical soil impacts due to logging facilities, but soil restoration treatments would be applied to reclaim and stabilize detrimental soil conditions on many of these facilities. It should be noted that Alternative 3 provide the greatest positive opportunity to reduce heavy fuel loadings before they accumulate on the forest floor and increase the hazard for high-severity ground fires in the future.

Direct and Indirect Effects Common to Alternative 2 (Proposed Action) and Alternative 3: Mechanical harvesters would only be allowed to make a limited number of equipment passes on any site-specific area between skid trails or away from log landings. The skidding equipment would be restricted to designated skid trails at all times. The majority of soil impacts would be confined to known locations in heavy use areas that can be reclaimed when these logging facilities are no longer needed for future management.

Soil condition assessments for similar soils and the same types of ground-based harvest systems, research references, and personal communications with timber sale administrators were used to predict the extent of detrimental soil disturbance anticipated from mechanized harvest and yarding activities. On the Deschutes National Forest, soil productivity monitoring has shown that detrimental soil conditions increase each time a stand is treated with mechanical equipment. Monitoring results following initial harvest entries have shown that 15 to 30 percent of the unit area can be detrimentally disturbed by ground-based harvest systems depending on harvest prescriptions, the spacing of skid trails, and soil conditions at the time of harvest (Soil Monitoring Report, 1995). Research studies and local soil monitoring have shown that soil compaction and soil displacement account for the majority of detrimental soil conditions resulting from ground-based logging operations (Deschutes N.F., Soil Monitoring Reports, 1996, 1997, and 1999; Page-Dumroese, 1993; Geist, 1989; Powers, 1999).

Estimates for predicted amounts of detrimental soil conditions following the proposed harvest account for the expected amount of volume removal, the type of logging equipment, the spacing of skid trails, and the number of log landings that would be needed to deck accumulated materials. Due to the gentle terrain and the type of machines that would likely be used for yarding operations, it is expected that skid trail networks would have an average spacing distance of approximately 100 feet between main trails. Individual skid trails would have an average disturbed width of 12 feet. On moderately flat ground with small timber, research found that skid trail spacing of 100 feet would account for approximately 11 percent of the unit area (Froehlich, 1981, Garland, 1983).

Existing skid trails and landings would be reutilized to the extent possible within the commercial harvest areas, but it is expected that the creation of additional skid trails and log landings would likely cause a 7 percent increase in detrimental soil conditions.

Soil restoration treatments would be applied to specific units using winged subsoiler to loosen and stabilize detrimentally compacted soil on certain management facilities. Additional treatment options for improving soil quality on disturbed sites include redistributing topsoil in areas of soil displacement damage, pulling available slash and woody materials over the treated surface, and planting shrubs and tree seedlings to establish ground cover protection. These activities would likely be funded with Knutson-Vandenburg (KV) monies or other sources, as available. This would be mandatory mitigation that would be required on activity areas to comply with Regional policy (FSM 2520, R-6 Supplement) and Forest Plan standards and guidelines SL-3 and SL-4 that limit the extent of detrimental soil conditions to 20 percent of an activity area. In areas where less than 20 percent detrimental soil conditions exist from prior activities the cumulative detrimental effect of the current activity following the project implementation and restoration must not exceed 20 percent. Therefore, units that exceed this part of the regional standard will be subsoiled and restored to comply with the regional standard. In units that exceed 20 percent from prior activities will be subsoiled to restore them back to existing soil detrimental prior to this activity (Refer to Table 53, page 107 and Table 54, page 110 for specific units and acres).

Road decommissioning treatments would include subsoiling to alleviate compacted road surfaces on about seven miles of local system road. These soil restoration treatments would result in a net improvement in soil quality in the project area. Decommissioning would occur on road segments on 7.3 miles of roads associated with activity areas to improve soil quality.

As previously described under Affected Environment, extensive areas of the project area have been covered by loose, non-cohesive ash deposits that consist of sandy textured soils with little or no structural development. Although equipment traffic can decrease soil porosity on these soil materials, compacted sites can be mitigated by tillage with a winged subsoiler (Powers, 1999). Dominant soils within the proposed activity areas are well suited for tillage treatments due to their naturally low bulk densities and the absence of rock fragments within soil profiles.

The winged subsoiling equipment used on the Deschutes National Forest has been shown to lift and shatter compacted soil layers in greater than 90 percent of the compacted zone with one equipment pass (Craigg, 2000).

Subsoiling treatments have been implemented with good success due to the absence of rock fragments on the surface and within soil profiles. Although rock fragments can limit subsoiling opportunities on some landtypes, hydraulic tripping mechanisms on this specialized equipment help reduce the amount of subsurface rock that could potentially be brought to the surface by other tillage implements. Most of the surface organic matter remains in place because the equipment is designed to allow adequate clearance between the tool bar and the ground, thereby allowing smaller slash materials to pass through without building up. Any mixing of soil and organic matter does not cause detrimental soil displacement because these materials are not removed off site. Although the biological significance of subsoiling is less certain, these restoration treatments likely improve subsurface habitat by restoring the soils ability to supply nutrients, moisture, and air that support soil microorganisms. Since the winged subsoiler produces nearly complete loosening of compacted soil layers without causing substantial displacement, subsoiled areas are expected to reach full recovery within the short-term (less than 5 years) through natural recovery processes.

Mitigation, including operational guidelines for equipment use, would minimize the extent of detrimentally disturbed soil from harvest activities between main skid trails and away from log landings. The primary factor that would limit soil compaction is the limited amount of equipment traffic off designated logging facilities. Research has shown that the first few equipment passes over an area compacts the upper few inches of the soil. Additional passes cause greater increases in bulk density and compact the soil to greater depths. The detrimental effects of soil compaction generally require more than 3-5 equipment passes (McNabb, Froehlich, 1983). Therefore, the effects of only two (2) passes by harvester machines on any site-specific area are not expected to qualify as a detrimental soil condition. Frost heaving and freeze-thaw cycles can generally offset soil compaction near the soil surface. Other natural processes that help restore soil porosity in soil surface layers include root penetration, rodent activity, wetting and drying cycles, and the accumulation of organic matter. On gentle to moderately sloping terrain, the maneuvering of equipment generally does not remove soil surface layers in large enough areas (at least 5 feet in width) to qualify as detrimental displacement (FSM 2520, R-6 Supplement). Smaller areas of gouging or the mixing of soil and organic matter would not constitute detrimental soil displacement. Conservative estimates were used to account for predicted amounts of detrimental soil conditions associated with logging facilities, and the relatively minor extent of these incidental soil disturbances is likely included in these estimates.

Prescribed burning would occur during moist cold weather conditions and would not substantially affect soils. Mechanical mowing would be accomplished using a mowing machine that would pass over the ground one time and would not cause soils to compact. Tight turns would not be permitted that would caused soil displacement.

There would be no machine piling of logging slash in random locations of activity areas. Although this method removes potential sources of woody debris off-site, it would not cause additional soil impacts because burning would occur on disturbed soils that already have detrimental conditions.

Shallow excavations and scalping to prepare sites for hand planting would not disturb large enough areas to qualify as a detrimental soil condition.

Cumulative Effects Common to Alternative 2 (Proposed Action) and Alternative 3: The effects of recreation use and livestock grazing would be similar to those described for Existing Condition of the Soil Resource. Future soil disturbances would be confined mainly to small concentration areas that have a relatively minor effect on overall site productivity. Future impacts from dispersed camping and incidental use by hikers and mountain bikers are expected to have a negligible effect on site productivity within the activity areas. Livestock could resume grazing in portions of the project area following the recovery of herbaceous vegetation. Livestock grazing within the proposed activity areas would be delayed until at least the fall of 2005. Appropriate stocking levels, rotation of grazing use, and periodic rest would ensure adequate ground cover that effectively minimizes erosion and adverse effects to the soil resource. There are no major soil-related concerns associated with the combined effects of these future activities.

Road maintenance activities would reduce accelerated erosion rates where improvements are necessary to correct drainage problems on specific segments of existing road. Surface erosion can usually be controlled by implementing appropriate Best Management Practices (BMPs) that reduce the potential for indirect effects to soils in areas adjacent to roadways. Road maintenance activities would not be necessary on roads closed for access restriction because self-maintaining drainage structures would be installed, where appropriate, to protect the road surface from erosion. There are no major soil-related concerns associated with the combined effects of these future activities.

Table 53 displays existing and predicted amounts of detrimental soil conditions in acres and percentages for each of the eight activity areas proposed under Alternative 2 (Proposed Action).

Table 53: Alternative 2 (Proposed Action) Existing And Predicted Detrimental Soil Conditions For Each Activity Area

Ea Unit Number	Unit Acres	Proposed Treatment	Existing Detrimental Soil Conditions	Estimated Detrimental Soil Disturbance After Treatment	Estimated Detrimental Soil Conditions After Subsoiling	
					Percent	Acres
7	68	HTH, UB	0 %	13 %	0 %	0
8	46	HSL, WTY, MST	1 %	8 %	8 %	0
9	47	UB	0 %	0 %	0 %	0
10	15	UB	0 %	0 %	0 %	0
11	54	HTH, WTY	0 %	13 %	13 %	0
12	102	HTH, WTY, MST, UB	0 %	13 %	13 %	0
13	267	HTH, WTY, MST, UB	0 %	13 %	13 %	0
14	205	HTH, MST, WTY	7 %	20 %	20 %	0
20	198	MST, UB	21 %	21 %	21 %	0
21	112	HSL, WTY, MST	24 %	31 %	24 %	0
22	172	HTH, WTY, MST	26 %	33 %	26 %	12.0
23	96	HTH, WTY, MST, UB	3 %	16 %	16 %	0
24	13	MST, UB	0 %	0 %	0 %	4.6
25	85	MST, UB	1 %	14 %	14 %	0
26	102	HSL, WTY, MST, UB	4 %	17 %	17 %	0
27	47	HSL, WTY, MST,	2 %	15 %	15 %	0
29	9	MST	10 %	10 %	10 %	0
30	64	MST	0 %	0 %	0 %	0
31	1	MST	6 %	0 %	6 %	0
33	14	HCR	6 %	19 %	19 %	0
34	52	HSL, WTY, HP	0 %	13 %	13 %	0
35	19	HSL, WTY, MST, UB, HP	0 %	13 %	13 %	0
36	14	HSL, WTY, UB	25 %	32 %	25 %	1.0
37	36	HTH, WTY, UB	0 %	13 %	13 %	0
38	24	HSL, WTY, MST, UB	0 %	13 %	13 %	0
39	66	HTH, WTY, UB	29 %	36 %	29 %	5.0
40	22	MST	29 %	29 %	29 %	0
41	54	HTH, WTY, MST, UB	29 %	36 %	29 %	4.0
44	41	HTH, WTY, UB	27 %	34 %	27 %	3.0
45	155	HTH, MST, WTY, UB	6 %	19 %	19 %	0
46	22	MST	29 %	29 %	29 %	0
47	224	HTH, WTY	14 %	21 %	20 %	2.0
48	43	MST	26 %	33 %	26 %	3.0
49	10	HTH, WTY, MST, HP, UB	0 %	13 %	13 %	0
50	108	HTH, WTY, MST, UB	2 %	15 %	15 %	0
52	1	HTH, WTY, MST, UB	29 %	36 %	20 %	1.0
53	3	MST	29 %	29 %	29 %	0
54	4	HTH, WTY, MST, UB	29 %	36 %	29 %	1.0

Table 53: Alternative 2 (Proposed Action) Existing And Predicted Detrimental Soil Conditions For Each Activity Area						
Ea Unit Number	Unit Acres	Proposed Treatment	Existing Detrimental Soil Conditions	Estimated Detrimental Soil Disturbance After Treatment	Estimated Detrimental Soil Conditions After Subsoiling	
					Percent	Acres
55	5	MST	29 %	29 %	29 %	0
56	69	HTH, WTY, MST, UB	29 %	36 %	29 %	5.0
57	17	MST	29 %	29 %	29 %	0
58	41	HSA, WTY, MST	29 %	36 %	29 %	3.0
59	15	HSL, WTY, UB	29 %	36 %	29 %	1.0
60	35	HSL, WTY, MST, UB	4 %	13 %	13 %	0
61	45	HSL, WTY, MST, UB	16 %	23 %	20 %	2.0
62	11	MST	29 %	29 %	29 %	0
63	10	MST	29 %	29 %	29 %	0
64	9	MST	7 %	7 %	7 %	0
65	11	HSL, WTY, MP	0 %	18 %	18 %	0
66	26	HSL, WTY, MST,UB	0 %	13 %	13 %	0
67	96	HTH, WTY, UB	19 %	26 %	19 %	7.0
68	46	HSL, WTY, MST, UB	0 %	13 %	13 %	0
69	22	HSL, WTY, MST, UB	0 %	13 %	13 %	0
70	21	HSL, WTY, MST, UB	0 %	13 %	13 %	0
71	36	HSL, WTY, MST, UB	0 %	13 %	13 %	0
73	11	HTH, WTY, MST, UB	0 %	13 %	13 %	0
74	12	HTH, WTY, MST, UB	0 %	13 %	13 %	0
75	3	HTH, WTY, MST, UB	0 %	13 %	13 %	0
77	46	MST, UB	28 %	28 %	28 %	0
78	29	HTH, WTY, MST	1 %	14 %	14 %	0
79	124	MST, UB	15 %	22 %	20 %	3.0
80	26	HTH, WTY, MST	0 %	13 %	13 %	0
81	75	MST	11 %	18 %	18 %	0
82	87	MST, UB	10 %	10 %	10 %	0
83	53	MST, UB	0 %	0 %	0 %	0
84	27	MST, UB	0 %	0 %	0 %	0
85	10	MST	0 %	0 %	0 %	0
86	5	MST	0 %	0 %	0 %	0
87	11	HPR, WTY, HP, UB	0 %	13 %	13 %	0
88	79	HTH, WTY, MST, UB	0 %	13 %	13 %	0
89	19	HTH, WTY, MST, UB	0 %	13 %	13 %	0
90	53	MST, UB	0 %	0 %	0 %	0
94	17	HTH, WTY, MST	0 %	13 %	13 %	0
95	5	MST	0 %	0 %	0 %	0
96	94	HTH, WTY, MST, UB	5 %	18 %	18 %	0
97	9	HTH, WTY	22 %	29 %	22 %	1.0
98	8	HTH, WTY, MST, UB	22 %	29 %	22 %	1.0
99	5	HSA, WTY, MST, UB	29 %	36 %	29 %	1.0
100	4	HSL, WTY, MST, UB	26 %	33 %	26 %	1.0
101	11	MST, UB	19 %	19 %	19 %	0
102	126	HTH, WTY, MST, UB	0 %	13 %	13 %	0
103	44	HTH, WTY, MST, UB	0 %	13 %	13 %	0
104	119	MST, UB	0 %	0 %	0 %	0
105	170	HTH, WTY, MST, UB	0 %	13 %	13 %	0
106	223	MST	20 %	20 %	20 %	0
107	10	MST	0 %	0 %	0 %	0
108	32	MST	1 %	14 %	14 %	0
109	60	MST	0 %	0 %	0 %	0
110	98	MST	3 %	16 %	16 %	0
111	75	HTH, WTY, UB	0 %	13 %	13 %	0

Table 53: Alternative 2 (Proposed Action) Existing And Predicted Detrimental Soil Conditions For Each Activity Area						
Ea Unit Number	Unit Acres	Proposed Treatment	Existing Detrimental Soil Conditions	Estimated Detrimental Soil Disturbance After Treatment	Estimated Detrimental Soil Conditions After Subsoiling	
					Percent	Acres
112	25	HTH, WTY, MST, UB	0 %	13 %	13 %	0
113	61	HTH, WTY	0 %	13 %	13 %	0
114	47	MST	11 %	11 %	11 %	0
115	53	MST	2 %	2 %	2 %	0
116	28	MST	0 %	0 %	0 %	0
117	51	HTH, WTY, MST, UB	0 %	13 %	13 %	0
119	70	HTH, WTY	0 %	13 %	0 %	0
120	36	HTH, WTY	0 %	13 %	0 %	0
121	93	HSL, WTY	0 %	13 %	0 %	0
122	76	HTH, WTY	0 %	13 %	0 %	0
123	405	UB	15 %	15 %	0 %	0
124	35	HTH, WTY, MST, UB	0 %	13 %	0 %	0
125	8	HSL, WTY	0 %	13 %	0 %	0
126	30	HSL, WTY, UB	3 %	16 %	16 %	0
127	41	HSL, WTY, MP	0 %	18 %	18 %	0
128	58	HSL, WTY, MP	0 %	18 %	18 %	0
129	54	HTH, MST	0 %	13 %	13 %	0
130	99	HTH, WTY, MST, UB	3 %	16 %	16 %	0
131	37	MST	29 %	29 %	29 %	0
132	94	MST	5 %	5 %	5 %	0
133	63	MST	16 %	16 %	16 %	0
134	231	MST	7 %	7 %	7 %	0
135	110	MST	0 %	0 %	0 %	0
136	213	MST	0 %	0 %	0 %	0
137	239	MST	15 %	15 %	15 %	0
138	113	MST	0 %	0 %	0 %	0
139	224	MST	15 %	15 %	15 %	0
140	12	MST	11 %	11 %	11 %	0
141	339	MST	11 %	11 %	11 %	0
142	269	MST, UB	16 %	16 %	16 %	0
143	69	MST, UB	17 %	17 %	17 %	0
145	247	MST, UB	17 %	17 %	17 %	0
146	157	HTH,WTY, MST, UB	0 %	13 %	13 %	0
147	135	HTH,WTY, MST, UB	0 %	13 %	13 %	0
148	5	HTH,WTY, MST, UB	0 %	13 %	13 %	0
149	5	HTH,WTY, MST, UB	0 %	13 %	13 %	0
150	4	HTH,WTY, MST, UB	0 %	13 %	13 %	0
151	238	UB	27 %	27 %	27 %	0
152	89	HTH, WTY, MST, UB	4 %	17 %	17 %	0
153	44	UB	0 %	0 %	0 %	0
154	68	UB	0 %	0 %	0 %	0
155	38	UB	0 %	0 %	0 %	0
156	18	HTH, WTY, UB	0 %	13 %	13 %	0
157	21	UB	0 %	0 %	0 %	0
158	10	UB	0 %	0 %	0 %	0
251	37	MST	0 %	0 %	0 %	0
254	49	HSA, WTY, MST	0 %	13 %	13 %	0
256	33	HTH, WTY, MST, UB	0 %	13 %	13 %	0
257	58	NONE	0 %	0 %	0 %	0
258	46	HSL, WTY, MST	0 %	13 %	13 %	0
259	27	HSL, WTY, UB	0 %	13 %	13 %	0
260	54	NONE	10 %	10 %	10 %	0

Table 53: Alternative 2 (Proposed Action) Existing And Predicted Detrimental Soil Conditions For Each Activity Area						
Ea Unit Number	Unit Acres	Proposed Treatment	Existing Detrimental Soil Conditions	Estimated Detrimental Soil Disturbance After Treatment	Estimated Detrimental Soil Conditions After Subsoiling	
					Percent	Acres
261	44	HSL, WTY, MST	16 %	23 %	20 %	1.0
262	69	HSL, WTY, UB	16 %	23 %	20 %	2.0
263	58	HTH, WTY, MST, UB	9 %	22 %	20 %	1.0
264	55	HTH, WTY, MST, UB	15 %	22 %	20 %	1.0
265	90	HTH, WTY, MST, UB	0 %	13 %	13 %	0
266	58	NONE	0 %	0 %	0 %	0
267	69	HSL, WTY, UB	0 %	13 %	13 %	0
268	84	HSL, WTY, MST	1 %	14 %	14 %	0
269	62	HTH, WTY, MST, UB	0 %	13 %	13 %	0

Table 54 displays existing and predicted amounts of detrimental soil conditions in acres and percentages for each of the eight activity areas proposed under Alternative 3.

Table 54: Alternative 3 Existing And Predicted Detrimental Soil Conditions For Each Activity Area						
Ea Unit Number	Unit Acres	Proposed Treatment	Existing Detrimental Soil Conditions (Percent)	Estimated Detrimental Soil Disturbance After Treatment (Percent)	Estimated Detrimental Soil Conditions After Subsoiling	
					Percent	Acres
9	47	RP/SPC	1 %	0 %	0 %	0
11	54	HTH, WTY	8%	21 %	20 %	1.0
20	198	MST, UB	24 %	24 %	24 %	0
21	112	HTH, WTY	26 %	33 %	33 %	8
22	172	HTH, WTY	37 %	44 %	37 %	12
23	96	HTH, WTY	3 %	10 %	10 %	0
24	13	MST, UB	0 %	0 %	0 %	0
26	102	HSL, GPR, WTY	4 %	17 %	17 %	0
29	9	MST	11 %	11 %	11 %	0
31	1	MST	0 %	0 %	0 %	0
33	14	HCR	1 %	14 %	14 %	0
37	36	HCC, HP	0 %	13 %	13 %	0
39	66	HTH, HP	29 %	36 %	29 %	4.6
41	54	HTH, WTY, MST, UB	29 %	36 %	29 %	3.8
42	41	HTH, MS, UB	29 %	36 %	29 %	2.9
45	155	HTH, MST, UB	13 %	20 %	20%	20.0
48	43	MST, UB	2 %	2 %	2 %	0
49	10	HTH, MST, UB	0 %	13 %	13 %	0
53	3	MST, GRP	0 %	5 %	5 %	2.0
55	5	MST, GPR, HP	8 %	8 %	8 %	0
57	17	MST, GPR, HP	29 %	29 %	29 %	0
61	45	HSL, HP	16 %	23 %	20 %	2.0
62	11	MST,	29 %	29 %	29 %	0
63	10	MST, HP	29 %	29 %	29 %	0
65	11	HSL, MP, HTY	29 %	41 %	29 %	1
73	11	HTH, WTY	0 %	5 %	5 %	0
74	12	HTH, MST, UB	0 %	13 %	13 %	0
75	61	HTH, MST, WTY	0 %	13 %	13 %	0
77	46	MST, UB	0 %	5 %	5 %	0
78	29	HTH, MST, HTY	2 %	15 %	15 %	0
81	75	MST	0 %	0 %	0 %	0
82	87	MST,	10 %	10 %	10 %	0
83	53	MST, UB	0 %	0 %	0 %	0

Table 54: Alternative 3 Existing And Predicted Detrimental Soil Conditions For Each Activity Area						
Ea Unit Number	Unit Acres	Proposed Treatment	Existing Detrimental Soil Conditions (Percent)	Estimated Detrimental Soil Disturbance After Treatment (Percent)	Estimated Detrimental Soil Conditions After Subsoiling	
					Percent	Acres
87	11	HPR, UB	13 %	20 %	20 %	0
88	79	HTH, MST, UB	13 %	13 %	13 %	2.0
89	19	HTH, MST, UB	10 %	10 %	10 %	10.0
96	94	HTH, UB	3 %	10 %	10 %	0
98	8	HTH, MST, UB	22 %	29 %	20 %	1.0
99	5	HSA, MST, WTY, GPR, UB	29 %	36 %	29 %	1.0
100	4	HSL, MST, WTY, UB	26 %	33 %	26 %	1.0
102	126	HTH, WTY, UB	1 %	8 %	8 %	0
103	44	HTH, WTY	10 %	10 %	10 %	0
106	223	MST, HP	0 %	0 %	10 %	0
107	10	MST	1 %	1 %	1 %	0
108	114	MST	0 %	0 %	0 %	0
109	60	MST	0 %	0 %	0 %	0
110	98	MST	3 %	3 %	3 %	0
113	61	HTH	0 %	13 %	13 %	0
114	47	MST	0 %	0 %	0 %	0
115	53	MST	2 %	2 %	2 %	0
116	28	MST	0 %	0 %	0 %	0
119	70	HTH, WTY	0 %	13 %	13 %	0
120	36	HTH, WTY	0 %	13 %	13 %	0
121	93	HSL, HTY	0 %	13 %	13 %	0
122	76	HTH, WTY	0 %	13 %	13 %	0
123	405	UB	8 %	8 %	8 %	0
125	8	HSL ,WTY	0 %	13 %	13 %	0
126	30	HSL, HTY	3 %	16 %	16 %	0
127	41	HSL, MP	0 %	18 %	18 %	0
128	58	HSL, MP	0 %	18 %	18 %	2.0
129	54	HTH. WTY, HP	0 %	13 %	13 %	0
131	37	MST, HP	29 %	29 %	29 %	0
132	94	MST	5 %	5 %	5 %	0
133	63	MST	16 %	16 %	16 %	0
134	231	MST	3 %	3 %	3 %	0
135	110	MST	0 %	0 %	0 %	0
136	213	MST	0 %	0 %	0 %	0
137	239	MST	14 %	14 %	14 %	0
141	339	MST	11 %	11 %	11 %	0
143	69	MST, UB	17 %	17 %	17 %	0
144	8	MST, UB	0 %	0 %	0 %	0
145	247	MST/ UB	17 %	17 %	17 %	0
148	5	HTH, WTY, MST, UB	0 %	13 %	13 %	0
149	5	HTH, HTY, MST, UB	0 %	13 %	13 %	0
150	4	HTH, HTY	0 %	13 %	13 %	0
152	89	HTH, WTY, MST, UB	1 %	1 %	1 %	0
153	44	UB	0 %	0 %	0 %	0
200	20	HTH, WTY, UB	0 %	13 %	13 %	0
201	20	HTH, WTY, UB	0 %	13 %	13 %	0
202	8	HTH, WTY	0 %	13 %	13 %	0
203	9	HTH, WTY, HP	0 %	13 %	13 %	0
204	12	HTH, WTY, HP	0 %	13 %	13 %	0
205	5	HTH, WTY ,HP	0 %	13 %	13 %	0
206	7	HTH, HTY,MST	0 %	13 %	13 %	0
207	75	MST, UB	0 %	0 %	0 %	0
208	110	MST, UB	0 %	0 %	0 %	0

Table 54: Alternative 3 Existing And Predicted Detrimental Soil Conditions For Each Activity Area						
Ea Unit Number	Unit Acres	Proposed Treatment	Existing Detrimental Soil Conditions (Percent)	Estimated Detrimental Soil Disturbance After Treatment (Percent)	Estimated Detrimental Soil Conditions After Subsoiling	
					Percent	Acres
209	44	HTH, WTY, MST, UB	0 %	13 %	13 %	0
210	34	HTH, WTY, MST, UB	0 %	13 %	13 %	0
212	35	HTH, WTY	0 %	13 %	13 %	0
213	40	HTH, WTY	0 %	13 %	13 %	0
214	37	HTH	0 %	13 %	13 %	0
215	70	HTH, MST, UB	0 %	13 %	13 %	0
216	21	UB	0 %	0 %	0 %	0
217	47	HTH, UB	0 %	13 %	13 %	0
218	32	HTH, WTY, MST	1 %	14 %	14 %	0
219	89	HTH, WTY, MST, UB	10 %	17 %	17 %	0
220	48	HTH, WTY, UB	0 %	13 %	13 %	0
221	16	MST, HP	0 %	0 %	0 %	0
222	61	MST	0 %	0 %	0 %	0
223	164	MST	4 %	4 %	4 %	0
224	4	HTH, WTY, MST	8 %	15 %	15 %	0
225	10	HTH, WTY, MST	0 %	13 %	13 %	0
226	30	MST	0 %	0 %	0 %	0
227	24	HTH, WTY, MST	0 %	13 %	13 %	0
229	19	HTH, WTY	0 %	13 %	13 %	0
230	10	HTH, WTY	0 %	13 %	13 %	0
231	9	HTH, WTY	0 %	13 %	13 %	0
232	8	HTH, WTY, MP	0 %	18 %	18 %	0
233	38	HTH, WTY, MP	0 %	18 %	18 %	0
234	71	UB	1 %	1 %	1 %	0
237	103	UB	0 %	0 %	0 %	0
238	57	UB	29 %	0 %	29 %	0
239	61	HTH, WTY, MST	1 %	14 %	14 %	0
240	15	HTH, WTY	0 %	13 %	13 %	0
241	52	HTH, WTY	17 %	24 %	20 %	0
242	62	HTH, WTY	29 %	36 %	29 %	4.0
243	19	HTH, WTY	2 %	13 %	13 %	0
244	61	HTH, WTY	13 %	20 %	20 %	0
245	99	UB	0 %	0 %	0 %	0
246	60	HTH, WTY	16 %	23 %	20 %	2
247	62	HSL, WTY	0 %	13 %	13 %	0
248	42	HTH, WTY	4 %	17 %	17 %	0
250	21	HTH, WTY	0 %	13 %	13 %	0
251	37	MST	0 %	0 %	0 %	0
252	34	UB	0 %	0 %	0 %	0
253	32	HTH, WTY, MST	0 %	13 %	13 %	0
254	49	HSA, GPR, WTY	0 %	13 %	13 %	0
255	99	UB	0 %	0 %	0 %	0
256	33	HTH, WTY, MST, UB	0 %	13 %	13 %	0
257	58	NONE	0 %	0 %	0 %	0
258	46	HSL, WTY, MST	0 %	13 %	13 %	0
259	27	HSL, WTY, GRP, UB	0 %	13 %	13 %	0
260	54	NONE	15 %	0 %	15 %	0
261	44	HSL, WTY, MST	16 %	23 %	20 %	2.0
262	69	HSL, WTY, UB	16 %	23 %	20 %	2.0
263	58	HTH, WTY, MST, UB	9 %	16 %	16 %	0
264	55	HTH, WTY, MST, UB	15 %	22 %	20 %	1.0
265	90	HTH, WTY, MST, UB	0 %	13 %	13 %	1.0
266	58	NONE	0 %	0 %	0 %	0

Table 54: Alternative 3 Existing And Predicted Detrimental Soil Conditions For Each Activity Area						
Ea Unit Number	Unit Acres	Proposed Treatment	Existing Detrimental Soil Conditions (Percent)	Estimated Detrimental Soil Disturbance After Treatment (Percent)	Estimated Detrimental Soil Conditions After Subsoiling	
					Percent	Acres
267	69	HSL, WTY, UB	0 %	13 %	13 %	0
268	84	HSL, WTY, MST	0 %	13 %	13 %	0
269	62	HTH, WTY, MST, UB	0 %	13 %	13 %	0
270	16	MST	0 %	0 %	0 %	0
271	19	MST	0 %	0 %	0 %	0
272	3	HTH, WTY, MST, HP	0 %	13 %	13 %	0
273	2	HTH, WTY, MST	0 %	13 %	13 %	0
274	25	UB	0 %	0 %	0 %	0
275	20	UB	0 %	0 %	0 %	0
276	1	HTH, WTY, MST, HP,	0 %	13 %	13 %	0
277	98	HTH, WTY, MST, UB	0 %	13 %	13 %	0
278	4	HSA, WTY	0 %	13 %	13 %	0
279	20	UB	0 %	0 %	0 %	0
280	14	MST	0 %	0 %	0 %	0
281	5	UB	11 %	11 %	11 %	0
307	80	HTH, WTY, MST	0 %	13 %	13 %	0
308	46	HTH, WTY, MST	1 %	14 %	14 %	0
312	102	HTH, WTY, MST, UB	0 %	13 %	13 %	0
313	267	HTH, WTY, MST, UB	0 %	13 %	13 %	0
314	205	HTH, WTY, MST, UB	7 %	20 %	20 %	0
316	30	HTH, MST, UB	0 %	13 %	13 %	0
325	85	UB	1 %	14 %	14 %	0
327	47	HTH, WTY, MST	2 %	15 %	15 %	0
335	19	HSL, WTY	0 %	13 %	13 %	0
338	24	HSL, WTY, UB	0 %	13 %	13 %	0
340	22	MST	4 %	0 %	4 %	0
346	22	MST	29 %	0 %	29 %	0
347	224	HTH, WTY	12 %	19 %	19 %	0
352	1	HTH, WTY, MST	29 %	36 %	0 %	1.0
354	4	HTH, WTY, MST	29 %	36 %	20 %	1.0
356	69	HTH, WTY, MST	28 %	35 %	28 %	5.0
360	35	HSL, WTY, MP	9 %	21 %	20 %	1.0
366	4	HSL,WTY, MP	0 %	18 %	18 %	0
367	96	HTH, WTY, UB	29 %	35 %	29 %	7.0
368	46	HTH, WTY, MST	17 %	24 %	20 %	2.0
369	22	HSL, WTY, MST, UB	0 %	13 %	13 %	0
404	119	UB	0 %	0 %	0 %	0
405	170	HTH, WTY, MST, UB	0 %	13 %	13 %	0
411	75	HTH, WTY, UB	0 %	13 %	13 %	0
412	25	HTH, WTY, MST	0 %	13 %	13 %	0
424	35	HTH, WTY, MST, UB	0 %	13 %	13 %	0
430	99	HTH, WTY, MST, UB	3 %	16 %	16 %	0
442	269	HSL, WTY, MST, UB	18 %	25 %	20 %	14.0
446	157	HTH, WTY, MST, UB	0 %	13 %	13 %	0
447	135	HTH, WTY, MST, UB	0 %	13 %	13 %	0
451	238	MST	27 %	27 %	27 %	0

FOREST PLAN CONSISTENCY

Under Alternative 2 and 3, the amount of disturbed soil associated with temporary roads and logging facilities would be limited to the minimum necessary to achieve management objectives. As previously discussed under direct and indirect effects, the Mitigation Measures and Best Management Practices (BMPs), pages 36-39 built into these alternatives are all designed to avoid or minimize potentially adverse impacts to the soil resource. Compliance

with Forest Plan standard and guideline SL-5 is addressed by mitigating areas with sensitive soils on steep slopes (greater than 30 percent) from activity areas. All reasonable Best Management Practices for Timber Management and Road Systems would be applied to protect the soil surface and control erosion on and adjacent to roads and logging facilities that would be used during project implementation. These conservation practices are to be implemented during and following project activities to meet the stated objectives for protecting and maintaining soil productivity.

Soil restoration treatments would be applied to rectify impacts by reducing the amount of detrimentally compacted soil dedicated to specific management areas of the proposed activity areas. Restoration treatments, such as subsoiling, are designed to promote maintenance or enhancement of soil quality. These conservation practices comply with Forest Plan interpretations of Forest-wide standards and guidelines SL-3 and SL-4 (Final Interpretations, Document 96-01, Soil Productivity, 1996), and Regional policy (FSM 2520, R-6 Supplement No. 2500-98-1) for planning and implementing management activities.

Under Alternative 2, the percentages of detrimental soil conditions would increase above existing conditions by approximately 8 to 11 percent in all eight activity areas. None of the activity areas would exceed the Forest Plan standard of 20 percent following implementation of project and restoration treatments. It is expected that enough fallen trees and other organic materials would be available after harvest activities to meet recommended guidelines for CWD retention in the short-term. Therefore, the proposed actions comply with Regional and Forest Plan standards and guidelines for maintaining soil productivity within all proposed activity areas
.
Under Alternative 3, the percentages of detrimental soil conditions would increase above existing conditions by approximately 8 to 12.5 percent in all activity areas. None of the activity areas would exceed the Forest Plan standard of 20 percent following implementation of project and restoration treatments. It is expected that enough fallen trees and other organic materials would be available after harvest activities to meet recommended guidelines for CWD retention in the short-term. Therefore, the proposed actions comply with Regional and Forest Plan standards and guidelines for maintaining soil productivity within all proposed activity areas.

The overall effects of the action alternatives combined with all past, present, and reasonably foreseeable management activities would be within allowable limits set by Forest Plan standards and guidelines for protecting and maintaining soil productivity.

The action alternatives would improve soil productivity in specific areas where soil restoration treatments (subsoiling) are implemented on soils committed to roads and logging facilities.

HERBICIDES

Conditions are currently favorable for competing and unwanted vegetation on the site of the 1995 Green Mountain Fire (Kelsey Unit 106). The stand prior to the burn was dominated by ponderosa pine, including plantations that had been planted in the early 1960s. Conditions following the fire favored the growth of greenleaf manzanita (*Arctostaphylos patula*) and snowbrush (*Ceanothus velutinus*) from sprouts and seeds. On remaining sites proposed for planting, tree canopy cover ranges from 15 to 40 percent, not high enough to eliminate manzanita, snowbrush, Idaho fescue (*Festuca idahoensis*), or Ross sedge (*Carex rossii*) from the sites, species having the greatest potential to compete with seedlings. Viable seed for competing and unwanted vegetation is likely present in the soil. Maintaining or increasing tree canopy cover would encourage natural control of competing and unwanted vegetation. Refer to Appendix F, page 197 for the complete herbicide analysis.

Greenleaf manzanita has the ability to regenerate quickly in areas with frequent fires, allowing it to perpetually dominate a site. Stands of manzanita can live 20 to 100 years and growth of ponderosa pine seedlings is severely limited by manzanita, primarily due to competition for water, with growth loss up to 60 percent. Where fire is excluded for long periods of time, manzanita may enhance the microclimate for some tree seedlings and soil conditions through the addition of organic material.

Snowbrush regenerates from both sprouts and seeds. Seeds may remain viable for as long as 200 years, is short lived, and is intolerant to shade. Fire commonly stimulates seed germination, although high soil temperatures caused by solar radiation and mechanical abrasion may also be factors. Relatively low germination can be sufficient to produce high densities of snowbrush shrubs. Too frequent or intense fire can eliminate snowbrush. Soil moisture depletion is probably the major factor limiting conifer growth. Snowbrush may be beneficial to the site. It is capable of fixing nitrogen, increasing humidity, decreasing wind velocity, and minimizing soil temperatures. Several studies have documented better initial establishment of conifer species under Ceanothus canopies than in the open (Conard et.al. 1985).

Idaho fescue is a vigorous, native, long-lived, perennial, cool-season, bunchgrass. It reproduces from seeds and tillers (a shoot that sprouts from the base of a grass). Seed production is variable. Tillering may result in rapid increase in plant size in non-competitive environments. This small bunchgrass can survive fire, harmed by more severe fire. Rapid tillering occurs when root crowns are not killed and soil moisture is favorable. (Zouhar. 2000, November).

Ross sedge is a native, long-lived perennial graminoid, regenerating through rhizomes and seed. Seeds may remain dormant for long periods prior to germination and are resistant to fire. Rhizomes survive low to moderate severity fires. Ross sedge increases following fires that heat the soil but do not completely consume duff. Recovery takes 2 to 10 years to return to preburn populations (Cope. 1992).

The following discussion of human health, terrestrial plants and animals, aquatic species, soil, and air quality have the common Alternative 1 (No Action) and cumulative effects: There would be no additional effects other than those described for the broader Alternative 1 (No Action) without the application of herbicides.

Treatment: Within one (1) to two (2) years following mechanical shrub treatment or underburning, if surveys indicate that shrubs, grasses, or sedges are re-establishing and have potential to adversely affect seedling growth, vegetation would be treated with herbicide within the units. A second application of herbicide would be done approximately two (2) years following initial treatment if surveys indicate competing and unwanted vegetation again has potential to exceed the action threshold.

Treatment would spot apply, within a 3-foot radius of all planted ponderosa pine (200 to 250 trees per acre), a dry granular form of hexazinone (Pronone^{R}MG) that provides both contact and residual control, inhibiting photosynthesis. It can be applied over ponderosa pine without damage. Granular forms of this herbicide act through root uptake and movement in an upward direction through the plant. Approximately 13 percent to 16 percent of an acre would receive an application of herbicide (approximately 2.6 to 3.2 pounds per acre of product containing 0.26 to 0.3 pounds of active ingredient. Application would occur either in the spring after the ground thaws or in the fall before snowfall. The total acreage affected, using the 3-foot radius around seedlings, would be approximately 44 acres under Alternative 2 and 36 acres under Alternative 3, the preferred alternative.

Pronone^{R}MG consists of particles of an insoluble clay-based material that is surface coated with hexazinone (SERA 1997). The granules have an outer coating of hexazinone-free material that is designed to minimize the formation of dust (SERA 1997). The product label for Pronone MG (Pro-Serve, Inc 1994) indicates 10 percent of the product formulation is active ingredient (Hexazinone) and 90 percent is inerts.

The Material Safety Data Sheet for PRONONE^{R}MG (Pro-Serve 1999) lists one inert ingredient: Pluronic L61. The Material Safety Data Sheet (MSDS) for Pluronic L61 (BASF Corporation 2002) indicates this ingredient is a surfactant. This surfactant (Pluronic L61) is included on the EPA's List 4B of inert ingredients found in pesticides (U.S. EPA 2003b). Inerts found on List 4B have sufficient data to substantiate they can be used safely in pesticide products (U. S. EPA 2003a). List 4B inerts are generally recognized as safe by the EPA.

Hexazinone is an herbicide that inhibits photosynthesis in plants. It is a water-dispersible, general herbicide providing both contact and residual control of many weeds, including annual and biennial weeds, brush, woody vines, and many types of perennial grasses. It can be applied over ponderosa pine without damaging it. Granular forms of this herbicide act through root uptake and movement in an upward direction through the plant.

Hexazinone has been registered for use for general weed control since 1975 and for forestry use since 1977 (U.S. EPA 1994). A Reregistration Eligibility Decision (RED) was completed in September 1994 (U.S. EPA 1994). The Tolerance Reassessment Progress and Risk Management Decision (TRED) for Hexazinone (U.S. EPA 2002) were approved on August 1, 2002. Monitoring of the granular application of hexazinone on the Bend/Fort Rock Ranger District has shown little mortality of vegetation has occurred beyond the circle of direct herbicide application (Matt Deppmeier, 2003, Reforestation Forester, Bend-Fort Rock Ranger District, Personal Communication).

The Bend-Fort Rock Ranger District analyzed alternatives for treating competing and unwanted vegetation growing around tree seedlings (USDA Forest Service 2000a), including the installation of 6-foot by 6-foot plastic mulch mats. It was found that herbicide treatment would reduce or eliminate competing vegetation from around tree seedlings in an efficient and economic manner while providing for worker safety and meeting other resource needs.

Scalping (grubbing) and no treatment were also considered. Scalping the soil with hand tools can be an effective means of removing grass although with limited effectiveness because of a short duration of control. Scalping also removes much of the nutrient rich humus layer of soil, thereby decreasing the amount of nutrients available to the seedlings. Poor seedling survival and growth would result from no treatment, reducing the potential to provide desired deer hiding and thermal cover. In some areas, reduced survival and growth would also reduce potential for meeting timber yield objectives.

Alternative 1 (No Action) Common to Human Health, Terrestrial Animals and Plants, Aquatic Species, Soil, and Water and Air Quality

Direct and Indirect Effects: Without the application of herbicides, there would be no effects to the environments that are described in the following discussions. Effects would be the same as those described under each resource for the broader no action alternative.

HUMAN HEALTH

The units proposed for herbicide application (Table 5, Page 24) nearest private land are units 258 and 259. Unit 258 is approximately 0.3 miles south of private property and approximately 0.7 miles southeast from human habitation[5]. Unit 259 is approximately 0.6 mile south of private property and 1.0 mile southeast from human habitation. These units are approximately 0.8 to 1.0 mile southeast of the High Desert Museum. Remaining proposed herbicide units proposed are 1.0 to 4.5 miles from the boundary of other landowners. There are no developed recreation sites within or adjacent to units proposed for herbicide treatment. Dispersed recreational use would be the primary recreation use of the treatment areas, primarily off highway vehicle (OHV) use and hunting.

Alternative 2 (Proposed Action) and Alternative 3

Direct and Indirect Effects

- **Hazard Evaluation (**The characteristic of an object or substance that can inflict injury or illness): Dermal toxicity of hexazinone is relatively low and is not well absorbed after dermal exposure. Applying a granular formulation of hexazinone indicates that dermal absorption would occur. With the proposed application of herbicide, worker exposure to hexazinone would be limited by the following: method of application, vegetation and ground conditions, use of personal protective equipment, and restricted entry into the treatment area for 48 hours following herbicide application. Greatest potential for inhalation of dust from the granular form of hexazinone would occur when loading the spot-applicator with herbicide. Use of a respirator or mask during the loading process would minimize the potential for dust inhalation.

Mutagenicity

There is a lack of mutagenic activity of hexazinone in several *in vivo*[6] and *in vitro*[7] bioassays. One bioassay for chromosomal damage was positive (SERA 1997, Page 3-4).

Neurotoxicity, Immunotoxicity, and Endocrine Disruption

According to the SERA report, "there is no scientific basis for asserting that hexazinone causes specific toxic effects on the nervous system, immune system, or endocrine function" (SERA 2002, Page xiii).

Endocrine Disruption

Hexazinone has not undergone evaluation for its potential to interact or interfere with the estrogen, androgen, or thyroid hormone systems. Extensive testing in experimental animals provides reasonably strong evidence against hexazinone being an endocrine disruptor (SERA 2002, Page xiii).

Metabolites

Hexazinone is metabolized extensively in plants and animals, with little parent product recovered in tissue. Therefore, the toxicological effects, if any, of the metabolites are likely to be captured by animal toxicology studies involving whole-body exposure to hexazinone. (SERA 1997, Page 3-8)

Inert Ingredients *(Information Ventures, Inc 1995)*

An inert ingredient is anything added to the product other than an active ingredient. The product label for Pronone MG (Pro-Serve, Inc 1994) indicates 10 percent of the product formulation is active ingredient (Hexazinone) and 90 percent is inerts. The Material Safety Data Sheet for PRONONE^{R}MG (Pro-Serve 1999) lists one inert ingredient: Pluronic L61. The Material Safety Data Sheet (MSDS) for Pluronic L61 (BASF Corporation 2002) indicates this ingredient is a surfactant. This surfactant (Pluronic L61) is included on the

[5] Human habitation considered to be structures visible on 1995 Aerial Photos.
[6] In vivo (Definition) – Occurring in the living organism (SERA 1997)
[7] In vitro (Definition) – Isolated from the living organism and artificially maintained, as in a test tube (SERA 1997).

EPA's List 4B of inert ingredients found in pesticides (U.S. EPA 2003b). Inerts found on List 4B have sufficient data to substantiate they can be used safely in pesticide products (U. S. EPA 2003a).

Based on references from the published literature, the major component of granular formulations of hexazinone appears to be clay. Based on the acute toxicity of these formulations relative to technical grade hexazinone, there is no indication that the carriers contribute to the toxicity of the granular formulations of hexazinone. If anything, the granular formulations of hexazinone appear to be slightly less toxic than hexazinone itself. This is also evident in the aquatic toxicity studies using formulations relative to hexazinone itself. (SERA 1997, Page 3-10)

- **Exposure Evaluation** (The amount of a potentially harmful substance actually encountered by an organism): Occupational exposure generally involves inhalation and dermal exposure, the dermal route generally contributing far more to exposure than the inhalation route (SERA, 1997, Page 3-11). The proposed application rate of 0.26 to 0.32 pounds active ingredient per acre is less than the application rate (1 pound active ingredient per acre) assumed in the SERA risk assessment (SERA 1997, Page 3-15). Workers would likely be exposed to doses less than those assumed in the SERA risk assessment.

  Worker exposure would be limited by the following: method of application, vegetation and ground conditions, use of personal protective equipment, and restricted entry into the treatment area for 48 hours following herbicide application. The herbicide would be directed downward during application, reducing potential worker contact with the herbicide. The relatively small percent of treated acreage (approximately 13 to 16% of an acre) would provide a low potential of walking through an area treated with herbicide. Shrubs or grasses that resprout following prescribed underburn and mechanical shrub treatments would be generally less than 1 foot tall. With this vegetation condition and the application method, there would be limited potential for workers to have dermal exposure by rubbing against herbicide intercepted by vegetation. All proposed application sites are on relatively flat ground, slopes ranging from 5 to 10 percent. Potential for falling and coming in contact with herbicide on the ground would be limited.

  Greatest potential for inhalation of dust from the granular form of hexazinone would occur when loading the spot-applicator with herbicide. Use of a respirator or mask during the loading process would minimize the potential for dust inhalation.

  Under normal conditions, members of the general public should not be exposed to substantial levels of hexazinone (SERA 1997, Page 3-18). There would be no potential for the public to receive a dermal dose of the herbicide from drift or from accidental direct spraying. Potential for coming in contact with herbicide found on vegetation or the soil would be relatively low. Treatment areas would be signed to restrict entry for 48 hours. Public use of the treatment areas is relatively low and infrequent. Given the type of vegetation in the proposed treatment areas, there is little to no potential the public would consume plants from the area that might have herbicide residues.

  Potential for the public to be exposed to water with herbicide residues would be low, with the lack of surface water in the immediate vicinity of the treatment units. There is no potential the public would drink surface water contaminated with herbicide residues. Exposure by way of groundwater contamination should be minimal due to the great depth to groundwater (see effects to water, Page 122).

- **Risk Evaluation** (The likelihood of illness or injury based on the results of hazard and exposure evaluation): Risk characterization for occupational exposure to hexazinone, excluding accidental or incidental exposures, is summarized in the SERA risk assessment (SERA 1997, Page 3-29, Table 3-5). Given the lower application rate proposed with this treatment, the hazard quotients at the low end of the range would be expected.

Risk characterization for workers after accidental or incidental exposure to hexazinone is summarized in the SERA risk assessment (SERA 1997, Page 3-30, Table 3-6), considering the potential for dust from the granules coming in contact with the skin and the hexazinone dissolving from the granules into perspiration. The longer-term accidental scenarios – wearing contaminated gloves and dermal contact with dust-yield hazard quotients that should be regarded with a high level of concern (SERA 1997, Page 3-31). The potential for adverse reproductive effects in female workers is plausible (SERA 1997, Page 3-31).

Risk characterization for the general public is summarized in the SERA risk assessment (SERA 1997, Page 3-32, Table 3-7). Most routine exposure scenarios lead to estimated daily doses in the range of 0.001-0.006 mg/kg/day (SERA, 1997, Page 3-11). This is less than the most recently derived RfD for hexazinone of 0.05 mg/kg/day. Only the exposure scenario of a naked child receiving a direct spray of hexazinone resulted in a hazard quotient greater than unity. There would be no potential for this type of exposure to occur.

The SERA risk assessment (SERA 1997, Page 3-33) identified a sensitive subgroup of people. Because hexazinone was demonstrated to induce fetal resorptions, pregnant women are an obvious group at increased risk. This group is given explicit consideration and is central to the risk characterization. There are no other reports in the literature suggesting subgroups that may be sensitive to hexazinone exposure. There is no indication that hexazinone causes sensitization or allergic responses. Some individuals with multiple chemical sensitivity may be sensitive to hexazinone as well as many other chemicals.

Cumulative Effects: Within the next 5 to 10 years, OHV trails may be developed within or adjacent to the following units proposed for herbicide treatment: Alternative 2 (Units 7, 8, 14, 21, and 259); Alternative 3 (Units 21, 259, and 442). Where trails enter or are adjacent to areas treated with herbicide, signs would be posted for 48 hours to warn trail users (Mitigation Measure). Potential for trail users to be exposed to herbicide would be minimized.

The U.S. EPA evaluated the dietary risks associated with hexazinone. It determined there is a reasonable certainty that no harm to any population subgroup will result from aggregate exposure to hexazinone when considering dietary, drinking water and residual exposure and all other non-occupational sources of pesticide exposure for which there is reliable information (U.S. EPA, 2002).

TERRESTRIAL ANIMALS

Existing Condition: There are no known bird nests within the units proposed for treatments. It may be assumed that the units would provide habitat either as forage, hiding cover, or nesting substrate for birds.

Alternative 2 (Proposed Action) and Alternative 3

Direct and Indirect Effects: There is little indication that hexazinone is likely to cause adverse effects in terrestrial animal species. The consumption of contaminated water or vegetation yields hazard indices that are well below a level of concern at any plausible application rate either immediately after hexazinone applications or over prolonged periods after applications. There is no data indicating that birds will consume any of the granular formulations that contain hexazinone. The minor reduction of vegetation associated with proposed herbicide application would have little to no effect on wildlife populations.

- **Hazard Analysis:** The toxicity of hexazinone to terrestrial wildlife species, particularly invertebrates, is not well characterized. The assessment of effects to terrestrial species is based primarily on available data for experimental mammals. Exposure to hexazinone is associated with decreased weight gain and reproductive effects in several standard test species (SERA 1997, Page 4-1).

  When applied at the recommended field rate, hexazinone had little or no measurable effect on microbial community size, activity, or function. Results suggest that hexazinone treatment does not disrupt microbial

communities or soil arthropod assemblages. The results of this study raise no concern about direct toxic effects of hexazinone for the soil organisms and processes that were measured. In an earlier study, the indirect effect of vegetation removal resulting from herbicide application was found to be inconsequential to soil biota (Busse et al 2001). There is some evidence suggesting that soil microarthropods may be sensitive to hexazinone treatments (SERA 1997, Page 4-2).

- **Exposure Analysis:** Terrestrial animals may be exposed to any applied herbicide from direct spray, the ingestion of contaminated media (vegetation, prey species, or water); grooming activities; indirect contact with contaminated vegetation; or inhalation (SERA 1997, Page 4-4). It is possible that in addition to consuming contaminated vegetation, certain wildlife species may directly consume granules that contain hexazinone, particularly those granules that are applied dry. For example, birds may consume pellets or granules based on size, color, or texture of the particles. Although there are no reports in the literature suggesting that birds will consume any of the granular formulations of hexazinone, there is no information suggesting that birds will avoid these granules. (SERA 1997, Page 4-8)

- **Risk Analysis:** The U.S. EPA has determined that the registration for this herbicide should be maintained because the herbicide can be used without significant risk to humans or wildlife (SERA, 2002, Page vii). There is little indication that hexazinone is likely to cause adverse effects in terrestrial animal species. The consumption of contaminated water or vegetation yields hazard indices that are well below a level of concern at any plausible application rate either immediately after hexazinone applications or over prolonged periods after applications (SERA 1997, Page 4-18). The minor reduction of vegetation associated with proposed herbicide application would have little to no effect on wildlife populations.

  If birds consume hexazinone granules immediately after application, reproductive effects and possibly overt signs of toxicity might occur. If birds were to preferentially consume these granules, exposure levels could be much higher. In that case, toxic effects including mortality could occur. There are no data indicating that birds will consume any of the granular formulations that contain hexazinone. Thus, a lower limit on the exposure assessment is zero. Without additional information with which to improve the exposure assessment, this risk cannot be characterized further.

Cumulative Effects: Reasonably foreseeable future actions, in combination with proposed herbicide application, will have no cumulative effects.

TERRESTRIAL PLANTS
Existing Condition: Greenleaf manzanita, snowbrush, Idaho fescue, and Ross sedge are the dominant species with potential to be competing and unwanted vegetation.

Alternative 2 (Proposed Action) and Alternative 3
Direct and Indirect Effects: Proposed herbicide application would not eradicate any plant species or population of vegetation. A relatively small percent of each treatment unit would be treated with herbicide.

- **Hazard Evaluation:** The differential toxicity of hexazinone to various plant species is based on variations in the ability of different plants to absorb, degrade, and eliminate the herbicide (SERA 1997, Page 4-1). Hexazinone would be toxic to non-conifer plants. It would be non-toxic to ponderosa pine. Expected toxicity is consistent with vegetation response observed on the Bend/Fort Rock Ranger District following the application of hexazinone.

- **Exposure Evaluation:** Vegetation within approximately a three-foot radius around ponderosa pine seedlings would be directly exposed to the herbicide. Approximately 13 to 16% of each unit proposed for herbicide

application would be exposed to the herbicide. Non-target terrestrial plants may be exposed to the herbicide through unintended direct deposition and soil transport (SERA 1997, Page 4-9).

- **Risk Evaluation:** Proposed herbicide application will not eradicate any plant species or population of vegetation. A relatively small percent of each treatment unit would be treated with herbicide. Outside the area of direct herbicide application, there would be limited potential for nontarget terrestrial plants to be exposed to hexazinone. Ground applications of granular formulations of hexazinone should be associated with little significant drift (SERA 1997, Page 4-19). There would be limited potential for nontarget plants to be exposed to herbicide through soil transport. Slopes are relatively gentle (5 to 10 percent) in the areas proposed for herbicide treatment. The planning area receives relatively low levels of precipitation.

Cumulative Effects: Reasonably foreseeable future actions, in combination with proposed herbicide application, will have no cumulative effects.

SOILS

Existing Condition: Soils have developed in volcanic ash deposits originating from Mt. Mazama (Crater Lake) and overlay other older volcanic materials. They have a sand or sandy loam soil surface texture. Thickness of the volcanic ash layer ranges from a depth of 28 inches to greater than 60 inches. Some of these soil types have a subsurface soil layer of finer residuum soil material over bedrock. Others have volcanic ash directly over bedrock. Water infiltration rate in these soil types is rapid. Permeability is rapid to very rapid in the surface layers and rapid in subsurface layers. Organic matter contents in surface horizons ranges from 2 to 4 percent. The soil types are not considered sensitive where the use of herbicides is proposed.

Alternative 2 (Proposed Action) and Alternative 3

Direct and Indirect Effects: Hexazinone may remain in the soil at low concentrations for up to three years after application (Information Ventures, Inc. 1995). Annual precipitation, depth to groundwater and soil characteristics in the areas proposed for application are highly likely to limit the direct input of this herbicide into groundwater systems. The relatively high water holding capacity of coarse textured volcanic pumice and ash loamy sands, as well as sufficient organic matter levels and microbial populations to absorb and degrade this herbicide, would combine to limit the extraneous travel and persistence of this herbicide.

AQUATIC SPECIES

Existing Condition: The Deschutes River, adjacent to the Kelsey Planning Area, is home to a variety of aquatic species. Within the Kelsey Planning Area, there is limited habitat for the following amphibians: the pacific chorus frog and the western toad.

Alternative 2 (Proposed Action) and Alternative 3

Direct and Indirect Effects

- **Hazard Analysis:** Comparable studies on aquatic algae and aquatic animals clearly indicate that most algal species are much more sensitive to hexazinone compared with fish and aquatic invertebrates. Other than lethality, the most common effect noted on aquatic animals is growth inhibition. Only one amphibian study was located, suggesting that amphibians are less sensitive than fish or aquatic invertebrates to hexazinone (SERA 1997, Page 4-1).

- **Exposure Analysis:** In the aquatic environment, exposure levels can be characterized simply as concentrations of hexazinone in water (SERA 1997, Page 4-14). Aquatic species within the Deschutes River would not be exposed to the herbicide. Application of herbicide is not proposed in areas considered amphibian habitat.

- **Risk Analysis:** With no habitat present in units proposed for herbicide treatment, there would be limited potential for amphibians to receive a toxic dose of hexazinone.

Cumulative Effects: Reasonably foreseeable future actions, in combination with proposed herbicide application, will have no cumulative effects.

WATER QUALITY

Existing Condition: The Deschutes River provides the only surface water and borders the western boundary of the planning area. Within the planning area, there is no surface water and there are no known springs. During spring snow melt and storm events, very little above ground flow of water occurs. This is due to coarse soil textures with high infiltration rates, relatively low annual precipitation, and relatively flat ground. Within the planning area, groundwater is estimated to be 100 to 800 feet below the surface (Larry Chitwood. 2003. Geologist. Deschutes National Forest. Personal communication). Groundwater would be closest to the surface in the vicinity of Sunriver.

Movement of hexazinone through the soil profile was assessed on the Bend-Fort Rock Ranger District of the Deschutes National Forest between 1998 and 1999 (Herbicide Grass Control Demonstration Project, Deschutes National Forest). Sub-surface soil samples were taken at a depth of 15 centimeters (6 inches). Samples were taken 1 month, 6 months and 12 months following herbicide application. Sample results generally indicate the herbicide does not appear to be moving into the 15 cm depth and persisting (Craigg 2000, Sussman 1998). Soil types in units proposed for herbicide treatment are similar to those in the demonstration project. Movement of hexazinone through the soil profile is expected to be similar to that found in the demonstration project.

Alternative 2 (Proposed Action) and Alternative 3

Direct and Indirect Effects: Surface ground water contamination is not expected. The closest application of herbicide to the Deschutes River would be approximately 1.7 miles away from the river (Unit 27, Alternative 2 and Unit 327, Alternative 3). With the manual application of herbicide, there is no potential for herbicide to be directly applied to the river. Due to the distance of application from the river and the limited potential for herbicide to be transported by overland flow of water there would be limited to no potential for the herbicide to come in contact with the river.

Annual precipitation, depth to groundwater and soil characteristics in the areas proposed for application are highly likely to limit the direct input of this herbicide into groundwater systems. Based on the soil sampling results from the Herbicide Grass Control Demonstration Project and the depth to the water table, herbicide would not be expected to move down to the level of groundwater.

AIR QUALITY

Alternative 2 (Proposed Action) and Alternative 3

Direct and Indirect Effects: No effects on air quality are expected as a result the application of hexazinone. Hexazinone does not evaporate easily and the burning of hexazinone-treated wood does not create additional toxic byproducts (compared to the burning of untreated wood) (Information Ventures, Inc. 1995).

ROADS AND TRANSPORTATION

Existing Condition: There are approximately 258 miles of Forest Service roads and 13 miles of state, county, or other roads within the planning area, totaling 271 open road miles. Most roads within the planning area, outside of NNVM, are currently open to year around use by both motorized and non-motorized use. Present uses include, but are not limited to, access by utilities, horseback riding, sightseeing, biking, cross country skiing, hunting, off-highway vehicle (OHV) use such as ATVs, motorcycles, 4WD, snowmobiles, special use access, and Forest Service administrative use. Many of the activities take place in critical winter mule deer and key elk habitat. Because roads are not maintained during the winter, winter use is primarily limited to snowmobiles and skiing. NNVM is closed to all off-road motorized use except utility maintenance and snowmobiles.

These roads are separated into three categories: primary, secondary, and others. An administrative closure to off-highway vehicle use is in effect from the southern urban growth boundary south to the 400 and 900 roads and east to the Pacific Gas and Electric (PG&E) power lines.

- Primary roads: The public is encouraged to use primary roads for access into and through the Forest. These total approximately 36 road miles.
- Secondary roads: These routes make a direct single connection to areas outside the reach of the primary system and used by vehicles from high-clearance to passenger cars. Some of these routes may resemble primary routes and function similarly but do not meet primary road criteria. These roads total approximately 32 road miles.
- Other Roads: All other roads that have minimal risk to safety or environment. These roads total approximately 202 road miles and include closed roads.

Table 55: Road Classifications and Miles

Classification	Length (miles)
Primary	36.4
Secondary	32.2
Other	202.4
Total	271.0

Most Primary and Secondary roads are in good condition. Roads classified as other are becoming overgrown with vegetation. Portions of primary, secondary and other roads would be expected to require maintenance or reconstruction work to prepare them for project use. Closed roads (inactivated) remain part of the transportation system, with motorized use eliminated for one or more years. These roads are stabilized and placed in an inactive status, remaining on the Forest Transportation Inventory and available for future project use.

There are also numerous unclassified, user-created roads throughout the planning area that are not included in the totals listed above. Unclassified roads have evolved over time for non-planned uses. They are typically short length roads to old landing locations, remnants of roads that were used for mining and logging dating to the early 1900s, or roads developed by four-wheel drive vehicles. Some of these roads are grown in with vegetation and not drivable by full sized vehicles.

The Forest Plan provides desired road density direction for the various Management Areas. Densities are to be used as thresholds for evaluation and not to serve as the basis for assessing Forest Plan conformance. The NNVM Management Plan does not provide for a specific road density. The desired road densities are described in the Forest Plan. The recommended road densities result from the Roads Analysis. Road density includes maintenance level roads 2 through 5, and state and county roads. Table 56, page 124 provides a comparison between present, desired, and recommended road density for each Management Area.

Table 56: Present, Desired, And Recommended Road Densities By Management Area			
Management Area	**Present Open Road Density (Miles/Square Mile)**	**Desired* Open Road Density (Miles/Square Mile)**	**Recommended** Open Road Density (Miles/Square Mile)**
Deer Habitat (MA-7)	**4.3**	**1.0 to 2.5**	**3.9**
Deer Habitat - Inside 18 Fire	*3.6*	-----	*3.1*
Deer Habitat – Overall	*4.2*	-----	*3.8*
General Forest (MA-8)	**3.3**	**2.5**	**3.0**
General Forest – Inside 18 Fire	*5.0*	-----	*3.8*
General Forest – Overall	*3.4*	-----	*3.0*
Scenic Views (MA-9)	**6.2**	**2.5**	**5.3**
Old Growth (MA-15)	**2.8**	**2.5**	**2.8**
Wild and Scenic (MA-17)	**4.4**	**Lowest density to meet Long-term needs**	**3.4**
Ryan Ranch – Key Elk Habitat	**6.0**	**0.5 to 1.5**	**4.8**
NNVM	**0.8**	**Lowest density to meet Long-term needs**	**0.8**
Overall Planning Area Road Density	**3.6**	**Refer to Above Densities**	**3.2**

* Desired road density is derived from the Forest Plan. Open road density describes density of open, system roads.
** Recommended road density is the road density that would remain following proposed closure and decommissioning.
*** Density in parentheses is the density of the planning area, including the 18 Fire following proposed road closure.

Alternative 1 (No Action)
Direct and Indirect Effects: There would be no road construction or reconstruction for present management use. There would be no road closure or decommissioning activities of roads that have been determined as not needed for management through the district roads analysis (Official Record, Appendix H). Normal maintenance activities would continue. Maintaining unneeded roads would continue to keep road maintenance costs higher than desired.

Alternative 2 (Proposed Action) and Alternatives 3
Direct and Indirect Effects: Open road miles would be decreased through road closures within all Management Areas. There would be no new permanent road construction in either action. One (1) temporary road may be constructed for short-term use where the risk of resource impact is low, or can be mitigated, and where analysis has shown to be cost effective. The most economical and effective method for road inactivation that meets management objectives would be used for closure of temporary roads. Road reconstruction and maintenance activities would occur under both action alternatives. Access to proposed Unit 111 would require access on county roads through Deschutes River Woods.

Vegetation management activities would result in no change to the overall transportation system mileage. Approximately 22.0 miles of roads would be reconstructed prior to thinning activities. Approximately one-half (1/2) mile of temporary road would need to be constructed for access into one (1) unit. This road would be would be closed and rehabilitated following vegetation management activities. Roads that are proposed for closure and decommissioning (Tables 8 and 9, page 26) would be closed or decommissioned following completion of vegetation treatments.

Cumulative Effects: Future considerations within the planning area include an Off Highway Vehicle (OHV) trail system and staging/play area. Some of the roads being proposed for closure under this EA would be considered for use as part of the planned trail system.

The Oregon Department of Transportation (ODOT) has installed a median barrier at highway centerline on Highway 97 within a portion of the planning area. Direct access to some roads in the Kelsey planning area is

limited where the barrier has been installed. This may cause travel times to increase and adversely affect wildfire suppression access and success. Future access to Lava River Cave, Lava Lands Visitor Center, and Benham Falls on the Deschutes River may change. Access to these areas would be via frontage type roads from possible reconstruction activities at the Cottonwood Interchange.

The Highway 97 Weigh and Safety Station has been completed. Forest road access to Highway 97 in this area would be limited through proposed road closure.

The proposed ODOT interchange at Highway 97 near the present access to Sunriver via Road 40 would not change road access within the planning area.

RECREATION

Existing Condition: Recreation use is expected to rise approximately five (5) percent per year. This is similar to the expected population increase of Central Oregon and the increase in popularity of the area as a recreation destination. Developed and dispersed recreation sites and activities are located in some areas where shrub and tree density is substantial. The density of the vegetation provides fuels that provide an immediate threat, in the event of wildfire, to these developed and dispersed recreation areas.

Developed Recreation – Developed recreation sites within the planning area include; 1) Lava Lands Visitor Center, 2) Lava River Cave, and 3) Benham Falls East Day Use area. There are five official non-motorized system trails within the planning area: 1) Bessie Butte; 2) Benham Falls day use area interpretive loop; 3) Benham Falls day use area to both Sunriver and Lava Lands Visitor Center; 4) Trail of the Molten Lava; and 5) Trail of the Whispering Pines. Trail of the Molten Lava and Trail of the Whispering Pines are associated with the Lava Lands Visitor Center. A canoe take out is located between Sunriver and Benham Falls day use area at the end of Forest Road 600.

Dispersed Recreation – Dispersed recreation activities include camping, driving for pleasure, OHV use, flat-water river use, fishing, designated and undesignated trail use, firearm use, and forest products collection. Substantial recreation use occurs within the Wildland/Urban interface zone, primarily from Sunriver, Deschutes River Woods, and Woodside Ranch. Much of the trail from Sunriver to the day use area parallels the River, which also accesses dispersed recreation sites. Numerous roads and trails within the planning area, adjacent to the urban areas, are used as hiking, biking, skiing, and OHV trails. There are 111 recorded, dispersed campsites within the planning area. Approximately 25 percent of these sites (24) are located adjacent to the Deschutes River. The remaining dispersed sites (87) are primarily hunting camps that are used in the fall, receive moderate to no use during the summer season, and are not water related. Lava flows provide little recreation other than dispersed exploration and winter use. Resource vandalism and dumping of trash are dispersed problems in this area due to the proximity to the Bend urban area.

Alternative 1 (No Action)
Direct and Indirect Effects:
Developed Recreation – Developed recreation use would be expected to continue to increase with no increase in developed recreation opportunities. With no reduction in vegetation and fuels densities, there would be a continued high risk to loss or degradation of the developed recreation resource by fire. In addition, public health and safety of forest users would be at high risk during a wildfire event.

Dispersed Recreation – There would be no change to dispersed recreation opportunities. Current dispersed use levels would be expected to increase. Adverse impacts from dispersed use in the form of sprawling campsites, trampled vegetation, compacted soils, depletion of woody debris, and undesignated roads would be maintained in the current condition or increase.

Alternative 2 (Proposed Action) and Alternative 3
Direct, Indirect, and Cumulative Effects:
Developed – Proposed vegetation and fuels treatments would reduce fire risk, improve public safety, provide opportunities for more open views, and provide interpretive opportunities at developed sites. Thinning, mowing, and prescribed burning treatments would reduce the fire risk to Lava River Cave and the Benham Falls day use area interpretive loop. Short-term impacts to recreationists would occur during the proposed activities such as noise and dust**.** Trails and dispersed and developed sites may need to be closed during operations. Activities would occur outside of the peak recreation season that lasts from Memorial Day through Labor Day.

Dispersed – Recreational use would likely not be affected by the proposed vegetation treatments. Treatments for the reduction of tree density and diseased trees would improve visual quality for the recreating public.

Road closure and decommissioning would impact the use of 4 dispersed campsites within the Wild and Scenic River corridor. Non-motorized access would continue to occur.

It is estimated that nine (9), non-water related sites would become inaccessible by motorized vehicles due to the decommissioning or closing of roads. There are numerous other flat and dry sites, which could be utilized as dispersed campsites.

Cumulative Effects: Recreational use will likely change with the designated trail from Lava Lands Visitor Center to Benham Falls day use area to Sunriver. OHV use would likely increase with the development and designation of an OHV play area and trail system. An OHV trail system would likely alter dispersed camping within the planning area. The proposed winter seasonal closure would reduce recreational use, particularly during low precipitation winter months. Road closure activities would alter access and use patterns within the planning area, particularly within the Wild and Scenic Management Area.

CULTURAL

Management direction for cultural resources is found in the Deschutes National Forest Land and Resource Management Plan, in the Forest Service Manual section 2360, the 1995 Programmatic Agreement between Region 6, Oregon SHPO, and The Advisory Council On Historic Preservation. The Forest Plan directs the consideration of the effects to cultural resources for projects that fall within the Forest's jurisdiction. Further direction indicates that the Forest will determine what cultural resources are present on the forest, evaluate each resource for eligibility to the National Register of Historic Places (Register) and protect or mitigate effects to resources that are eligible.

Existing Condition: Twelve previous projects, between 1981 and 1997, conducted cultural resource surveys within the current analysis area. Of these, seven inventories were conducted to standards acceptable today and included surveys that covered approximately 4,000 acres. During the 12 previous surveys, a total of 54 cultural resource sites were recorded. An additional 1,000 acres were inventoried and an additional 22 cultural resource sites were located and recorded. Eleven (11) of the 76 recorded sites were determined eligible for the National Register of Historic Places, 12 were determined not eligible, and 53 are still unevaluated. Two (2) of these sites have both an historic and a prehistoric component, 16 are historic, and 58 are prehistoric.

Alternative 1 (No Action)
Direct and Indirect Effects: Without implementation of proposed activities, disturbance to cultural sites would not occur. The risk of a high intensity fire would continue. Wildfire could both reveal new cultural sites and damage new and previously recorded sites. Artifact hunters could potentially loot any revealed sites.

Alternative 2 (Proposed Action) and Alternative 3
Direct, Indirect, and Cumulative Effects: Heavy equipment, log skidding, activity at landings, and pile burning can all adversely effect an historic property. Machine piling of slash can break and redistribute artifacts. Intense heat associated with pile burning can shatter lithic artifacts, disrupting dating analysis opportunities. Ground disturbing fire suppression activities, using hand tools or mechanical devices, can also impact prehistoric sites by breakage or redistribution of artifacts. Historic sites are vulnerable to glass and tin artifact damage in debris dumps or scatters using mechanical treatments. There is potential for damage to remains of historic structures, corrals, fence lines, and other historic artifacts of concern. Underburning can cause similar impacts as mechanical treatments to historic sites that contain perishable materials.

Alternative 2 (Proposed Action) has ten (10) sites in areas proposed for commercial harvest, four (4) sites in areas with proposed precommercial thinning, three (3) sites where mechanical shrub treatments (mowing) would occur, three (3) sites with both mowing and burning proposed, and eight (8) sites within units proposed to be underburned.

Alternative 3 has 11 sites in areas proposed for commercial harvest, four (4) sites in areas with proposed precommercial thinning, three (3) sites where mowing would occur, four (4) sites with both mowing and burning proposed, and eight (8) sites within units proposed to be underburned.

Hand thinning with chainsaws and no pile burning would not affect lithic scatter sites. Mechanical shrub treatment (mowing) has similar light impacts as hand thinning. Lithic scatter sites would not be adversely affected. Potential adverse effects can be avoided through on the site monitoring and modification of implemetation if sites are found during operations. Decommissioning roads by subsoiling can destroy, break, or redistribute artifacts from the surface to a depth of one meter. Road closures that involve installed barriers to road use can do similar damage to a site. These road actions also have the beneficial effect of stopping ongoing damage from road use and maintenance. Adverse effects can be avoided through mitigation measures (page 38).

BOTANY

Existing Condition

Proposed, Endangered, Threatened, and Sensitive (PETS) Species – No plant species that are on the Region 6 Forester's Sensitive Plant List (May 13, 1999) were found during surveys. Sites of Estes artemisia *(Artemisia ludoviciana* spp. *Estesii)* a sensitive plant, have been documented adjacent to the project area on the Deschutes River. The activities proposed in the alternatives in the Kelsey Vegetation and Fuels Treatments Project will not have direct, indirect, or cumulative impacts to habitat, sites, cause a loss of viability or a trend toward Federal listing for *Artemisia ludoviciana* var. *estesii* or for Green–tinged paintbrush *(Castilleja chlorotica)*. No known habitat for Threatened or Endangered plant species exists within the planning area. Refer to Appendix E, page 170, Botany Report for the Regional Forester's Sensitive Plant List for the Deschutes National Forest. Table 57 displays plant species that are on the Region 6 Forester's Sensitive Plant List.

Table 57: Regional Forester's Sensitive Plants (1999) – Deschutes National Forest

Scientific Name	Common Name	Listing Status[8]	Codes[9]
Agoseris elata	Tall agoseris	ONHP List 2	D
Arabis suffrutescens var. *horizontalis*	Crater Lake rockcress	Sp. Of Concern; ONHP List 1	S
Arnica viscosa	Shasta arnica	ONHP List 2	D
Artemisia ludoviciana ssp. *Estesii*	Estes' artemisia	Sp. Of Concern; ONHP List 1	D
Aster gormanii	Gorman's aster	Sp. Of Concern; ONHP List 1	S
Astragalus peckii	Peck's milk-vetch	Sp. Of Concern; ONHP List 1	S
Botrychium pumicola	Pumice grape-fern	Sp. Of Concern; ONHP List 1	D
Calamagrostis breweri	Brewer's reedgrass	ONHP List 2	S
Calochortus longebarbatus var. *longebarbatus*	Long-bearded mariposa lily	Sp. Of Concern; ONHP List 1	S
Carex hystricina	Porcupine sedge	ONHP List 2	S
Carex livida	Pale sedge	ONHP List 2	S
Castelleja chlorotica	Green-tinged paintbrush	Sp. Of Concern; ONHP List 1	D
Cicuta bulbifera	Bulb-bearing water-hemlock	ONHP List 2ex	S
Collomia mazama	Mt. Mazama collomia	Sp. Of Concern; ONHP List 1	S
Gentiana newberryi var. *newberryi*	Newberry's gentian	ONHP List 2	D
Lobelia dortmanna	Water lobelia	ONHP List 2	D
Lycopodiella inundata	Bog club-moss	ONHP List 2	D
Lycopodium complanatum	Ground cedar	ONHP List 2	S
Ophioglossum pusillum	Adder's-tongue	ONHP List 2	S
Penstemon peckii	Peck's penstemon	Sp. Of Concern; ONHP List 1	D
Pilularia americana	American pillwort	ONHP List 2	S
Rorippa columbiae	Columbia cress	Sp. Of Concern; ONHP List 1	S
Scheuchzeria palustris var. *americana*	Scheuchzeria	ONHP List 2	D
Scirpus subterminalis	Water clubrush	ONHP List 2	D
Thelypodium howellii ssp. *Howellii*	Howell's thelypody	ONHP List 2	S

Noxious Weeds – Surveys for noxious weeds were conducted at the same time as the PETS plants surveys. A map with weed site locations in the Kelsey planning area is included in the project files. Several sites are in the planning

[8] **Species of Concern** = Federal Designation; neither Endangered or Threatened; **Oregon Natural Heritage Program (ONHP) List 1:** Contains species which are endangered or threatened throughout their range or which are presumed extinct; **ONHP List 2:** Contains species which are threatened, endangered or possibly extirpated from Oregon, but more common or stable elsewhere; **ONHP List 3:** Contains species for which more information is needed before status can be determined, but which may be threatened or endangered in Oregon or throughout their range.

[9] **D** = Documented; **S** = Suspected

area. Table 58 lists the known noxious weed sites within the planning area. Refer to Appendix E, page 172**,** for the Deschutes National Forest Noxious Weed List.

Table 58: Known Noxious Weed Sites (2002) – Kelsey Planning Area		
Species	**Location**	**Units**
Diffuse and Spotted knapweed	Highway 97	50,96-101,117,130,147, 152,268,269
Dalmatian toadflax; Diffuse and Spotted knapweed	Road 40, west of Highway 97 to Sunriver	30, 265-267
Diffuse and Spotted knapweed	Cottonwood Road, east of Sunriver	68,73-75,105,148-150,269
Spotted knapweed	Mowed areas by Lava Butte	129 (adjacent)
Dalmatian toadflax and spotted knapweed	Road 100, south of High Desert Museum	No unit
Spotted Knapweed	Slough Camp, Dillon Falls	No unit
Diffuse knapweed, Spotted knapweed, Dalmatian toadflax, Bull thistle, Russian thistle	Road 18	133,134,137,141
Dalmatian toadflax	Northwest boundary of Forest, west of China Hat Road (Road 18), Road 1801199	133
Dalmatian toadflax	South side of Road 18, west of power line	141
Knapweed, Bull thistle	Benham Falls	84-87

Alternative 1 (No Action)
Direct and Indirect Effects: Without implementation of vegetation and fuels treatments, there would be a low-risk for the introduction and spread of noxious weeds to new sites from existing sites in and near the project area. Present populations of noxious weeds would continue to survive, grow, and would likely expand.

Alternative 2 (Proposed Action) and Alternative 3
Direct and Indirect Effects: Proposed vegetation and fuels activities would provide a high-risk for the spread of noxious weeds in the planning area. Approximately 25 percent more acres are proposed for treatment in Alternative 3, which would have the highest risk for the spread of noxious weeds.

Cumulative Effects: Potential use from a designated OHV play/staging area and trail system would substantially increase the likelihood that new populations of noxious weeds would be introduced and existing populations would spread within the planning area. The likelihood of the introduction of noxious weeds due to the 18 Fire is high. Road closures associated with the 18 Fire would reduce the opportunity for an increase in those areas where those roads would enter the remaining portion of the Kelsey planning area.

SCENIC

Existing Condition: High-density vegetation blocks views of areas with high natural scenic quality, particularly distant views and along designated scenic corridors including the Deschutes River. Views of these areas are presently obscured or obstructed by stands of young growth ponderosa and lodgepole pine within foreground and middleground view areas, including Newberry National Volcanic Monument and the Upper Deschutes Wild and Scenic River.

Under the Visual Management System[10], noticeable deviations must blend with the landscape character being viewed over the long-term (5 years and beyond). Decades of fire suppression and other human activities have led to vegetative conditions that do not meet social expectations of the landscape character, such as the open, park-like ponderosa pine forest historically found within the area. The existing Scenic Integrity Level within the planning area has a low to medium rating, with both disturbed and undisturbed areas.

An estimated 18,224 acres (40 percent) of the planning area falls within the Scenic Views management allocation **(**Table 59**)**. This allocation is included within Newberry National Volcanic Monument (7,621 acres) and the Upper Deschutes Wild and Scenic River (designated scenic) (480acres). The remaining portions of Scenic Views (10,123 acres) are within the Foreground (Retention – SV1, 2,723 acres/Partial Retention – SV2, 2,837 acres) and Middleground (Retention – SV3, 1,717/Partial Retention – SV4, 2,846) categories. The Foreground and Middleground viewing distance zones are the primary zones viewed from travel corridors including: Highway 97 and County Road 40 (Retention Foreground), and Forest Roads 9720, 9710, and 9702 (Partial Retention Foreground) and the Deschutes River. Stands of trees, single species or mixed ponderosa and lodgepole pine, and diverse riparian species, provide strong line, textural and color patterns. Some stands provide occasional filtered-view openings that display cinder cones that provide unique form and structure although the density of vegetation limits views into the forest. A variety of forbs, shrubs, and grasses border the sides of the travel routes, including the Deschutes River.

Table 59: Management Areas and Treatment Acres/Percent

Management Areas	Existing Acres/%	Alternative 2, Proposed Treatment Acres/%	Alternatives 3 Proposed Treatment Acres/%
General Forest	11,570 Acres (25.2 %)	2,051 Acres (17.7%)	2,698 Acres (23.3%)
Deer Habitat	14,400 Acres (31.3%)	4,124 Acres (28.6%)	4,312 Acres (30.0%)
Scenic Views:			
a) SV1,SV2,SV3,SV4	10,134 Acres (22.0%)	2,970 Acres (29.3%)	3,724 Acres (36.8%)
b) Wild and Scenic River	480 Acres (01.0%)	27 Acres (05.7%)	78 Acres (16.3%)
c) NNVM	7,621 Acres (16.6%)	852 Acres (11.2%)	873 Acres (11.5%)
Other Allocations	1,785 Acres (03.9%)	856 Acres (48.0%)	345 Acres (19.3%)
Total	**45,990 Acres**	**10,880 Acres (23.7%)**	**12, 030 Acres (26.2%)**

Other visually sensitive areas are Middleground Retention and Partial Retention Scenic Views, primarily cinder cones and buttes, including Lava Butte and Green Mountain. Some areas of Middleground views have stands of

[10] The Forest Service has adopted a national policy for describing relative visual quality impacts and objectives. The visual descriptions in the new terminology replace the Visual Quality Objectives with descriptions of the relative scenic integrity of a piece of land. While exact comparisons have not been developed, "Retention" is roughly equivalent to "Very High or High" Scenic Integrity, while "Partial Retention" is roughly equivalent to "moderate" Scenic Integrity. Until a more comprehensive comparison of the elements of each system has been completed, the Forest Plan will not reflect amendments to these new descriptors.

over stocked regeneration with large ponderosa. Facility developments, such as Lava Lands Visitor Center and urban interface developments deviate from the "natural appearing" landscape.

Alternative 1 (No Action)

Direct and Indirect Effects: The Forest Plan direction and the Desired Future Condition for Scenic Resources would not be met. The entire acreage of the planning area would not be managed, altered or changed by management activity with the exception of wildfire suppression and normal routine stewardship activities. The scenic resource would continue to be at high risk from natural disturbance regimes that would potentially lead to patch sizes larger than what historically occurred. Scenic integrity and landscape character would remain essentially the same during the short-term duration (0 to 5 years) and could be adversely altered with any increase in natural disturbance through time (5 years and beyond). Large, old growth pine would remain an important constituent.

Alternative 2 (Proposed Action) and Alternative 3

Direct and Indirect Effects: Scenic views would be enhanced. Activities within the General Forest allocation would be more intensive while being consistent with visual objectives. Proposed treatments would benefit long-term scenic quality, scenic integrity level, and landscape character. Proposed treatments within the foreground landscape of scenic corridors would create "filtered views" and open, park-like, late and old structure ponderosa pine stands. Treatments in dense stands would create natural appearing openings. The overall landscape character would draw attention to trees of variable ages and sizes. Views into the forested landscape would be created that would include lava flows and distant buttes. The visitor's experience would be enhanced along the travel corridors. There would be short-term, adverse effects to the scenic resource.

Alternative 3 would move the scenic resource further toward desired future conditions. Approximately 1,220 additional acres would have vegetative and fuels treatments than Alternative 2 (Proposed Action), benefiting long-term scenic quality, scenic integrity, and landscape character. To be consistent with and address the intent of the Monument Plan, fewer acres (approximately 270) of mechanical fuels treatment would occur while increasing the use of prescribed fire. In the short term, scenery in the Monument may be adversely affected by disturbance associated with stand treatment activities.

RANGE

Existing Condition: Portions of two vacant grazing allotments, Sugar Pine and Coyote, are included within the planning area **(**Table 60**)**. The allotments are located primarily within transitional rangeland. Livestock grazing was historically a common use of the planning area with official records indicating that grazing occurred as early as the 1930s. The completed Cinder Hill EA, July 2004 was initiated to determine future grazing activities, including those that may occur within the Coyote Allotment.

Grazing potential for livestock is: excellent, 5,199 acres (30 percent); moderate, 5,451 acres (32 percent); poor, 5,904 acres (34 percent); and very poor, 605 acres (4 percent). These ratings are based on climax community conditions and may not reflect current conditions on these portions of the two allotments. Management activities often substantially increase available forage for short periods of time. Wildfires have also increased forage quality and quantity of Idaho fescue.

Table 60: Grazing Allotment Status

Allotment	Total Allotment Acres	Acres and Percent of Allotment Within Planning Area	Permitted Livestock Type	Last Year Actively Grazed/Status
Sugar pine	22, 236	3,447 (16%)	Cattle	1996/Vacant
Coyote	35, 181	13, 712 (39%)	Cattle	1991/Vacant

Sugar Pine Allotment – Approximately 16 percent of the allotment falls within the planning area. The allotment was grazed by sheep prior to 1972 and by cattle from 1972 until it became vacant in 1997. The current condition of forage species is poor to fair. Forage quality is decreasing because of tree and shrub canopy closure and lack of grazing. Where management activities, such as tree thinning, mowing, and prescribed burning, has occurred, forage quality is being maintained or is increasing. Improvements include 10 miles of barbed wire fence. The only source of water for livestock is permanent watersets, filled by hauling water.

Coyote Allotment – The allotment was established in 1936 as a community allotment to provide range for cattle and horses belonging to adjacent landowners. Prior to 1936, horses and sheep grazed the area. The Allotment was grazed until 1991 when it became vacant. Forage conditions are fair to good. Portions of the allotment treated to manage fuels along the urban interface are in good condition. Second-growth ponderosa pine continues to mature while plant structure and vigor of forbs, grasses, and shrubs is decreasing under stands of ponderosa pine as crown closure increases, particularly in dense stands. Improvements include 15.5 miles of barbed wire fence that have had little or no maintenance since 1991. Some private landowners are maintaining the existing boundary fence or have replaced it with private fence. The only source of water for livestock is six (6) permanent watersets, filled by hauling water.

Alternative 1 (No Action)
Direct and Indirect Effects: This alternative would allow tree canopy closure to increase and the availability, quantity, and quality of forbs, grasses and shrubs to decrease. A decline in the quantity and quality of livestock forage Range improvements, in need of repair, would not be removed or maintained and would remain a continued hazard to big game and the forest user. Vegetation condition would continue to decline, not being beneficial for livestock management.

Cumulative Effects: Water sets would continue to be utilized by recreational visitors for camping, parking, and other related activities when not being used for grazing operations. Expansion of water sets because of recreational use would not have a measurable impact. Water sets currently occupy less than one tenth of one percent (0.1 percent) of both each allotment and the project area. Increasing the size of the area by 10 feet in all directions

would result in an increase of impacted area to approximately 1.17 acres, an increase of approximately 17 percent per site.

Alternative 2 (Proposed Action) and Alternative 3

Direct and Indirect Effects: The proposed vegetation and fuels activities within the allotments would increase the quantity and quality of available livestock forage over time. Approximately 5,960 acres for Alternative 2 (Proposed Action) and approximately 6,510 acres for Alternative 3 are proposed for treatment within the allotments. A reduction of existing bitterbrush could limit seasonal grazing opportunities for a short period of time following treatments. Alternative 3 would provide a more favorable effect to the range resource than Alternative 2 (Proposed Action) based on the number of acres proposed for treatment.

Shrubs would be lost from burning, construction of 0.5 mile of temporary road, and the creation and use of landings and skid trails. Mowing and burning would also be expected to result in short term losses, 1 to 2 years before individual plants recovered. Reductions in bitterbrush numbers and distribution could result in a reduction in potential livestock stocking levels to reduce the risk of livestock browsing the remaining plants and further reducing bitterbrush forage levels and winter forage for mule deer.

Cumulative Effects

The Cinder Hill Grazing EA analyzed the effects of grazing in vacated allotments. Livestock may utilize existing roads for travel. Livestock and vehicles using the same routes can cause vehicle damage, personal injury, injury to livestock, and less than desirable interaction between livestock and public users. Livestock "water sets" are often popular camping locations, creating dual use areas, which may be compatible as long as they occur at separate times.

The Kelsey Access EA, which would include road closures, and a foreseeable designated off highway vehicle (OHV) trail system and play area, would: 1) increase the human/livestock interaction; 2) require the relocation of an existing water set; 3) concentrate compaction in new areas of new water sets; 4) increase fence line maintenance; and 5) decrease permittee access.

SPECIAL USES

Existing Condition: Special Uses and permitted utilities in the planning area include; 1) power lines, buried and aerial, 2) gas pipeline, and 3) phone lines. All are under permit and maintained by the permittee. Tree removal work was conducted adjacent to aerial power lines in 1999.

Alternative 1 (No Action), Alternative 2 (Proposed Action), and Alternative 3
There would be no changes to the existing special uses and utilities. Utility maintenance activities would continue as necessary. No adverse impacts would be expected with implementation of any alternative.

PUBLIC HEALTH AND SAFETY

No significant adverse effects to public health or safety have been identified. The effects of implementation of the alternatives are well known, not highly controversial, and do not involve any unique or unknown risks. Effects meet or exceed state water and air quality standards.

THINNING AND BURNING
Alternative 1 (No Action)
Wildfire risk would remain a concern along the wildland/urban interface and along public escape routes. Fine airborne particulate matter could increase the incidence of respiratory problems during wildfires. Shading and associated ice on Cottonwood Road would remain a concern to drivers during the winter months.

Alternative 2 (Proposed Action), and Alternative 3
Proposed activities would improve public health and safety by: 1) the reduction of the risk of entrapment from wildfire; 2) the reduction of the risk of wildfire encroachment onto private and urban lands; 3) the reduction of the risk of increased airborne particulates from wildfire; and 4) the reduction of winter shade and associated ice on Cottonwood Road.

HERBICIDE APPLICATION
Existing Condition: Unit 258 is approximately 0.3 mile south of private property and approximately 0.7 mile southeast from human habitation[11]. Unit 259 is approximately 0.6 mile south of private property and approximately 1.0 mile southeast from human habitation. These units are approximately 0.8 to 1.0 mile southeast of the High Desert Museum, east of Highway 97. Remaining units proposed for herbicide application are 1.0 to 4.5 miles from the boundary of other landowners. There are no developed recreation sites within or adjacent to units proposed for herbicide treatment. Dispersed recreational use would potentially occur in or near the treatment areas.

Alternative 2 (Proposed Action) and Alternative 3
Direct and Indirect Effects: The tool used for applying the herbicide would direct the herbicide down to the ground, minimizing potential for the herbicide to come in dermal contact with the worker. Herbicide would be applied on a relatively small percent of each site (approximately 13 to 16 percent of an acre). In a treatment area, there would be a low potential of walking through an area treated with herbicide. Shrubs or grasses that resprout following prescribed underburn and mechanical shrub treatments would be generally less than one (1) foot tall. With this vegetation condition and the application method, there would be limited potential for workers to have dermal exposure by rubbing against herbicide intercepted by vegetation. All sites proposed for application of herbicide are on relatively flat ground, with slopes ranging from 5 to 10 percent. Potential for falling and coming in contact with herbicide on the ground would be limited (Appendix F, page 177).

[11] Human habitation considered to be structures visible on 1995 Aerial Photos.

FIREWOOD GATHERING – PUBLIC and COMMERCIAL

The goal of the Deschutes National Forest is to maintain a supply of firewood while protecting other resources. Forest-wide areas for personal use firewood gathering are coordinated among Ranger Districts and designated after the appropriate level of analysis to consider all resources such as wildlife, soil, fuels/fire management, cultural resources and botany. The objective for these areas can serve more than one purpose such as for personal firewood and to reduce fuel loadings in a given area. However, the firewood-gathering program does not sufficiently reduce the slash that causes the greater risk of loss from fire. Firewood gathering areas usually require additional cleanup and restoration activities when the firewood gathering areas are closed.

ECONOMICS

Table 61 summarizes the economic effects from each alternative. The main factors affecting these values are the amount of fiber removed (0 to an estimated 19 Million Board Feet), subsoiling, planting, and road closure/decommissioning. It does not include mechanical shrub treatments and prescribed burning, nor does it attempt to place a value on the benefits that may occur due to a possible future reduction of road maintenance and fire suppression costs. Amenity values, such as dispersed recreation, were not included in this analysis.

Table 61: Economic Effects of the Alternatives

Alternative	1 (No Action)	2 (Proposed Action)	3
Present Net Value @ 4%	0	$168,482	$395,740
Benefit Cost Ratio @ 4%	0	1.06	1.25
Returns to the Federal Government[1]	0	$1,190,819	$1,380,490
***Jobs Supported**	0	190	221

*** 14 jobs per one (1) million board feet is the regional average based on the 1997 Timber Sale Annual Report.**

PRIME LANDS

There are no lands within the planning area that are classified as prime farm or rangelands. Proposed activities in Alternatives 2 (Proposed Action) and 3 would not change areas classified as prime forestland. There would be no direct, indirect, or cumulative adverse effect to these resources and thus are in compliance with the Farmland Protection Act and Departmental Regulation 9500-3, "Land Use Policy".

CIVIL RIGHTS AND ENVIRONMENTAL JUSTICE

Civil Rights legislation and Executive Order 12898 (Environmental Justice) direct an analysis of the proposed alternatives as they relate to specific subsets of the American population. The subsets of the general population include ethnic minorities, disabled people, and low-income groups. The purpose of the analysis is to determine whether adverse civil rights impacts are anticipated on an under represented population. The analysis is to determine also whether disparate or disproportionate impacts associated with the alternatives are anticipated. A purpose of the action alternatives is to provide for the health and safety of all members of the public by reducing the risk of entrapment from wildfire. Provision of these benefits does not discriminate between subsets of the general population.

COMPLIANCE WITH STATE AND LOCAL LAWS

[1] Assumes ¾ of the revenues from stumpage of the Kelsey project to the Federal Government and ¼ of the revenues to Deschutes County for roads and schools.

Implementation of Alternative 1 (No Action), Alternative 2 (Proposed Action), or Alternative 3 would be consistent with relevant Federal, State and local laws, regulations, and requirements designed for the protection of the environment including the Clean Air and Clean Water Act. None of the alternatives establishes a precedent for future actions or a decision in principle about a future consideration.

OTHER EFFECTS AND FINDINGS

Wetlands, fisheries, water quality and designated floodplains would not be adversely affected by any of the proposed management activities.

There would be no effects to Essential Fish Habitat from any alternative. Although the Upper Deschutes 4th field watershed is mapped by the National Marine Fisheries Service as Essential Fish Habitat for chinook salmon, there are no present or historical records of chinook populations above Big Falls on the Deschutes River, over 50 miles downriver from the project area.

No inventoried roadless areas, old growth stands, Wild and Scenic Rivers, or parkland would be adversely affected by the proposed activities.

No significant irreversible or irretrievable commitment of resources would occur under Alternative 2 (Proposed Action) or Alternative 3. There would be some negligible irretrievable losses of dust caused by mechanical operations. There would be an irretrievable loss of firm wood fiber over the long-term under Alternative 1 (No Action), as existing dead lodgepole pine deteriorates in value and is unable to be utilized for commercial firm wood fiber.

The alternatives are consistent with the goals, objectives and direction contained in the Deschutes National forest Land and Resource Management Plan and accompanying Final Environmental Impact Statement and Record of Decision dated August 27, 1990 as amended by the Regional Forester's Forest Plan Amendment #2 (6/95) and Inland Native Fish Strategy. The alternatives are in compliance with the Upper Deschutes Wild and Scenic River and State Scenic Waterway Comprehensive Management Plan and accompanying Final Environmental Impact Statement and Record of Decision dated July 25, 1996. The alternatives are consistent with the goals, objectives and direction contained in the Newberry National Volcanic Monument Comprehensive Management Plan and accompanying Final Environmental Impact Statement and Record of Decision dated August 1, 1994.

PAST, PRESENT, AND REASONABLY FORESEEABLE FUTURE ACTIONS ADJACENT TO OR WITHIN THE PROJECT AREA

The following past, ongoing, or reasonably foreseeable actions were considered for the cumulative effects analysis.

18 Fire Hazard Tree Removal CE – Completed – 2004
18 Fire Salvage EIS – This project has been analyzed for vegetation management and road closure and decommissioning – 2004

Cinder Hill Range Allotment EA: Proposes to reauthorize grazing on three (3) grazing allotments totaling approximately 89,210 acres – 2004
Lava Cast Planning Area – Vegetation Management – This project would include prescribed burning, mechanical shrub treatment, non-commercial thinning, commercial harvest, and associated activities – 2005
Opine Planning Area – Vegetation Management – This project would include prescribed burning, mechanical shrub treatment, non-commercial thinning, commercial harvest, and associated activities – 2004
Tumbull Planning Area – Vegetation Management – This project would include prescribed burning, mechanical shrub treatment, non-commercial thinning, commercial harvest, and associated activities – 2005

Fuzzy EA – Vegetation Management – Implementation activities ongoing through 2010
Lava Lands Visitor Center and Lava River Caves Fuels Reduction CE – Completed – 2002
Highway 97 Barriers – Completed – 2004
Weigh and Safety Station – Completed – 2004

Access Management – This project would focus on motorized recreation including: 1) the development of a designated OHV trail system and play area and 2) access on Forest roads.

CHAPTER 4 – LIST OF PREPARERS AND AGENCIES CONSULTED

This section identifies the Forest Service personnel who participated in the analysis and the preparation of the EA. For a list of organizations and individuals contacted during the scoping process, refer to the project file located at the Bend-Fort Rock Ranger District.

INTERDISCIPLINARY TEAM

David Frantz	Writer/Editor/Team Leader
Maurice Evans	Fire/Fuels Specialist
Barbara Schroeder	Silviculturist
Kevin Keown	Wildlife Biologist
Barbara Webb	Wildlife Biologist
Carolyn Close	Botanist
Rick Cope	Soils
Steve Bigby	District Road Manager
Chuck Hedges	Engineer
Marv Lang	Recreational Planner
Connie Rawson	Geographical Information Systems
Gini Stoddard	Geographical Information Systems
Don Sargent	District Range Technician
Tom Walker	District Fisheries Biologist
Rob Tanner	Hydrologist
Ronnie Yimsut	Landscape Architect
Don Zettel	Archaeologist

AGENCIES CONSULTED

Oregon Department of Fish and Wildlife (ODFW)
Confederated Tribes of Warm Springs, Warm Springs, Oregon
Burns Paiute Tribe, Burns, Oregon
Klamath Tribe, Chiloquin, Oregon
Oregon State University

APPENDIX A

CONSISTENCY WITH RELEVANT STANDARDS AND GUIDES

CONSISTENCY WITH RELAVENT STANDARDS AND GUIDES

Table 1: Relevant Standards and Guides	
Standard and Guide	**Description of Standard and Guide**
DESCHUTES NATIONAL FOREST LAND AND RESOURCE MANAGEMENT PLAN	
Standards and Guides, as stated within the Forest Plan, provide overall direction that guide the application of project prescriptions for management areas. The Standards and Guides with Management Areas provide the framework for use, development, and protection of the Forest's resources. The following Forest Plan Standards and Guides apply to activities on the Deschutes National Forest. Applicable Standards and Guides have been used to maintain consistency of this environmental assessment with the Forest Plan.	
	Wildlife
WL-3, 11, and 19	Raptor nests discovered during project preparation or implementation will be protected from disturbing activities within ¼ mile (1 mile for the use of explosives) of the nest by restricting operations during the nesting period (March 1 to August 31: *Red-tailed hawk & northern goshawk*); (February 1 to July 31: *Golden Eagle*); (April 15 to August 31: *Cooper's hawk & sharp-shinned hawk*).
WL-9, 17, 25	Where nest sites are unknown, use the following criteria: mean canopy cover of 60% or greater, tree density of at least 195 trees per acre, stand age of 100 years or more (*Northern Goshawk*); mean canopy cover of 60% or greater, tree density of at least 365 trees per acre, stand age of 50-80 years (*Coopers Hawk*); mean canopy cover of 65% or greater, tree density of at least 475 trees per acre, stand age 40-60 years (*Sharp-shinned Hawk)*.
WL-31	Lodgepole pine dominated overstory, overstory tree density of 67 trees per acre for trees greater than 12 inches diameter at breast height, canopy cover of 60% (50-70%), distance to nearest meadow 440 (63-1,070) feet (*Great Gray Owl)*.
WL-38	Retain all existing soft snags as supplemental wildlife trees for roosting and foraging except when impractical because of human safety, other resource protection, or project logistics (*Deschutes National Forest Wildlife Tree Implementation Plan)*.
WL-47, 49, 51	Provide cover and visual screening throughout the Ryan Ranch Key Elk area with 30 percent of the commercially harvested units that contain cover retained in untreated clumps greater than 2 acres in size.
WL-48, 56	Travel corridors may be provided where needed by linking stands that meet hiding cover definitions for deer and elk.
WL-54	Hiding areas must be present over at least 30 percent in each implementation unit. Hiding cover is defined as vegetation capable of hiding 90 percent of a standing adult deer or elk from view of a human at a distance equal to or less than 200 feet.
WL-72	Fallen trees and other woody debris will be retained in sufficient quantity, distribution, and physical characteristics to provide habitat for viable populations of dependent wildlife species over time.
WL-73	Within commercial harvest and fuels treatment units that are below minimum management levels for coarse woody material (CWM), leave one slash pile (approximately 100 square feet) or concentration (approximately 200 square feet) per acre to supplement qualifying material.
WL-74	Diversity of habitat will be provided. Large homogenous areas of the same species and /or successional stages will be avoided.
WL-75	Habitat for species associated with special or unique habitats will be protected during project development.
CV-3	Trees will not be harvested in a 150 to 250 foot radius around cave entrances.
	Soils
SL-1	Management activities will be prescribed to promote maintenance or enhancement of soil productivity. The potential for detrimental soil damages will be specifically addressed through project environmental analysis. Alternative management practices will be developed and mitigating measures implemented when activities will result in detrimental soil compaction, puddling, displacement, or soils with severely burned surfaces or those with accelerated erosion.

Table 1: Relevant Standards and Guides	
Standard and Guide	**Description of Standard and Guide**
SL-3	Leave a minimum of 80 percent of an activity area in a condition of acceptable productivity potential for trees and other managed vegetation following land management activities. Include all system roads, landings, spur roads, and skid roads or trails to evaluate impacts. Soil monitoring, to include statistical methods, will be required on all sensitive soil areas.
SL-4	Any sites where this direction cannot be met will require rehabilitation. Measures may include tillage, smoothing, fertilizing or spreading of biological rich organic materials.
SL-5	The use of mechanical equipment in sensitive soil areas will be regulated to protect the soil resource. Operations will be restricted to existing trails and roads whenever feasible.
SL-6	In order to minimize soil erosion by water and wind, the following ground cover objectives should be met within the first 2 years after an activity is completed.
	Cultural
CR-2	Cultural resource properties located during inventory will be evaluated for eligibility to the Register.
CR-3	The Forest will develop thematic Register nominations and management plans for various classes of cultural resources.
CR-3	Project level inventories or the intent to conduct such shall be documented through environmental analysis for the project.
	Forest Health
FH-3	Treatments emphasize prevention of insect and disease problems rather than suppression.
	Timber Management
TM-9	Site preparation and planting would be done within if there is no positive trend toward meeting minimum stocking requirements within 10 years (OSU study).
TM-13	Fuels treatments (site preparation) in these units would be completed within 2 years of harvest. Reforestation within 3 years of harvest.
TM-15	Establishment of a new age class would occur through natural regeneration.
TM-16	Even-aged groups may be as small as .25 acre or in rare cases as large as 6 or 7 acres. Even-aged groups are usually less than 2 acres in size and no wider than twice the height of mature trees in the stand.
TM-18	Uneven-aged management is proposed in ponderosa pine stands that 1) currently display a mixed size structure, or 2) are immature and even-aged.
TM-20	Ponderosa pine is expected to dominate mixed conifer stands following proposed treatments.
TM-21	Uneven-aged management is not appropriate in the lodgepole pine community types.
TM-23	Stands proposed for uneven-aged management are generally on slopes less than 30 percent.
TM-32	Dwarf mistletoe will be at low levels and is projected to be maintainable at low levels in stands proposed for uneven-aged management.
TM-38	Uneven-aged management is most applicable where there is reasonable assurance that natural regeneration will occur within ten years.
TM-48	Natural regeneration is planned where stand and site conditions are appropriate.
TM-49	Natural regeneration would meet minimum stocking requirements within 10 years of site preparation.
TM-50	Treatment is proposed where the stand would be minimally stocked (100 trees per acre) within 10 years of site preparation at least 80% of the time.
TM-53	Fuels treatment and site preparation would reduce fuel loading to a level where no fuels treatment would be required following seed tree removal in 10-15 years.
TM-58	Forest openings created by even-aged silviculture should not exceed 40 acres in ponderosa pine and mixed conifer.
TM-61	Timber management activities that create essentially uniform structural conditions should generally not exceed 100 contiguous acres on >95% of each implementation unit.
	Deer Habitat (MA-7)

Table 1: Relevant Standards and Guides	
Standard and Guide	**Description of Standard and Guide**
M7-3	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.
M7-5	Even and uneven-aged management will be applied and may include precommercial and commercial thinnings. Stocking levels will be based on sit-specific conditions. A crown cover greater than 40 percent with trees 30 feet his is recommended for thermal cover.
M7-10	Habitat management will be designed to provide a mosaic of forested conditions.
M7-13	Crown cover greater than 40 percent with trees 30 feet tall is recommended for thermal cover on the Deschutes National Forest.
M7-14	Forage conditions will be maintained or improved with emphasis on increasing the variety of plants available for forage.
M7-15	Where forag3 improvement activities which are not directly associated with manipulation of the tree stands (crushing, prescribed burning) are planned, the size of the treatment units normally will be 300 to 500 acres including unmanipulated islands. If more than one unit is treated in a single year, treatment units should be 600 to 1,200 feet apart. The untreated portion of the area involved can be improved after the treated areas provide a good quality of forage.
M7-16	Thermal cover will be maintained immediately adjacent to the foraging site.
	General Forest (MA-8)
M8-7	Uneven-aged management is the preferred silviculture system; should be prescribed within the mature and over mature ponderosa pine and mixed conifer community types where stand and site conditions are appropriate.
	Scenic Views (MA-15)
M9-4	Ponderosa pine retention foreground areas, visual changes will not be noticeable to the casual forest visitor.
M9-5, 16, 24, 41, 55, 67	Perpetuate the desired visual condition and control insect and disease problems.
M9-10	While creation of openings is allowed within ponderosa pine foreground retention, creation of such openings is to result from harvesting natural mortality.
M9-11, 12, 32	Trees greater than or equal to 24 inches dbh are to be retained.
M9-14	Thin immature trees ... to maintain acceptable health and vigor of stands, with the objective of eventually producing replacement trees of 24 inches diameter and larger. In retention foregrounds, thin to slightly closer than normal spacing in order to provide full crowns and some screening. In partial retention foregrounds, normal silviculturally prescribed spacings are acceptable.
NEWBERRY NATIONAL VOLCANIC MONUMENT COMPREHENSIVE MANAGEMENT PLAN	
M-1	Land management activities should allow natural ecological succession of vegetation to continue to the maximum extent practical. Where natural succession is not practical, analysis of projects and activities should explain why it is necessary to intervene and how this intervention is consistent with the purposes and provisions of the Monument legislation.
M-8	Overall, any projects to alter existing vegetation should respond to one or more of the following needs: 1) Protect existing large, old trees and provide for the perpetuation of the genetic heritage they represent, 2) Reestablish conditions that allow natural ecological succession of vegetation to the maximum extent practical, 3) Protect public health and safety, 4) Enhance wildlife or sensitive plant habitat, scenic quality, or recreational values, and 5) Reduce serious threats from insects, fire, or disease to resources outside the Monument.
M-10	Restoration treatments would provide for habitat diversity, including horizontal, vertical, and vegetative species diversity. Existing vegetative species diversity would be maintained.
M-12	Treatment to reduce or prevent insect or disease effects should be a result of integrated resource analysis that has identified quantifiable land management objectives, based on the intent of the Monument legislation. Treatment on an isolated stand-by-stand basis is not

Table 1: Relevant Standards and Guides	
Standard and Guide	**Description of Standard and Guide**
	recommended, but may be required to meet a particular resource objective.
M-13	Where feasible and practical, favor manual methods for vegetation restoration activities. If mechanized equipment must be used, choose equipment and methods that avoid or reduce undesirable impacts to soils and damage to vegetation intended to remain on the site. The following guidelines are some ways to avoid or reduce undesirable impacts when heavy machinery is used:
M-14	Machine piling of slash during fuels treatment should be used only when no other metho accomplish objectives, and should generally be avoided on slopes over 30 percent. Min impacts of machine piling by piling no more than needed to break up fuel continuity.
M-15	Where practical in light of other resource objectives, reestablish "historic" ponderosa pine old growth (over time) on a substantial portion of the ponderosa pine sites. The intent is to create (over time) fuel conditions that allow stands to be maintained and perpetuated solely with prescribed fire (or where appropriate, prescribed natural fire) rather than through mechanical treatments. While prescribed fire or natural prescribed fire is the preferred treatment method, some mechanical treatments may be needed before fire can be used safely. The choice of which sites to manage for this condition should be integrated with other resource objectives such as wildlife habitat, scenic quality, and recreation.
M-43	Wildfires within the Monument are to be suppressed to ensure no more than 300-400 acres burn annually as a result of wildfire.
TZ-1	Manage Mokst Butte Research Natural Area (RNA) in accordance with provisions of the final Establishment Report and Designation Order for this RNA. (No proposed treatments)
The Plan includes standards and guidelines for protection, restoration, and enhancement of riparian vegetation. Facilities may be redesigned, and dispersed camping may be limited or prohibited to protect riparian areas.	
UPPER DESCHUTES WILD AND SCENIC RIVER AND STATE SCENIC RIVER COMPREHENSIVE MANAGEMENT PLAN	
V-9	Prescribed fire may be used at locations, scale, intensity, and frequency which will mimic pre-suppression historical averages for the watershed, where such fires would not have long-term adverse effects on other river values or cause undue risk to public health and safety or private property.
V-12	Some fuel reduction activities (pre-treatments), may be permitted (if such activities would not adversely affect Outstandingly Remarkable Values) to assist in the safe use of prescribed fire and adjacent to private inholdings to reduce the threat of fire spreading to federal, state, or county lands and elsewhere.
V-16	Ponderosa pine or other species suitable for eagle or osprey nesting will be managed to provide trees which are 20 inches or larger in diameter.
V-17	Vegetation will appear natural and emphasize protection of riparian plant communities. Any silvicultural practices which provide long-term benefits to Outstandingly Remarkable Values may be allowed.
INLAND NATIVE FISH STRATEGY	
RF-2	For each existing or planned road, meet the Riparian Management Objectives (RMOs) and avoid adverse effects to inland native fish.
RF-3	Determine the influence of each road on the RMOs. Meet RMOs and avoid adverse effects on inland native fish.
RM-2	Adjust dispersed and developed recreation practices that retard or prevent attainment of RMOs or adversely affect inland native fish. Where adjustment measures such as education, use limitations, traffic control devices, increased maintenance, relocation of facilities, and/or specific site closures are not effective in meeting RMOs and avoiding adverse effects on inland native fish, eliminate the practice or occupancy.
Active management is intended for ICBEMP A2 sub watersheds, but is to pose a low risk for sediment delivery and low risk of adversely affecting the hydrologic regime and riparian areas.	

THE CLEAN WATER ACT AND SECTIONS 319 AND 303(D)

The objective of the Clean Water Act (CWA) of 1972 is to restore and maintain the chemical, physical, and biological integrity of all waters. Under Section 319 of the 1987 CWA Amendments, states are required to determine those waters that will not meet the goals of the CWA, determine those non-point source activities that are contributing pollution, and develop a process on how to reduce such pollution to the "maximum extent practicable". Section 303(d) of the CWA requires that a list be developed of all impaired or threatened waters within each state. The Oregon Department of Environmental Quality (ODEQ) is responsible for compiling the 303(d) list, assessing data, and submitting the 303(d) list to the Environmental Protection Agency (EPA) for federal approval.

Hydrology

Desired future watershed conditions to come out of the Kelsey Access Management Project include the following;

- Manage watershed health and integrity so as prevent future listing as 303(d) streams.
- Incorporate management activities involving OHV, roads, and dispersed sites that may aid in removing streams from the 303(d) list.

INTERIM MANAGEMENT DIRECTION ESTABLISHING RIPARIAN, ECOSYSTEM AND WILDLIFE STANDARDS FOR TIMBER SALE (REGIONAL FORESTER'S Forest Plan AMENDMENT #2)

The following provide management direction that supersedes Interim Management Direction established by the Regional Forester's Forest Plan Amendment #2:

- Legislation for Newberry National Volcanic Monument specifies the Monument is to be managed in accordance with laws, rules, and regulations pertaining to the National Forest System and to the Deschutes National Forest, to the extent that such laws and regulations are consistent with the Monument legislation. The Monument legislation supersedes any Forest Plan direction that is inconsistent with the purposes for which the Monument was established. The direction provided in the Monument Plan (August 8, 1994) takes precedence over the Forest Plan.
- The Final Environmental Impact Statement (FEIS) and the Record of Decision (ROD) for the Upper Deschutes River amends the 1990 Deschutes National Forest Land and Resource Management Plan (as amended by the Regional Forester's Forest Plan Amendment #2 also know as Interim Management Direction and the Inland Native Fish Strategy). Direction found in The Upper Deschutes Wild and Scenic River and State Scenic Waterway Comprehensive Management Plan (Wild and Scenic River Plan) results from the FEIS.
- According to the Decision Notice Correction for the Inland Native Fish Strategy, the interim standards and guidelines included in the Inland Native Fish Strategy (1995) replace the interim riparian standard established May 20, 1994 in the Decision Notice for the Continuation of Interim Management Direction Establishing Riparian, Ecosystem, and Wildlife Standards for Timber Sales (Interim Management Direction).

Interim Riparian Standard

Interim Management direction for riparian areas has been replaced by: a) Wild and Scenic River Standards and Guidelines and b) Inland Native Fish Strategy Standards and Guidelines. Consequently, the Kelsey project was not evaluated for consistency with interim riparian standards.

Interim Ecosystem Standard

Consistent with the Interim Ecosystem Standard, the Kelsey Planning Area has been characterized for patterns of stand structure by biophysical environment and compared to the Historic Range of Variability (HRV). Attachment 2 documents this analysis.

Interim Wildlife Standard

Scenario A of the interim wildlife standard applies for the single story and multi-story late or old (LOS) stand structure. Both of these structural stages are below the Historic Range of Variability (HRV). According to interim direction, there should be no net loss of late or old structure. No timber sale harvest activities are to occur within LOS stages that are below HRV.

NATIONAL FOREST MANAGEMENT ACT (NFMA)

Clearcutting would only be used when it is determined to be the optimum method to achieve multiple use values [NFMA 16 USC 1606 (g) (3) (E) (iv)]. This harvesting system is proposed for reasons other than it would give the greatest dollar return or the greatest unit output of timber [NFMA 16 USC 1606 (g) (3) (F) (i)].

NATIONAL FOREST POLICY ON CLEARCUTTING

In an announcement on June 4, 1992, Chief F. Dale Robertson announced a policy that would reduce the amount of clearcutting that would be done on national forests. With this policy, clearcutting would be limited to areas where it is essential to meet forest plan objectives and involve one or more of the following circumstances:

1. To establish, maintain, or enhance habitat for threatened or endangered species.
2. To enhance wildlife habitat or water yield values, or to provide for recreation, scenic vistas, utility lines, road corridors, facility sites, reservoirs, or similar developments.
3. To rehabilitate lands adversely impacted by events such as fires, windstorms, or insect or disease infestations.
4. To preclude or minimize the occurrence of potentially adverse impacts of insect or disease infestations, windthrow, logging damage, or other factors affecting forest health.
5. To provide for the establishment and growth of desired tree or other vegetative species that are shade intolerant.
6. To rehabilitate poorly stocked stands due to past management practices or natural events.
7. To meet research needs.

APPENDIX B

ALTERNATIVE 2 (PROPOSED ACTION)
And
ALTERNATIVE 3

UNIT SUMMARIES

Alternative 2 (Proposed Action) Vegetation and Fuels Treatment Summary				
Unit #	**Gross Acres**	**Management Area**	**Treatment Summary[12]**	**Objectives[13]**
7	80	Scenic Views, General Forest	HSL, SPC, GPR, MST	2,5
8	46	General Forest	HSL, SPC, GPR, MST	2,4
9	47	Transition Zone	UB	2,7,8
10	15	Transition Zone	UB	7,8
11	54	Transition Zone	HTH, UB	1,2,7,8
12	102	General Forest	HTH, MST/UB	5
13	219	General Forest, Deer Habitat	HTH, MST/UB	5
14	72	Deer Habitat	HSL, SPC, GPR, MST/UB	1,5,12a
20	198	Deer Habitat, Scenic Views	MST/UB	5,7
21	112	Deer Habitat, General Forest	HSL, SPC, GPR, MST	1,4,12a
22	172	Scenic Views, General Forest, Deer Habitat	HSL, SPC, MST	1,5,12b
23	96	Scenic Views, Deer Habitat, General Forest	HTH, MST/UB	5
24	13	Deer Habitat, General Forest	MST/UB	5
25	85	Lava Zone, Transition zone	MST/UB	5,7,8
26	102	Scenic Views, General Forest	HSL, SPC, GPR, MST	2,6
27	47	General Forest	HSL, SPC, GPR, MST	2,6
29	9	Scenic Views, General Forest	GPR, MST	2,6
30	64	General Forest, Scenic Views	MST	6
31	1	General Forest	GPR, MST	2,6
33	14	Scenic Views, General Forest	HCR	1,2,5
34	52	Scenic Views, General Forest	HSL, SPC	1,5,11b
35	19	Scenic Views	HSL, SPC, MST/UB	1,5,11b
36	14	Scenic Views	HSL, SPC, GPR, UB	5,10
37	36	Scenic Views	HTH, SPC, UB	1,5,11a
38	24	Transition Zone	HSL, SPC, MST/UB	1,5,7,8,11b
39	66	General Forest	HTH, UB	2,5
40	22	Scenic Views, General Forest	SPC, MST	3,4
41	54	Scenic Views	HTH, MST/UB	1,5
42	41	Scenic Views, General Forest	HTH, UB	5,10
45	155	Scenic Views, General Forest	HTH, MST/UB	1,5,6
46	22	General Forest	SPC, MST	3,4
47	224	General Forest, Scenic Views	HTH	1,11a
48	43	Scenic Views, General Forest	SPC, MST	3,4,5
49	10	Scenic Views	HTH, MST/UB	5
50	108	Scenic Views, General Forest	HTH, MST/UB	1,5
52	1	Scenic Views	HTH, MST/UB	1,2,5
53	3	Scenic Views	SPC, GPR, MST	2,5
54	4	General Forest, Scenic Views	HTH, MST/UB	1,2,5
55	5	General Forest	SPC, GPR, MST	2,5
56	69	General Forest, Transition Zone	HTH, MST/UB	2,5,7,10
57	17	General Forest	SPC, GPR, MST	2,5
58	41	General Forest	HSA, SPC, GPR, MST	2,4
59	15	General Forest	HSL, SPC, GPR, UB	2,4,11b
60	35	General Forest	HSL, SPC, MST/UB	1,4,11b

[12] **Treatment Summary: HSL** = Uneven-aged Management, **HTH** = Commercial Thin, **HCR** = Seed Tree Removal, **HSA** = Sanitation Cut, **HPR** = Partial Removal, **SPC** = Noncommercial Thin, **MST** = Mechanical Shrub Treatment, **UB** = Burn Under Trees, **SRL** = Release, **GPR** = Prune, **RPL** = Plant, **RSH** = Research (Oregon State University).

[13] **Objectives: 1)** Reduce beetle risk; **2)** Reduce mistletoe infection; **3)** Maintain/improve plantation growth; **4)** Protect wildlife habitat; **5)** Create: **a** - Fuels break/safety corridor; **b** - strategic fuel breaks; **6)** Reduce wildfire risk: **a** – wildland/urban interface, **b** – spotting/crown fire, **c** - Old Growth Management Area, **d** – Benham Falls day use area, **e** – Lava Lands/Lava River Cave; **7)** Reintroduce fire; **8)** Maintain/accelerate ponderosa pine development/growth in Monument; **9)** Reduce ice on Cottonwood Road; **10)** Maintain/increase ponderosa pine dominance; **11)** Accelerate: **a** – single-story, late and old structure; **b** – multi-story, late and old structure; **12)** Enhance: **a** – deer habitat; **b** – goshawk habitat; **13)** Promote open, park-like stands..

Alternative 2 (Proposed Action) Vegetation and Fuels Treatment Summary				
Unit #	**Gross Acres**	**Management Area**	**Treatment Summary[12]**	**Objectives[13]**
61	45	Transition Zone	HSL, SPC, MST/UB	1,8,11b
62	11	General Forest, Scenic Views	SPC, MST	3,4
63	10	Scenic Views	SPC, MST	3,4
64	9	Scenic Views	HSL, SPC, MST	1,5,11b
65	11	Transition Zone	HSL, SPC	1,5,8,11b
66	26	Transition Zone	HSL, SPC, MST/UB	1,5,8,11b
67	96	Scenic Views	HTH, UB	7,11a
68	46	Scenic Views, General Forest	HSL, SPC, GPR, MST/UB	1,5,6,10
69	22	Scenic Views	HSL, SPC, MST/UB	1,5,6
70	21	Scenic Views	HSL, SPC, MST/UB	1,5
71	36	Scenic Views	HSL, SPC, MST/UB	1,5
73	11	Scenic Views	HTH, SPC, MST/UB	5,9
74	12	Scenic Views	HTH, SPC, MST/UB	5,9
75	3	Scenic Views	HTH, SPC, MST/UB	5,9
77	46	Scenic Views	MST/UB	5
78	29	Wild & Scenic, Scenic Views	HTH, SPC, MST	6
79	124	Scenic Views	MST/UB	4,5
80	26	Scenic Views	HTH, SPC, MST	5,6
81	75	Scenic Views, General Forest	MST	6
82	87	Lava Zone	MST/UB	5,7,8
83	53	Scenic Views	SPC, MST/UB	5
84	27	Lava Zone, Wild & Scenic	MST/UB	6,7,8
85	10	Lava Zone	MST	5
86	5	Scenic Views	MST	5
87	11	Lava Zone, Wild and Scenic	HPR, SPC, UB	6,7,8,10,13
88	79	Lava Zone	HTH, SPC, MST/UB	1,7,8
89	19	Lava Zone	HTH, SPC, MST/UB	1,5,7,8
90	53	Lava Zone	MST/UB	8
94	17	Lava Zone	HTH, MST	1,5,6,8
95	5	Lava Zone	MST	6
96	94	Lava Zone	HTH, SPC, MST/UB	1,5,7,8
97	9	Lava Zone	HTH, SPC	1,2,6,13
98	8	Lava Zone	HTH, SPC, MST/UB	1,2,6,7,13
99	5	Lava Zone	HSA, SPC, MST/UB	2,6,7,13
100	4	Lava Zone	HSL, SPC, MST/UB	2,6,7,13
101	11	Lava Zone	MST/UB	3,6,7
102	126	Lava Zone, Transition Zone	HTH, SPC, MST/UB	1,7,8
103	44	Deer Habitat, Scenic Views	HTH, SPC, MST/UB	1,4
104	119	Lava Zone	HTH, MST/UB	5,7,8,12a
105	170	Scenic Views	HTH, UB/MST	4,5,12a
106	223	Scenic Views	SPC, MST/UB	3,4
107	10	Scenic Views	MST	5
108	32	Scenic Views	SPC, MST/UB	3,4
109	60	Scenic Views	SPC, MST/UB	3,4
110	98	Scenic Views	SPC, MST/UB	3,4
111	75	Scenic Views	HTH, SPC, UB	1,6,7,11a
112	25	Scenic Views	HTH, SPC, MST/UB	1,5
113	61	Scenic Views	HTH, SPC	1
114	47	Scenic Views	SPC, MST	3,4
115	53	Scenic Views	SPC, MST	1,4
116	28	Scenic Views	MST	4
117	51	Scenic Views	HTH, SPC, MST/UB	1,5
119	70	Deer Habitat	HTH	1,12a
120	36	Deer Habitat	HTH	1,12a
121	93	Deer Habitat	HSL, SPC	1,12a
122	76	Deer Habitat	HTH	1

Alternative 2 (Proposed Action) Vegetation and Fuels Treatment Summary				
Unit #	**Gross Acres**	**Management Area**	**Treatment Summary[12]**	**Objectives[13]**
123	405	Deer Habitat	UB	5,7
124	35	Scenic Views	HTH, UB/MST	1,4,5,12a
125	8	Deer Habitat	HSL, SPC	1,11b
126	30	Deer Habitat	HSL, SPC, UB	1,4,11b
127	41	Deer Habitat	HSL, SPC	1,11b
128	58	Deer Habitat	HSL, SPC	1,12a
129	54	Scenic Views	HTH, SPC, MST/UB	1,5
130	99	Scenic Views	HTH, SPC, MST/UB	5
131	37	Scenic Views	SPC, MST	3,4
132	94	Deer Habitat	MST/UB	5,6
133	63	Deer Habitat	MST/UB	5,6
134	231	Deer Habitat	MST/UB	5,6
135	110	Deer Habitat	MST/UB	5,6
136	213	Deer Habitat	MST/UB	5,6
137	239	Deer Habitat	MST/UB	5,6
138	113	Deer Habitat	MST/UB	5,6
139	224	Deer Habitat	MST/UB	5,6
140	12	Deer Habitat	MST	5
141	326	Deer Habitat	MST/UB	5
142	211	Deer Habitat	MST/UB	5,7
143	69	Deer Habitat	MST/UB	5
145	247	Deer Habitat	MST/UB	5
146	157	Deer Habitat	HTH, MST/UB	5
147	135	Scenic Views	HTH, MST/UB	5
148	5	Scenic Views	HTH, SPC, MST/UB	5,9
149	5	Scenic Views	HTH, SPC, MST/UB	5,9
150	4	Scenic Views	HTH, SPC, MST/UB	5,9
151	238	Deer Habitat	UB	5,7
152	89	Scenic Views	HTH, MST/UB	5,11a
153	44	Deer Habitat	UB	5,7
154	68	Deer Habitat	UB	5,7
155	38	Deer Habitat	UB	5,7
156	18	Deer Habitat	HTH, UB	1,5,7
157	21	Deer Habitat	UB	5,7
158	10	Deer Habitat	UB	5,7
251	37	Deer Habitat, Scenic Views	MST/UB	6,7
254	49	Deer Habitat	HSA, MST, SPC,GPR, MST/UB	2,6,7
256	33	Deer Habitat	HTH, MST/UB	RSH, 4,11a,12a
257	58	Deer Habitat	NO TREATMENT (CONTROL PLOT)	RSH, 4,11a,12a
258	46	Deer Habitat	HSL, MST, GPR, RPL	RSH, 4,11a,12a
259	27	Deer Habitat	HSL, UB, GPR, RPL	RSH, 4,11a,12a
260	54	General Forest	NO TREATMENT (CONTROL PLOT)	RSH, 6,11a
261	44	General Forest	HSL, MST, GPR	RSH, 6,11a
262	69	General Forest	HSL, UB, GPR	RSH, 6,11a
263	58	General Forest, Scenic Views	HTH, MST/UB	RSH, 6,11a
264	55	General Forest, Scenic Views	HTH, MST/UB	RSH, 6,11a
265	90	General Forest, Scenic Views	HTH, MST/UB	RSH, 5
266	58	General Forest, Scenic Views	NO TREATMENT (CONTROL PLOT)	RSH, 5
267	69	General Forest, Scenic Views	HSL, UB, GPR	RSH, 5
268	84	Scenic Views	HSL, MST, GPR	RSH, 5
269	62	Scenic Views	HTH, MST/UB	5
TOTAL	**9,750**			

Alternative 3: Vegetation and Fuels Treatment Summary				
Unit #	**Gross Acres**	**Management Area**	**Treatment Summary[14]**	**Objectives[15]**
9	47	Transition Zone	UB	2,7,8
11	54	Transition Zone	HTH, UB	1,2,7,8
20	198	Deer Habitat, Scenic Views	MST/UB	5,7
21	112	Deer Habitat, General Forest	HSL, MST, GPR	1,4,12a
22	172	Scenic Views, General Forest, Deer Habitat	HSL, SPC, MST	1,5,12b
23	96	Scenic Views, Deer Habitat, General Forest	HTH, MST/UB	5
24	13	Deer Habitat, General Forest	MST/UB	5
26	102	Scenic Views, General Forest	HSL, MST, GPR	2,6
29	9	Scenic Views, General Forest	MST, GPR	2,6
31	1	General Forest	MST, GPR	2,6
33	14	Scenic Views, General Forest	HCR	1,2,5
37	36	Scenic Views	HTH, SPC, UB	1,5,11a
39	66	General Forest	HTH, UB	2,5
41	54	Scenic Views	HTH, MST/UB	1,5
42	41	Scenic Views, General Forest	HTH, UB	5,10
45	155	Scenic Views, General Forest	HTH, MST/UB	1,5,6
48	43	Scenic Views, General Forest	SPC, MST	3,4,5
49	10	Scenic Views	HTH, MST/UB	5
53	3	Scenic Views	SPC, GPR, MST	2,5
55	5	General Forest	SPC, GPR, MST	2,5
57	17	General Forest	SPC, GPR, MST	2,5
61	45	Transition Zone	HSL, SPC, UB	1,8,11b
62	11	General Forest, Scenic Views	SPC, MST	3,4
63	10	Scenic Views	SPC, MST	3,4
65	11	Transition Zone	HSL, SPC	1,5,8,11b
73	11	Scenic Views	HTH, SPC, MST/UB	5,9
74	12	Scenic Views	HTH, SPC, MST/UB	5,9
75	3	Scenic Views	HTH, SPC, MST/UB	5,9
77	46	Scenic Views	MST/UB	5
78	29	Wild & Scenic, Scenic Views	HTH, SPC, MST	6
81	75	Scenic Views, General Forest	MST	6
82	87	Lava Zone	MST/UB	5,7,8
83	53	Scenic Views	SPC, MST/UB	5
87	11	Lava Zone, Wild and Scenic	HPR, SPC, UB	6,7,8,10,13
88	79	Lava Zone	HTH, SPC, MST/UB	1,7,8
89	19	Lava Zone	HTH, SPC, MST/UB	1,5,7,8
90	53	Lava Zone	MST/UB	8
96	94	Lava Zone	HTH, SPC, UB	1,5,7,8
97	9	Lava Zone	HTH, SPC	1,2,6,13
98	8	Lava Zone	HTH, SPC, MST/UB	1,2,6,7,13
99	5	Lava Zone	HSA, SPC, MST/UB	2,6,7,13
100	4	Lava Zone	HSL, SPC, MST/UB	2,6,7,13
102	126	Lava Zone, Transition Zone	HTH, SPC, UB	1,7,8
103	44	Deer Habitat, Scenic Views	HTH, SPC, MST/UB	1,4

[14] **Treatment Summary: HSL** = Uneven-aged Management, **HTH** = Commercial Thin, **HCR** = Seed Tree Removal, **HSA** = Sanitation Cut, **HPR** = Partial Removal, **SPC** = Noncommercial Thin, **MST** = Mechanical Shrub Treatment, **UB** = Burn Under Trees, **SRL** = Release, **GPR** = Prune, **RPL** = Plant, **RSH** = Research (Oregon State University).

[15] **Objectives: 1)** Reduce beetle risk; **2)** Reduce mistletoe infection; **3)** Maintain/improve plantation growth; **4)** Protect wildlife habitat; **5)** Create: **a** - Fuels break/safety corridor; **b** - strategic fuel breaks; **6)** Reduce wildfire risk: **a** – wildland/urban interface, **b** – spotting/crown fire, **c** - Old Growth Management Area, **d** – Benham Falls day use area, **e** – Lava Lands/Lava River Cave; **7)** Reintroduce fire; **8)** Maintain/accelerate ponderosa pine development/growth in Monument; **9)** Reduce ice on Cottonwood Road; **10)** Maintain/increase ponderosa pine dominance; **11)** Accelerate: **a** – single-story, late and old structure; **b** – multi-story, late and old structure; **12)** Enhance: **a** – deer habitat; **b** – goshawk habitat; **13)** Promote open, park-like stands: **14)** Aspen Enhancement.

Alternative 3: Vegetation and Fuels Treatment Summary				
Unit #	**Gross Acres**	**Management Area**	**Treatment Summary[14]**	**Objectives[15]**
106	223	Scenic Views	SPC, MST/UB	3,4
107	10	Scenic Views	MST	5
108	32	Scenic Views	SPC, MST/UB	3,4
109	60	Scenic Views	SPC, MST/UB	3,4
110	98	Scenic Views	SPC, MST/UB	3,4
113	61	Scenic Views	HTH, SPC	1
114	47	Scenic Views	SPC, MST	3,4
115	53	Scenic Views	SPC, MST	1,4
116	28	Scenic Views	MST	4
119	70	Deer Habitat	HTH	1,12a
120	36	Deer Habitat	HTH	1,12a
121	93	Deer Habitat	HSL, SPC	1,12a
122	76	Deer Habitat	HTH	1
123	405	Deer Habitat	UB	5,7
125	8	Deer Habitat	HSL, SPC	1,11b
126	30	Deer Habitat	HSL, SPC, UB	1,4,11b
127	41	Deer Habitat	HSL, SPC	1,11b
128	58	Deer Habitat	HSL, SPC	1,12a
129	54	Scenic Views	HTH, SPC, MST/UB	1,5
131	37	Scenic Views	SPC, MST	3,4
132	94	Deer Habitat	MST/UB	5,6
133	63	Deer Habitat	MST/UB	5,6
134	231	Deer Habitat	MST/UB	5,6
135	110	Deer Habitat	MST/UB	5,6
136	213	Deer Habitat	MST/UB	5,6
137	239	Deer Habitat	MST/UB	5,6
138	113	Deer Habitat	MST/UB	5,6
139	224	Deer Habitat	MST/UB	5,6
141	326	Deer Habitat	MST/UB	5
143	69	Deer Habitat	MST/UB	5
145	247	Deer Habitat	MST/UB	5
148	5	Scenic Views	HTH, SPC, MST/UB	5,9
149	5	Scenic Views	HTH, SPC, MST/UB	5,9
150	4	Scenic Views	HTH, SPC, MST/UB	5,9
152	89	Scenic Views	HTH, MST/UB	5,11a
153	44	Deer Habitat	UB	5,7
200	20	Lava Zone, Wild and Scenic	HTH, UB, SPC	1
201	20	Wild and Scenic	HTH, UB, SPC	1
202	8	Wild and Scenic	HTH, SPC	1
203	9	Wild and Scenic	HTH, SPC	1
204	12	Wild and Scenic	HTH, SPC	1
205	5	Wild and Scenic	HTH, SPC	1
206	7	Wild and Scenic	HTH, MST, SPC	6
207	75	Scenic Views	MST/UB	5
208	110	Scenic Views	MST/UB	4, 5
209	44	Scenic Views, General Forest	HTH, MST/UB	1
210	34	Scenic Views	HTH, MST/UB	1, 5, 13
211	71	General Forest	HTH, MST	1
213	40	Scenic Views, General Forest	HTH	1
218	32	Scenic Views	HTH, MST	1
219	89	Scenic Views	HTH, MST/UB	1
220	48	Scenic Views	HTH, UB	1, 5, 13
221	16	Scenic Views	MST, SPC	6
222	61	Scenic Views	MST	6
223	164	Scenic Views	MST	6,7
224	4	Scenic Views	HTH, MST, SPC	6

Alternative 3: Vegetation and Fuels Treatment Summary				
Unit #	**Gross Acres**	**Management Area**	**Treatment Summary[14]**	**Objectives[15]**
225	10	General Forest	HTH, MST	1,6
226	30	General Forest	MST	6
227	24	Scenic Views, General Forest	HTH, MST	1,6
229	19	Scenic Views	HTH, SPC	1
230	10	Scenic Views	HTH	1
231	9	Scenic Views	HTH	1
232	8	Scenic Views	HTH, SPC	1
233	38	Scenic Views	HTH, SPC	1
234	71	Lava Zone	MST/UB	7
237	103	Lava Zone	MST/UB	7
238	57	Lava Zone	MST/UB	7
239	61	General Forest	HTH, MST	EC,1
240	15	General Forest	HTH	EC,1
241	52	General Forest, Scenic Views	HTH	EC,1
242	62	General Forest	HTH	1
243	19	General Forest	HTH	1,12B
244	61	General Forest	HTH	1,12B
245	99	Scenic Views, General Forest	UB	7
246	60	General Forest	HTH	1
247	62	Scenic Views, General Forest	HSL, SPC	1,4,11B
248	42	General Forest	HTH, MST	1
251	37	Deer Habitat, Scenic Views	MST/UB	6,7
252	34	Deer Habitat, Scenic Views	UB	6,7
253	32	Deer Habitat	HTH, UB	1,6,7
254	49	Deer Habitat	HSA, MST, SPC, GPR, MST/UB	2,6,7
255	99	Deer Habitat	UB	6,7
256	33	Deer Habitat	HTH, MST/UB	RSH, 4,11a,12a
257	58	Deer Habitat	NO TREATMENT (CONTROL PLOT)	RSH, 4,11a,12a
258	46	Deer Habitat	HSL, MST, GPR, RPL	RSH, 4,11a,12a
259	27	Deer Habitat	HSL, UB, GPR, RPL	RSH, 4,11a,12a
260	54	General Forest	NO TREATMENT (CONTROL PLOT)	RSH, 6,11a
261	44	General Forest	HSL, MST, GPR	RSH, 6,11a
262	69	General Forest	HSL, UB, GPR	RSH, 6,11a
263	58	General Forest, Scenic Views	HTH, MST/UB	RSH, 6,11a
264	55	General Forest, Scenic Views	HTH, MST/UB	RSH, 6,11a
265	90	General Forest, Scenic Views	HTH, MST/UB	RSH, 5
266	58	General Forest, Scenic Views	NO TREATMENT (CONTROL PLOT)	RSH, 5
267	69	General Forest, Scenic Views	HSL, UB, GPR	RSH, 5
268	84	Scenic Views	HSL, MST, GPR	RSH, 5
269	62	Scenic Views	HTH, MST/UB	5
270	16	Scenic Views	MST	5
271	19	Scenic Views	MST, SPC	5
272	3	Scenic Views	HTH, MST, SPC, GPR	PS,1
273	2	Scenic Views	HTH, MST, SPC, GPR	PS,1
274	25	Scenic Views	UB	4,5
275	20	Transition Zone	UB	7
276	1	Lava Zone	HTH, MST, SPC, GPR	PS,1
277	98	Scenic Views, general Forest	HTH, MST/UB	1
278	4	Lava Zone	HSA,SPC	1,2,6,13
281	5	Transition Zone	UB, WHIPFELL	14
307	80	Scenic Views, General Forest	HTH, MST/UB, SPC	2,5
308	46	General Forest	HTH, MST, SPC	2,4
312	102	General Forest	HTH, MST/UB	5
313	218	General Forest, Deer Habitat	HTH, MST/UB	5
314	72	Deer Habitat	HTH, MST/UB	1,5
325	85	Lava Zone, Transition zone	MST/UB	5,7

Alternative 3: Vegetation and Fuels Treatment Summary				
Unit #	**Gross Acres**	**Management Area**	**Treatment Summary[14]**	**Objectives[15]**
327	47	General Forest	HTH, MST, SPC	2,6
335	19	Scenic Views	HSL, SPC	1,5,11b
338	24	Transition Zone	HSL, UB, SPC	1,5,8,11b
340	22	Scenic Views, General Forest	MST, SPC, GPR	EC,3,4
346	22	General Forest	MST, SPC, GPR	EC,3,4
347	224	General Forest, Scenic Views	HTH	EC,1,11a
352	1	Scenic Views	HTH, MST	1,2,5
354	4	General Forest, Scenic Views	HTH, MST	1,2,5
356	69	General Forest, Transition Zone	HTH, MST	2,5
360	35	General Forest	HSL, SPC	1,11b
366	26	Transition Zone	HSL, SPC	1,5,8,11b
367	96	Scenic Views	HTH, UB	7,11a
368	46	Scenic Views, General Forest	HTH, MST, SPC	1,5,6
369	22	Scenic Views	HSL, MST/UB, SPC	1,5,6
404	119	Lava Zone	MST/UB	5,7,12a
405	170	Scenic Views	HTH, UB/MST	4,5,12a
411	75	Scenic Views	HTH, UB, SPC	1,6,7,11a
412	25	Scenic Views	HTH, MST, SPC	1,5
424	35	Scenic Views	HTH, UB/MST	1,4,5,12a
430	99	Scenic Views	HTH, MST/UB, SPC	5
442	211	Deer Habitat	HSL, MST/UB, GPR	5,7,12a
446	157	Deer Habitat	HTH, MST/UB	5
447	135	Scenic Views	HTH, MST/UB	5
451	238	Deer Habitat	MST	5,7
TOTAL	**11,080**			

APPENDIX C

DESCRIPTION OF TREATMENT PRESCRIPTIONS (Page 158)

AND

TREATMENT OBJECTIVES (Page 160)

Description of Treatment Prescriptions

Thin plantations (Prescription 0)
Thin from below to approximately 90 to 170 trees per acre (approximately 16 to 22 foot spacing). Wider spacing would be used in plantations with larger diameter trees.

Thin to moderate stocking levels (Prescription 1)
Thin from below to approximately 60 square feet of basal area per acre (approximately 40 to 90 trees per acre). Retain lodgepole pine as needed to meet desired stocking levels. Depending on existing stand condition, treatment would either be even-aged (HTH) or uneven-aged (HSL) management.

Thin to low stocking levels (Prescription 2)
Thin from below to approximately 40 square feet of basal area per acre (approximately 30 to 50 trees per acre). Depending on existing stand condition, treatment would be even-aged (HTH) or uneven-aged (HSL) management.

Thin to variable stocking (Mistletoe) – No pruning (Prescription 4)
Thin from below to approximately 60 square feet of basal area per acre. Where mistletoe is present, reduce mistletoe infection by removing trees with heavy dwarf mistletoe infection (DMTR $\geq$4). Regardless of level of mistletoe infection, do not reduce stocking below minimum levels (approximately 20 BA/AC or 40 SDI). Retain lodgepole pine as needed to meet desired stocking levels. Treatment would be considered even-aged management (HTH).

Regeneration harvest – Individual Tree (Mistletoe) – Pruning (Prescription 6)
Remove all ponderosa pine less than 21 inches dbh with moderate to high levels of dwarf mistletoe infection (DMTR >=3). Thin remaining ponderosa pine from below to approximately 60 square feet of basal area per acre. Plant ponderesa pine seedlings in areas less than minimally stocked (100 trees per acre or 40 Stand Density Index). Prune mistletoe infected trees within 65 feet of planted trees. Treatment would be considered uneven-aged management (HSL).

Regeneration harvest – Individual Tree (Ponderosa pine restoration) (Prescription 7)
Remove all lodgepole pine less than 21 inches dbh. Remove ponderosa pine less than 21 inches dbh with moderate to high levels of dwarf mistletoe (DMTR >=3). Thin remaining ponderosa pine from below to approximately 60 square feet of basal area per acre. Underburn. Plant ponderosa pine seedlings in areas less than minimally stocked (100 trees per acre or 40 Stand Density Index). Prune mistletoe infected trees within 65 feet of planted trees. Treatment would be considered uneven-aged management (HSL).

Regeneration harvest – Clearcut (Prescription 8)
Over 30 to 40% of the stand, create openings 6 to 12 acres in size. Within these openings, all trees less than 21 inches dbh would be removed. Openings would be reforested by planting ponderosa pine. If mistletoe is present along the edge of the openings, no planting would be done within 65 feet of the edge to minimize potential for mistletoe to infect planted trees. Treatment would be considered uneven-aged management (HSL).

Next entry in this stand would occur within approximately 15 to 20 years. Thinning would occur outside of the created openings (at the time of the next entry it's projected that these openings would be providing hiding cover) to reduce beetle risk and maintain/improve forage.

Seed Tree Harvest (Prescription 10)
Regenerate lodgepole pine using seed tree harvest method. To provide seed, retain approximately 27 lodgepole pine per acre (approximately 40 foot spacing). Remove lodgepole pine excess to seed tree needs. Remove ponderosa pine and white fir that have poor vigor (ie: live crown ratios less than 40% or moderate to high levels of dwarf mistletoe infection (DMTR $\geq$4)).

Thin to variable stocking (Goshawk foraging) (Prescription 11)
Desired condition: Primarily single-story stand structure with a mosaic of conditions present. The following are desired within portions of the stand: 1) Large trees, 2) dense stocking, 3) open understory, 4) habitat for goshawk prey (down wood/shrubs), 5) small (1/3 to 2 acres) to medium (2 to 4 acres) openings, and 6) patches of mid-age forest scattered throughout the stand.

Treatment: Over approximately 13% of the unit, thin to approximately 20 trees per acre (approximately 47 foot spacing). Generally leave the largest trees available, while leaving the best, most vigorous trees with the least amount of dwarf mistletoe. Even spacing is not required. Retain approximately 10% of the area in dense tree cover. In remaining 77% of area, thin from below to approximately 60 square feet of basal area per acre.

Scenic Views (Prescription 12)
Thinning by Lava River Cave and Benham Falls Picnic Area. Thinning to done to meet scenic views objectives. Around Lava River Cave, thin from below to 60 square feet of basal area per acre. Mistletoe infected trees priority for removal. Thin additional trees as needed to open up view of Cascades. By Benham Falls Picnic Area, thin to highlight large diameter ponderosa. Remove lodgepole pine within 1 to 3 times the crown radius of ponderosa pine to be featured.

Thin to variable spacing to enhance growth of pruned trees (Prescription 13)
Around pruned trees, thin from below to 40 square feet of basal area per acre. Away from pruned trees, denser stocking can be retained. Thin from below to 60 square feet of basal area per acre.

Sanitation Harvest (Mistletoe) - Pruning (Prescription 14)
Remove ponderosa pine with moderate to heavy levels of dwarf mistletoe (DMTR $\geq$3). Regardless of level of mistletoe infection, do not reduce stocking below minimum levels (approximately 20 BA/AC or 40 SDI). Thin remaining ponderosa pine from below to approximately 60 square feet of basal area per acre. Prune residual overstory infected with mistletoe.

Cut conifers to release aspen (Prescription 15)
Cut all conifers less than 10 inches dbh. Conifers to be cut consist primarily of lodgepole pine. Treatment includes construction of a buck/pole fence around aspen stand.

Oregon State University (OSU) Study (Prescriptions 90, 91, 92, and 93)

Control – (Prescription 90)
No vegetation treatment (harvest or natural fuels treatment) is planned.

Wide Thinning (Prescription 91)
Trees will be thinned to a relatively wide spacing (30 to 40 trees per acre). The residual Stand Density Index (SDI) will be relatively low (60-90). The best dominant and codominant trees will be retained, with an emphasis on retaining trees with the least amount of dwarf mistletoe and that have been previously pruned. Leave trees not previously pruned would be pruned to 18 to 20 feet. All trees greater than 21 inches dbh would be retained.

Uneven-aged Thinning (Prescription 92)
Trees will be thinned wide enough to allow ponderosa pine regeneration (natural or planted) to develop and grow. Thinning will retain 70 to 100 trees per acre (saplings size and larger). The residual Stand Density Index (SDI) will range from 75 to 110. A variety of size class trees will be removed, however all trees greater than 21 inches dbh would be retained. Emphasis will be on retaining trees with the least amount of dwarf mistletoe and trees that have been previously pruned.

Stand will be regenerated using natural regeneration. Some small patches within the openings will be planted (micro-planting) to compare natural regeneration to planting. Minimal application of herbicides will be done. Tubes would be used to protect planted seedlings from big game browse.

Group/Patch Cutting (Prescription 93)
Across 25% of the stand, approximately 4 acre openings would be created. Within these openings, all trees less than 21 inches dbh would be harvested. In the remaining 75% of the stand, thinning will occur to levels that maximize stand growth while maintaining low to moderate beetle risk for the next 10 to 20 years.

Unit	Acres	25% of Area	Number of 4 acre openings
259	27	6.8	1
262	69	17.2	4
267	69	17.2	4

Openings will be regenerated primarily using natural regeneration. Some small patches within the openings will be planted (micro-planting) to compare natural regeneration to planting. Minimal application of herbicide will be done. Planted seedlings would be protected using either big game repellent or tubes.

Definitions
Dbh: Diameter Breast Height. Diameter of tree bole at 4.5 feet above ground.
Basal Area: Area of tree bole at 4.5 feet above ground.
Stand Density Index (SDI): a measure that expresses relative stand density in terms of the relationship of a number of trees to stand quadratic mean diameter. Assuming a primarily even-aged stand, it is the number of trees per acre based on a quadratic mean diameter of 10 inches dbh.

Kelsey Treatment Objectives

FH: Forest Health.
- FH-1: Reduce risk of mountain pine beetle outbreak.
- FH-2: Reduce level of dwarf mistletoe infection.
- FH-3: Maintain/improve plantation growth.

NF: Natural fuels.
- NF-1: Reduce risk of high intensity/stand replacing wildfire.
- NF-2: Create defensible/safe egress route.
- NF-3: Reduce wildfire risk within urban interface zone.
- NF-4: Long term study plot protection – Reduce risk of spotting/Crown fire.
- NF-5: Reduce risk of wildfire burning into Forest Plan Allocated Old Growth Areas.
- NF-6: Maintain low fuel loadings. Reduce fine fuels (duff/needle layer/bark slough/grass/limb cast).
- NF-7: Reduce wildfire risk adjacent to Benham Falls Picnic Area.
- NF-8: Reduce wildfire risk adjacent to Lava Lands/Lava River Cave.
- NF-9: Create strategic fuel breaks.

NVM: Newberry National Volcanic Monument.
- NVM-1**:** Maintain/accelerate development of ponderosa pine old growth.
- NVM-2: Reintroduce fire into fire associated ecosystems.

PS: Public Safety. Increase amount of sunlight on Cottonwood Road to reduce ice.

PPR: Ponderosa pine restoration. Maintain or increase ponderosa pine dominance.

WL: Wildlife.
- WL-1: Accelerate development of single-story late or old structure (LOS).
- WL-2: Accelerate development of multi-story late or old structure (LOS).
- WL-3: Enhance bitterbrush vigor within deer habitat.
- WL-4: Maintain or enhance goshawk habitat (foraging).
- WL-5: Promote deer hiding cover and vertical stand diversity within deer habitat.
- WL-6: Increase herbaceous and forb species; reduce duff/liter layer.
- WL-7: Restore/enhance aspen stands.

SV: Scenic Views. Maintain or enhance scenic views.
- SV-1: Promote open, park-like stands.

EC: Economic. Maintain or increase potential value gain on pruned trees.

RSH: Research. Evaluate alternative silvicultural treatments in even-aged, second growth ponderosa pine.

RSH2: Research. Evaluate vegetation response to fuels treatment. (Bitterbrush study)

WSR: Wild and Scenic River: Manage vegetation to protect and enhance Outstandingly Remarkable Values (*Artemisia ludoviciana* ssp. *estesii*, a Federal Category 2 Candidate for protection under the Endangered Species Act).

Notes:
Where thinning prescription will reduce stand stocking below optimum levels (wider spacing than required for beetle protection for 20 years), Forest Health will not be shown as a treatment objective. Even though Forest Health will be increased, only the objective(s) driving the desired spacing will be shown.

Within NNVM, the monument objectives (NVM-1 and NVM-2) were considered to be the highest priority, although other objectives (ie defensible/safe egress) are also important.

Within the Green Mountain Plantations, treatments were not considered strategic fuelbreaks due to their shapes.

Within scenic views, a scenic view objective is not listed unless treatment is driven by achieving a desired scenic views. Will deal with scenic views either as a mitigation or in the silviculture prescription.

APPENDIX D

WILDLIFE BIOLOGICAL EVALUATION (BE)

United States Department of Agriculture	**Forest Service**	**Deschutes National Forest**	**Bend-Ft. Rock Ranger District 1230 NE 3rd St., Ste. A-262 Bend, OR 97701**

File Code: **2670** **Date:** **July 15, 2003**

Subject: **Kelsey Vegetation Management Project Biological Assessment/Evaluation Threatened, Endangered, and Sensitive Wildlife**

To: **David Frantz**
Project NEPA Coordinator & Writer/Editor

Introduction

It is Forest Service policy to avoid all adverse impacts on threatened and endangered species and their habitats except when it is possible to compensate adverse effects totally through alternatives identified in a biological opinion rendered by the Fish and Wildlife Service. Measures are to be identified and prescribed to prevent adverse modification or destruction of critical habitat and other habitats essential for the conservation of endangered, threatened, and proposed species (FSM 2670.31). Through the biological evaluation process (FSM 2672.4), actions and programs authorized, funded, or carried out by the Forest Service are to be reviewed to determine their potential for effect on threatened and endangered species and species proposed for listing (FSM 2670.31). Species classified as sensitive by the Forest Service are to be considered through the National Environmental Policy Act process by conducting biological evaluations to determine the potential effect of all programs and activities on these species (FSM 2670.32). No impacts may be allowed on sensitive species that would result in loss of population viability or create significant trends toward Federal listing. The findings of biological evaluations are to be documented in a decision notice or, if applicable, in official files.

The following biological evaluation assesses the effects of all proposed alternatives for the Kelsey Vegetation Management Project including the No Action alternative. For species other than those classified as Proposed, Endangered, Threatened or Sensitive (PETS) refer to the Wildlife Report for the project. Candidate species are included in the biological evaluation. A Biological Assessment will not be prepared for the Kelsey Project because 1) it is not a major federal construction project that requires a environmental impact statement; 2) the effects on federal threatened, endangered and proposed species are not significant (i.e. adverse or jeopardy); 3) with minor exceptions it meets the Project Design Criteria for the Joint Aquatic and Terrestrial Programmatic Biological Assessment (BA) for the Fiscal Year 2000.

Effects of the project are evaluated for those PETS and C species that are documented or suspected to occur within the Project Area. Existing management direction is found in the Deschutes National Forest Land and Resource Management Plan (1990), as modified by the Eastside Screens (1995). Projects proposed in occupied or potential habitat of any P, T, E, or C species on the Forest must be consistent with the Project Design Criteria for that species, as described in the Deschutes National Forest Programmatic BA (Fiscal Year 2000).

Location Description/Legal

The Kelsey project area is located within the administrative boundary of the Deschutes National Forest. It is bordered by the southern urban growth boundary of Bend on the north and Sunriver and the Deschutes River on the west and southwest. The township and range legal description is: T. 19 S., R. 11-13 E. and T. 20 S., R. 11-13 E. It encompasses approximately 46,566 acres, including 576 acres of private lands. Major geologic features within the project area include the Lava Butte Geologic Area, Lava River Cave, Bessie Butte, Luna Butte, Mokst Butte, and the Deschutes River. Elevations range from 3,900 to 6,000 feet.

Landscape Overview

The project area contains seven management allocations, as designated by the Deschutes National Forest Land and Resource Management Plan (Forest Plan). Management allocations include General Forest (11,570 acres), Deer Habitat (14,401 acres), Old Growth (467 acres), Scenic Views (10,134 acres), Special Interest Area (7,621 acres), Wild and Scenic River (480 acres), and Research Natural Area (1,317 acres). It also includes the Newberry National Volcanic Monument (18,140 acres of the planning area) and the Upper Deschutes Wild and Scenic River Corridor. Management allocations or areas with emphasis on

providing high quality wildlife habitat include Deer Habitat, Key Elk Area, and Old Growth. The project area is located east of the range of the northern spotted owl. There are no inventoried (RARE II) roadless areas.

Wildlife habitats within the Kelsey project area are dry forest types including ponderosa pine, lodgepole pine, and mixed conifer. Ponderosa pine dominates the area. Stands are generally relatively young (50-100 years), small diameter (9-20 inches diameter at breast height (DBH)), and single-storied. There are few snags and down logs in these stands. Special/unique habitat types include buttes, eco-tones along lava flows and lava rock outcroppings, and wet meadow/riparian habitat along the Deschutes River. There is one man-made water catchment (wildlife guzzler) within the project area that provides water for wildlife.

The Kelsey project area includes mule deer summer range, spring/fall transitional range, and winter range. For the most part, summer and transitional range is designated in the Forest Plan as General Forest (Forest Plan Management Area 8), while the winter range is designated as Deer Habitat (Forest Plan Management Area 7). Besides the Deer Habitat management allocation, the biological winter range (area actually utilized by deer during winter time) includes areas designated by the Forest Plan as Old Growth and Scenic Views. Significant numbers of deer utilize these areas during late fall, winter, and early spring periods. They migrate from higher elevation summering areas located south and west of the project area in late fall and then return to summering areas during early spring. Elk are also known to regularly utilize the area, with the greatest amount of use occurring during winter months along the Deschutes River in the Ryan Ranch Key Elk Area. Potential calving habitat is found in the Ryan Ranch Key Elk Area in dense stands of lodgepole pine adjacent to the Deschutes River. Mountain lion, bobcat, and black bears are known to inhabit the area. Other predators include a variety of raptors, coyote, American marten, and badger. The following species with special designations are known or suspected to occur in the area.

Project/Activity Description

The Kelsey Environmental Assessment analyzed three alternatives, the no action alternative and two action alternatives. Activities proposed in the action alternatives would: 1) reduce stocking in high-density stands through precommercial thinning, commercial harvest, mechanical shrub treatment, and prescribed burn; 2) protect and enhance wildlife habitat; 3) treat areas with severe infection of dwarf mistletoe to improve stand resiliency; and 4) mechanically treat brush and/or prescribe burn to reduce fire flame lengths and transition towards a more historic low intensity, more frequent fire regime.

Following are detailed descriptions of the alternatives responding to the "Purpose and Need" that are considered to be reasonable and viable by the Decision Maker (the Deschutes National Forest Supervisor). Alternatives, other than the no action alternative, are designed to move towards the desired condition consistent with the standards and guidelines of the Forest Plan. **All measurements are approximate.**

Alternative 1 (No Action)

Under this alternative, the Forest Service would continue to manage the planning area under current Forest Plan direction. No vegetation or fuels reduction treatments, wildlife or scenic view enhancement activities, or activities to restore natural processes to soil would occur. This alternative provides a baseline by which compares relative changes and their effects that would occur with implementation of proposed activities in either Alternative 2 (Proposed Action) or Alternative 3. Current conditions and trends would likely remain unchanged with selection of the No Action Alternative.

Alternative 2 (Proposed Action)

Fuels and Vegetation: 10,840 acres are proposed for treatment. Where fuels treatments are proposed, the acreage to be treated will be variable and dependent upon site-specific needs. Proposed commercial harvest is outside the Riparian Habitat Conservation Area (**RHCA**).

Table 1: Alternative 2 (Proposed Action) Vegetation, Fuels, and Associated Treatments		
TREATMENT TYPE	**UNIT NUMBER**	**ACRES**
Fuels Treatment Only	1,2,5,6,9,10,17,18,20,24,25,30,77,79,81-86,90,95,101,104,107,116,123 132-145,151,153-155,157,158, 251	4,090
With Precommercial Thinning and/or Pruning	29,31,40,46,48,53,55,57,62,63,106,108-110,114,115,131	695
Sub-Total		**4,785**
Vegetation and Fuels Treatments	3,4,11-13,16,19,22,23,39,41,42,45,50,52,54,56,67,73-75,94,105,124,126 146-149,152,156,256,263-265,269	2,220

Table 1: Alternative 2 (Proposed Action) Vegetation, Fuels, and Associated Treatments		
TREATMENT TYPE	**UNIT NUMBER**	**ACRES**
With precommercial Thinning and/or Pruning	7,8,14,21,26,27,35-38,49,58-61,64,66,68-71,78,80,87-89,96,98-100,102 103,111,112,117,129,130,150,254,258,259,261,262,267,268	2,000
With Replant	7,8,14,21,26,27,36,58,59,68,258,259,261,262,267,268	915
With Sub-soiling	7,8,14,21,26,27,36,58,59,68,259,262,267	740
Sub-Total		**4,220**
Vegetation Treatment Only	47,119-122,125	505
With Precommercial Thinning and/or Pruning	15,33,34,65,97,113,127,128	245
With Sub-soiling	33	15
Sub-Total		**750**
Total		**9,755**

Alternative 3

Fuels and Vegetation: 11,0 acres are proposed for treatment. Where fuels treatments are proposed, the acreage to be treated will be variable and dependent upon site-specific needs. Proposed commercial harvest is outside the RHCA.

Table 2: Alternative 3 Vegetation, Fuels, and Associated Treatments		
TREATMENT TYPE	**UNIT NUMBER**	**ACRES**
Fuels Treatment Only	2,9,17,18,20,24,77,81-83,90,107,116,123,132-139,141,143-145,153207,208 216,222,223,226,234-238,245,249,251,252,255,270,274,275,325,404,451	4,495
With Precommercial Thinning and/or Pruning	29,31,48,53,55,57,62,63,106,108-110,114,115,131,221,271,281,340,346	735
Total		**5,230**
Vegetation and Fuels Treatments	3,11,19,22,23,39,41,42,45,73-75,126,148,149,152,209-211,215,217-220 225,227,239,248,253,256,263-265,269,277,312-314,316,352,354,356,367 405,424,446,447	2,700
With Precommercial Thinning and/or Pruning	21,26,37,49,61,78,87-89,96,98-100,102,103,129,150,200,201,206,224,254 258,259,261,262,267,268,272,273,276,307,308,327,338,368,369,411,412 430,442	1,900
With Replant	21,26,258,259,261,262,267,268,442	705
With Sub-soiling	21,26,259,262,267,442	505
Total		**4,600**
Vegetation Treatment Only	119-122,125,212-214,230,231,240-244,246,250,347	835
With Precommercial Thinning and/or Pruning	15,33,65,66,97,113,127,128,202-205,229,232,233,247,278,335,360	415
With Sub-soiling	33	15
Total		**1,250**
Total Acres		**11,080**

Analysis of Effects

The following species and their habitats were considered in the preparation of this document:

SPECIES		**FEDERAL CLASSIFICATION**
Haliaeetus leucocephalus	Northern bald eagle	T
Strix occidentalis caurina	Northern spotted owl	T
Lynx canadensis	Canada lynx	T
Rana pretiosa	Oregon spotted frog	C
Histrionocus histrionicus	Harlequin duck	SOC
Buffledhead duck		

Falco peregrinus anatum	American peregrine falcon	S
Numenius americanus	Long-billed curlew	S
Tricolored blackbird		
Centrocercus urophasianus	Western sage grouse	S, SOC
Coturnicops noveboracensis	Yellow rail	S
Podiceps auritus	Horned grebe	S
Red-necked grebe		
Gulo gulo luteus	California wolverine	S, SOC
Martes pennanti	*Pacific fisher*	*S*
Sylvilagus idahoensis	Pygmy rabbit	S, SOC
Corynorhinus townsendii	Townsend's big-eared bat	S, SOC

- E=Endangered, T=Threatened, S=USFS Region 6 Sensitive, P=Proposed for Federal listing,

  C=USFWS Candidate species, SOC=USFWS Species of Concern

Pre-field review summary and field survey results

The bald eagle is occasionally observed in, or in close proximity to the project area, however, there are no nest, winter roosts, or Bald Eagle Management Areas, as designated by the Deschutes National Forest Land and Resource Management Plan, within the project area.

There have been historical sightings of the peregrine falcon on the west side of the Deschutes River near Benham Falls. There are no known nests in the project area.

The bufflehead duck is commonly observed on the Deschutes River that borders the west side of the project area. The bufflehead is a "diving" duck, foraging mostly on aquatic insects, but also aquatic plants and small fish. It nests in small cavities in trees, usually old flicker holes, with most nest sites located within 600 feet of water.

Conclusion

Alternative 1 (No Action) would have **No Effect/No Impact** to PETS wildlife species.

Alternative 2 (Proposed Action) would have **No Effect/No Impact** to PETS wildlife species.

Alternative 3 would have **No Effect/No Impact** to PETS wildlife species.

Project activities occurring during the spring and summer breeding season could disturb nesting buffleheads, and potentially result in direct mortality of nesting ducks and/or young.
The project meets/does not meet all Project Design Criteria I and II of the Deschutes National Forest Programmatic BA (Fiscal Year 2000). There would be **No Effect** on any PETS or C species or associated habitat. The recommendation is to proceed as planned.

Prepared by: Kevin Keown Date: July 15, 2003
Wildlife Biologist

Reviewed by: James C. Lowrie Date:
Supervisory Wildlife Biologist

References

Joint Aquatic and Terrestrial Programmatic BIOLOGICAL ASSESSMENT For Federal lands within the Deschutes Basin Administered by Bureau of Land Management Prineville Office, Deschutes and Ochoco National Forests – 09/29/04

APPENDIX E

BOTANY
BIOLOGICAL EVALUATION (BE) (Page 170)
AND
NOXIOUS WEED RISK ASSESSMENT (Page 172)

Botany Report

Kelsey Vegetation and Fuels Treatments

Environmental Assessment
Bend-Fort Rock Ranger District

Deschutes National Forest

Prepared and Reviewed by: _____ Date: _____

Carolyn M. Close
District Botanist
Crescent Ranger District
Deschutes National Forest

INTRODUCTION

The Botany Report includes two (2) sections:

Section 1: Biological Evaluation (BE), prepared in compliance with the requirements of Forest Service Manual (FSM) 2672.4.

Section 2: Noxious Weed Risk Assessment prepared in compliance with requirements of FSM 2081.3 (November 29, 1995) and the February 3, 1999 Executive Order (13112) on Invasive Species.

SECTION 1: BIOLOGICAL EVALUATION

Effects of activities associated with the Kelsey Vegetation and Fuels Treatments Project are evaluated for those Proposed, Endangered, Threatened, or Sensitive (PETS) plant species on the current Region 6 Forester's Sensitive Plant List (dated May 13, 1999) which are documented or expected to occur on the Deschutes National Forest (DNF). If any project or species list changes occur, this BE will be reviewed for accuracy of the evaluation under the new situation; a re-evaluation may be required to adequately protect PETS plant species.

Table 1: REGIONAL FORESTER'S SENSITIVE PLANTS (1999): DESCHUTES NATIONAL FOREST

Scientific Name	**Common Name**	Listing Status[16]	**Codes[17]**
Agoseris elata	Tall agoseris	ONHP List 2	D
Arabis suffrutescens var. *horizontalis*	Crater Lake rockcress	Sp. Of Concern; ONHP List 1	S
Arnica viscosa	Shasta arnica	ONHP List 2	D
Artemisia ludoviciana ssp. *Estesii*	Estes' artemisia	Sp. Of Concern; ONHP List 1	D
Aster gormanii	Gorman's aster	Sp. Of Concern; ONHP List 1	S
Astragalus peckii	Peck's milk-vetch	Sp. Of Concern; ONHP List 1	S
Botrychium pumicola	Pumice grape-fern	Sp. Of Concern; ONHP List 1	D
Calamagrostis breweri	Brewer's reedgrass	ONHP List 2	S
Calochortus longebarbatus var. *longebarbatus*	Long-bearded mariposa lily	Sp. Of Concern; ONHP List 1	S
Carex hystricina	Porcupine sedge	ONHP List 2	S
Carex livida	Pale sedge	ONHP List 2	S
Castelleja chlorotica	Green-tinged paintbrush	Sp. Of Concern; ONHP List 1	D
Cicuta bulbifera	Bulb-bearing water-hemlock	ONHP List 2ex	S
Collomia mazama	Mt. Mazama collomia	Sp. Of Concern; ONHP List 1	S

[16] **Species of Concern** = Federal Designation; neither Endangered or Threatened; **Oregon Natural Heritage Program (ONHP) List 1:** Contains species which are endangered or threatened throughout their range or which are presumed extinct; **ONHP List 2:** Contains species which are threatened, endangered or possibly extirpated from Oregon, but more common or stable elsewhere; **ONHP List 3:** Contains species for which more information is needed before status can be determined, but which may be threatened or endangered in Oregon or throughout their range.
[17] **D** = Documented; **S** = Suspected

Scientific Name	Common Name	Listing Status[16]	Codes[17]
Gentiana newberryi var. *newberryi*	Newberry's gentian	ONHP List 2	D
Lobelia dortmanna	Water lobelia	ONHP List 2	D
Lycopodiella inundata	Bog club-moss	ONHP List 2	D
Lycopodium complanatum	Ground cedar	ONHP List 2	S
Ophioglossum pusillum	Adder's-tongue	ONHP List 2	S
Penstemon peckii	Peck's penstemon	Sp. Of Concern; ONHP List 1	D
Pilularia americana	American pillwort	ONHP List 2	S
Rorippa columbiae	Columbia cress	Sp. Of Concern; ONHP List 1	S
Scheuchzeria palustris var. *americana*	Scheuchzeria	ONHP List 2	D
Scirpus subterminalis	Water clubrush	ONHP List 2	D
Thelypodium howellii ssp. *Howellii*	Howell's thelypody	ONHP List 2	S

Project Description

See the Kelsey Environmental Assessment for project description.

Methods and Results

Prefield Review

Prefield reviews for all PETS plant species were conducted in April and June 1998. Habitat requirements of all PETS plant species known or suspected to occur on the Bend/Fort Rock Ranger District, Deschutes National Forest were compared with habitats that occur within the planning area.

All DNF PETS plant species and their habitat descriptions are on file at Bend/Fort Rock Ranger District.

Prefield Review Results

The □daho□ld review indicated that two species of PETS plants, *Castilleja chlorotica* and *Artemisia lucoviciana* ssp. *Estesii*, have sites near the Kelsey project area but only *Castilleja chlorotica* had potential habitat in the units to be surveyed in the project area. *Artemisia ludoviciana* ssp. *Estesii* has known sites along the Deschutes River on the western boundary of the Kelsey project area.

Survey Methods

Plant surveys were conducted in Kelsey project units in 1998 and 2000 using methods approved by the Deschutes National Forest. Surveys for other projects in the Kelsey Planning Area were conducted between 1990 and 1998. Surveyors inventoried plant populations and habitats using the controlled intuitive meander method. They traversed at least one-third of the total area of each unit in a semi-random fashion, but biased their search pattern to specifically include all areas that appeared to provide habitat for the suspect plants. The plant survey records are on file at Bend/Fort Rock Ranger District in the Botany files.

Survey Results

Records of surveys show that two (2) species of PETS plants, *Castilleja chlorotica* and *Artemisia lucoviciana* ssp. *Estesii*, have sites near the Kelsey project area. *Artemisia ludoviciana* ssp. *Estesii* has known sites along the Deschutes River on the western boundary of the Kelsey planning area. *Castilleja chlorotica* has potential habitat in some units in the Kelsey Planning Area, however, no sites for PETS plants were found during surveys in any units in the planning area.

Determination

The Kelsey Vegetation and Fuels Treatments Project will not have direct, indirect, or cumulative impacts to habitat, sites, cause a loss of viability or a trend toward Federal listing for *Artemisia ludoviciana* var. *estesii* or for *Castilleja chlorotica.* The vegetation and fuels treatments project will not have direct, indirect, or cumulative impacts to habitat, sites, or cause a loss of viability or a trend toward Federal listing of any other species on the Regional Forester's Sensitive Plant List.

SECTION 2: NOXIOUS WEED RISK ASSESSMENT

FSM direction requires that Noxious Weed Risk Assessments be prepared for all projects involving ground-disturbing activities. For projects that have a moderate to high risk of introducing or spreading noxious weeds, recent Forest Service policy requires that decision documents must identify noxious weed prevention practices and control measures that will be undertaken during project implementation (FSM 2081.03, November 29, 1995). The *Guide to Noxious Weed Prevention Practices* (July 2001) helps identify weed prevention practices that mitigate identified risks of weed introduction and spread that may occur due to Forest Service projects and programs. This Noxious Weed Risk Assessment and Identification of Prevention Practices has been prepared for the Kelsey Vegetation and Fuels Treatments Project.

Aggressive non-native plants, or noxious weeds, can invade and displace native plant communities causing long-lasting management problems. Noxious weeds can displace native vegetation, increase fire hazards, reduce the quality of recreational experiences, poison livestock, and replace wildlife forage. By simplifying complex plant communities, weeds reduce biological diversity and threaten rare habitats. Potential and known weeds for the Deschutes National Forest are listed at the end of this section.

Surveys for noxious weeds were conducted at the same time as the PETS plants surveys. A map with weed site locations in the Kelsey Planning Area is included in the project files. The following table gives information about weed sites in the Kelsey Planning Area found in previous surveys (DNF Weed EA, 1998):

TABLE 2: 1998 Weed Sites

Site number	Species	Location	Treatment	Strategy	Units
6110001	Diffuse and Spotted knapweed	Hwy 97	Chemical Pull	Correction; Treat from south end moving north	50,96-101, 117,130, 147, 152, 268, 269
6110002	Dalmation toadflax, Diffuse knapweed, Spotted knapweed, Bull thistle, Russian thistle	Road 18	Coordinate treatment with county	Prevention, Correction	133,134,137,141
6110003	Scotch thistle	North Paulina Road @ Hwy 97	Pull/clip	Maintenance; Past pulling seems to be successful; site is considered eradicated.	No unit
6110004	Dalmation toadflax; Diffuse and Spotted knapweed	Rd. 40 W of Hwy 97 to Sunriver	Chemical Pull	Prevention, Correction; Coordinate treatment with Sunriver	30, 265-267
6110019	Diffuse and Spotted knapweed	Cottonwood Road, East of Sunriver	Chemical Pull	Correction	68,73-75, 105, 148-150,269
6110021	Dalmation toadflax	NW boundary of Forest W of China Hat Road 18	Pull	Correction; Pulling has been effective; close to eradication	133
6110022	Dalmation toadflax	Rd. 18 S side, W of powerline	Pull	Correction	141
6110056	Dalmation toadflax and spotted knapweed	On NF just S of High Desert Museum	Chemical Pull	Correction	No unit
6110124	Spotted knapweed	Slough Camp	Pull	Correction; Lava Butte SIA	No unit
6110125	Spotted knapweed	Dillon Falls	Pull	Correction; Appears to be near ARLUE site	No unit
6110131	Knapweed Bull thistle	Benham Falls	Pull	Correction; Lava Butte SIA	84-87

Several sites in the proposed 2002 Noxious Weed EA are in the Kelsey Planning Area. These are:

1) new sites,
2) expansion of sites included in the 1998 Weed EA, or
3) sites in the 1998 EA but are now proposing treatment changes.

The following table lists the sites in the proposed 2002 Weed EA in the Kelsey Planning Area.

TABLE 3: 2002 Weed sites

Site number	Species	Location	Treatment	Strategy	Units
1) 6110083	Dalmation toadflax	Rd 18-199	Chemical Pull; Biocontrol	Correction	133
1) 6110090	Spotted knapweed	Mowed areas by Lava Butte	Chemical Pull	Early Treatment	129 (adjacent)
1) 6110096	Dalmation toadflax	Rd 100, south of High Desert Museum	Chemical Pull	Early Treatment	No Unit
1) 6110021 (also see table above)	Dalmation toadflax	Rd 18-199	Pull to Chemical Pull	Correction	133

- Prevention = Prevent further spread of the population.
- Maintenance = Maintain the population at the current level (i.e., either too large to eradicate or not high enough priority for aggressive treatment.
- Correction = Take direct action to reduce the size or eradicate the population.
- Early Treatment = Control the population when both the locations and numbers of plants are few.

RISK ASSESSMENT

- **Presence of known weed populations and whether or not those populations can be avoided**
  - See Table above for information about the known weed sites in the Kelsey Planning Area. These sites are mainly along roads and other disturbed areas. Vehicles and equipment used in the implementation of Kelsey Project activities would not be able to avoid known sites, especially traveling on weed infested roads to and from units.
- **Level of Disturbance**
  - Soil could be displaced and compacted by activities associated with the Kelsey project. Roads may need to be maintained, opened, or constructed. Temporary roads will be needed. Vegetation will be removed by harvest and/or fire creating bare ground.
- **Resource Value**
  - The project area includes the Lava Butte Geologic Area and Newberry National Volcanic Monument, and is adjacent to the High Desert Museum, Sunriver and other subdivisions, and the Deschutes River Benham Falls and Dillon Falls recreation areas. Highway 97 bisects the project area. The Deschutes River is on the western boundary of the Kelsey Planning Area where there are known sites for *Artemisia ludoviciana* spp. *Estesii*, a plant taxon on the R6 Sensitive Plant List.
- **Introduction Vectors**
  - Activities in the planning area include OHV use, heavy equipment, recreation activities, and other activities, including grazing, which can contribute to the introduction and spread of noxious weeds.

RISK DETERMINATION

Analysis of these factors indicates a **HIGH RISK** of the introduction and spread of noxious weeds in the project area. The Forest Service ***Guide to Noxious Weed Prevention Practices*** (USDA Forest Service, July 12, 2001) provides management direction that will help prevent noxious weeds from becoming established or help reduce the spread of noxious weeds that are already established. The ***Guide*** provides a toolbox of ideas for use in mitigating identified weed risks in resource management operations.

Vegetation Management Activities

Alternative 1 (No Action): No proposed harvest, stand improvement, or fuels reduction activities are associated with this alternative for the Kelsey Project, therefore there will be LOW RISK of the introduction and spread of noxious weeds. Other projects that are being implemented or that are planned or proposed for implementation in the Kelsey Project Area and in adjacent areas have been or will be assessed for the risk of the introduction or spread of noxious weeds.

Alternatives 2 – 5: Analysis indicates a HIGH RISK of the introduction and spread of noxious weeds in the project area. The risk rating will vary by alternative, but will be HIGH RISK for all action alternatives. For treatment activities

proposed in the Kelsey Project the weed risk rating will be somewhat lower for Alternative 2 than for Alternatives 3, 4, and 5, since fewer acres are proposed for treatment in Alternative 2.

Determination: If the following noxious weed prevention practices are implemented the risk of the of the introduction and spread of noxious weeds will be significantly lowered.

Weed prevention practices that are <u>required</u> by Forest Service Policy for this project are:

1. For forested vegetation management operations, use equipment cleaning contract provisions WO-C/CT 6.36. ***Applies to all units that are covered in contracts.***

MITIGATIONS

To reduce the risk of the introduction and spread of noxious weeds in the Kelsey Planning area **the following mitigations will apply**:

1. Begin project operations (i.e. commercial and precommercial thinning, prescribed fire, mechanical shrub treatment, etc.) in uninfested areas before operating in weed-infested areas. ***Begin project operations in units that are <u>not</u> listed in the tables above.***
2. To the extent feasible, during mowing and/or burning, avoid mowing over or lighting the obvious high-density cheatgrass spots, such as cattle water sets, hunter camps, or adjacent to roads. ***All units with mowing and/or burning activities proposed where cheatgrass occurs.***
3. To reduce the spread or introduction of cheatgrass in mowing units, leave a 15-20 foot untreated buffer strip along unit edges that lie adjacent to roads. This is often where the greatest amount of cheatgrass seedbank reserves are located; by leaving this zone alone, there will be fewer opportunities for this weed (and any others present) to spread. ***All units with mowing treatment proposed that are adjacent to roads.***
4. Ensure that equipment and vehicles used in prescribed fire projects are free of weed seed and propagules before entering the project area. ***All units with underburn treatment, especially units where cheatgrass occurs.***
5. Clean equipment, before leaving the project site, if operating in areas infested with weeds. ***All units listed in the tables above.***
6. Inspect all limited-term ground-disturbing operations, including temporary roads, in noxious weed infested and uninfested areas for at least three growing seasons following completion of the project. Provide follow-up treatments based on inspection results. (KV funding may be used to inspect KV projects.) Prioritize areas for inspection, and treatment if needed, to make the most efficient use of available funding. ***All units with KV-funded post sale treatments.***

Recommendations

To further reduce the risk of the introduction and spread of noxious weeds **the following recommendations may be applied where appropriate and when practical**:

- ***General***

1. To attempt to minimize the possibility of increased vigor and distribution of cheatgrass, consider planting competing native species, such as yarrow (*Achillea millefolium*) and rabbit brush (*Chrysothamnus viscidiflorus*) within selected mow or mow/burn units where cheatgrass is especially prevalent.
2. Minimize soil disturbance and retain native vegetation in and around project activity areas to the maximum extent possible consistent with project objectives.
3. Where appropriate and practical, stockpile weed-seed-free topsoil and replace it on disturbed areas (e.g. road embankments or landings).
4. In prescribed fire units, use appropriate preparation and suppression tactics to reduce disturbances to soil and vegetation.
5. Provide information, training, and appropriate weed identification materials to people potentially involved in weed introduction, establishment, and spread. Educate them to an appropriate level in weed identification, biology, impacts, and effective prevention measures.
6. Develop incentive programs encouraging weed awareness, detection, reporting, and for locating new invaders. Encourage the formation of Cooperative Weed Management Associations with adjacent landowners.

- ***Timber Harvest Operations***:

1. Treat weeds in project area, emphasizing treatment of weed infestations on existing landings, skid trails, and haul roads before activities commence. ***Units in the above table with harvest treatments.***
2. Train contract administrators to identify noxious weeds and select lower risk sites for landings and skid trails.
3. Encourage operators to maintain weed-free mill yards, equipment parking, and staging areas.

- ***Recreation and Special Management Areas:***

1. Encourage public land users, before recreating on public lands, to inspect and clean motorized and mechanized trail vehicles of weeds and weed seeds.
2. Periodically inspect for weeds all campgrounds, trailheads, and recreation areas that are open to public vehicle use. Treat infestations.
3. Maintain areas of concentrated public use in a weed-free condition. Consider high-use recreation areas, such as Benham Falls, as high priority for weed eradication.
4. Post weed awareness messages and prevention practices at strategic locations such as campgrounds, trailheads, roads, boat launches, and forest portals.

- ***Road Management:***

1. Periodically inspect system roads and rights-of-way for invasion of noxious weeds. Train road maintenance staff to recognize weeds and report locations to the noxious weed coordinator.
2. Treat weeds in road decommissioning and reclamation projects before roads are made impassable. Reinspect and follow up based on initial inspection and documentation.

- ***Wildlife***

1. Periodically inspect and document those areas where wildlife concentrate in winter and spring, resulting in overuse or soil scarification (e.g. deer winter range and key elk areas.

DESCHUTES NATIONAL FOREST NOXIOUS WEED LIST

SCIENTIFIC NAME	COMMON NAME	PRESENCE
Bromus tectorum	Cheatgrass	Documented
Cardaria (=Lepidium) draba	Whitetop	Potential
Carduus nutans	Musk thistle	Potential
Carduus pycnocephalus	Italian thistle	Potential
Centaurea diffusa	Diffuse knapweed	Documented
Centaurea maculosa	Spotted knapweed	Documented
Centaurea pratensis	Meadow knapweed	Documented
Centaurea repens	Russian knapweed	Potential
Centaurea solstitialis	Yellow star-thistle	Potential
Centaurea virgata* var. *squarrosa	Squarrose knapweed	Potential
Cirsium arvense	Canada thistle	Documented
Cirsium vulgare	Bull thistle	Documented
Conium maculatum	Poison hemlock	Potential
Cynoglossum officinale	Common houndstongue	Documented
Cytisus scoparius	Scot's broom	Documented
Dipsacus sylvestris	Teasel	Potential
Euphorbia esula	Leafy spurge	Potential
Hypericum perforatum	St. Johnswort	Documented
Isatis tinctoria	Dyer's woad	Documented
Kochia scoparia	Kochia	Potential
Linaria dalmatica	Dalmation toadflax	Documented
Linaria vulgaris	Butter and Eggs	Documented
Lythrum salicaria	Purple loosestrife	Potential
Onopordum acanthium	Scotch thistle	Documented
Phalaris arundinacea	Reed canarygrass	Documented
Ranunculus repens	Creeping buttercup	Potential
Salvia aethiopsis	Mediterranean sage	Potential
Senecio jacobaea	Tansy ragwort	Documented
Taeniatherum caput-medusae	Medusahead	Potential

The weed species listed above are on the Oregon State Noxious Weed List. *Verbascum thapsus*, common mullein, is not on that list. However, it is of concern on the Deschutes National Forest because it invades disturbed sites, especially past harvest units, and may compete with young trees and other desirable native plants.

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APPENDIX F

HERBICIDE ANALYSIS

Prevention Analysis

What is the nature and role of associated vegetation?

Table 1 lists plant associations (Volland 1985) found in: 1) existing plantations proposed for release treatments and 2) areas to be reforested to ponderosa pine following proposed regeneration harvest. The nature of associated shrub and grass vegetation is briefly described. Grass and shrub species within these plant associations have potential to reduce tree growth. Greenleaf manzanita (Arctostapylos patula) and snowbrush (Ceanothus velutinus) are the shrub species with the greatest potential to be competing and unwanted. Idaho fescue (Festuca idahoensis) and Ross Sedge (Carex rossii) are the grass and sedge species with greatest potential to be competing and unwanted.

Table 1. Plant associations within Kelsey Planning Area.

Plant Association	Plant Association	Native Understory Response to Timber Management[1]	Treatment for Artificial Regeneration[2]
CL-S2-11	Lodgepole/bitterbrush/needlegrass	Decrease in bitterbrush; in squirreltail.	Provide overhead protection.
CPS2-11	Ponderosa/bitterbrush/fescue	Decrease in bitterbrush. Goldenweed, needlegrass and fescue increase.	Scarify fescue.
CPS2-13	Ponderosa/bitterbrush-manzanita/needlegrass	Manzanita, snowbrush, needlegrass increase. Bitterbrush decreases.	Scarify for manzanita.
CPS2-17	Ponderosa/bitterbrush-manzanita/fescue	Increase in Idaho fescue and manzanita. Decrease in bitterbrush.	Scarify fescue.
CWS1-12	Mixed conifer/snowbrush-manzanita	Increase in manzanitas and snowbrush. Bitterbrush decreases.	Scarify for shrubs.

[1] Volland (1985). From Range and Wildlife Section (Pages 93 through 96)
[2] Volland (1985). From Timber Management Section 1 (Pages 97 through 100)

Greenleaf Manzanita (Arctostapylos patula)

The following information is from Zimmerman (1991):

Greenleaf manzanita has the ability to regenerate quickly in areas with frequent fires, allowing it to perpetually dominate a site. Greenleaf manzanita regenerates from seed, sprouts, and layering. Annually it produces seeds in large quantities that lie dormant in the soil. Seeds will germinate when exposed to heat from fire or mechanical scarification. When the plant reaches approximately 2 years of age, greenleaf manzanita is generally able to sprout from dormant buds in the root burl. Layering may occur when manzanita branches are forced to the ground and kept there for long periods of time, such as may occur with a heavy snowfall. With these conditions, branches may sprout roots and develop into separate plants.

Stands of manzanita can live 20 to 100 years. Greenleaf manzanita begins to die back when overtopped by trees, preferring open areas in full sunlight. It is very susceptible to fire due to its stand density, presence of volatile materials in its leaves, low moisture content of foliage during summer, and the persistence of its dead branches and stems.

Growth of ponderosa pine seedlings is severely limited by manzanita, primarily due to competition for water. Established tree seedlings seldom die from the suppressing effects of competing vegetation, but growth loss can be substantial. In one study, greenleaf manzanita crown density of only 25 percent resulted in a nearly 60 percent loss in tree productivity.

On sites where fire is excluded for long periods of time, greenleaf manzanita may provide a better microclimate for some tree seedlings than would exist on harsh sites in full sunlight, and it may enhance soil conditions through the addition of organic material. This could allow for the relatively slow but sure establishment of the seedling of some species of pine.

Snowbrush (Ceanothus velutinus)

The following information is from Conard et.al. (1985):

Snowbrush regenerates from both sprouts and seeds. It is generally a prolific seed producer. Seeds are able to remain viable in the soil for years. Excellent germination has been obtained in Ceanothus seeds known to be 9 to 24 years old. Seeds may remain viable for as long as 200 years. Fire commonly stimulates seed germination, although high soil temperatures caused by solar radiation and mechanical abrasion may also be factors. Because of large numbers of seeds in the soil, even

relatively low germination can be sufficient to produce high densities of Ceanothus shrubs. Sprouting is not the primary means of reproduction in the genus, although most forest species exhibit at least some ability to sprout. Even though disturbance is necessary to stimulate seed germination, fire can be either too frequent or too intense, and can eliminate Ceanothus species. Seed and plants can be destroyed with repeated burning.

Compared to other genera of shrubs, Ceanothus are short lived. Ceanothus is intolerant to shade. This may be due to being shaded out by overtopping vegetation. Overtopping begins to occur at 10 to 75 years on sites where conifers are present. In the Cascade Range, root crowns of mature C. velutinus can be damaged by snow, which can lead to senescence of stands. The functional life span of C. velutinus on many sites in the Cascades is believed to be between 20 and 40 years before shading by conifers and snow damage begin to decrease its vigor.

As with greenleaf manzanita, soil moisture depletion is probably the major factor limiting conifer growth. Ceanothus may have a competitive advantage because it can absorb water from relatively dry soil. Ceanothus is capable of fixing nitrogen, and to a point may be beneficial to the site. It can also provide site amelioration for seedlings by increasing humidity, decreasing wind velocity, and minimizing soil temperatures. Several studies have documented better initial establishment of conifer species under Ceanothus canopies than in the open.

Observations on the district indicate that snowbrush, when not covered by snow, can be damaged by cold temperatures. Damage includes dieback of exposed branches. Observations indicate plant usually sprouts from the root collar following this type of damage.

Idaho fescue (Festuca idahoensis)

The following information is from Zouhar (2000, November):

Idaho fescue is a vigorous, native, long-lived, perennial, cool-season, bunchgrass. It reproduces from seeds and tillers (a shoot that sprouts from the base of a grass). Seed production is variable. Tillering in Idaho fescue arises from a relatively small budding zone within a compact root crown area. In cases of disturbance in which the root crowns survive, tillering may result in rapid increase in plant size in non-competitive environments.

Idaho fescue is a small bunchgrass that can survive light-severity fires. It is usually harmed by more severe fire. Fires burning at 10- to 25-year intervals have neutral to negative effects on this bunchgrass. Rapid tillering occurs when root crowns are not killed and soil moisture is favorable. Plants may re-establish after fire if temperatures are low enough to allow for survival of seed. In a study done on the Fort Rock Ranger District, Idaho fescue resprouted after spring prescribed burns and within 3 months more than 80 percent of the Idaho fescue plants had vigorous growth, with greater production in burned areas than in adjacent unburned areas.

Ross Sedge (Carex rossii)

The following information is from Cope (1992):

Ross sedge is a native, long-lived perennial graminoid. Ross sedge reproduces by rhizome growth and by seed production. Seed may remain dormant for long periods of time prior to germination.

Ross sedge is resistant to fire. It regenerates through rhizomes and seed germination. Recovery is rapid to moderate, taking 2 to 10 years to return to preburn frequency. Ross sedge survives fire through buried seed with long-term viability. These seeds germinate after heat treatment. Ross sedge's rhizomes survive low- to moderate severity fires. Ross sedge increases after fires that heat the soil but do not completely consume duff. Season of fire does not appear to have a major effect on plant recovery.

Do conditions exist that favor the presence of competing and unwanted vegetation?

Conditions are currently most favorable for competing and unwanted vegetation on the site of the Green Mountain Fire (Kelsey Proposed Treatment Unit 106). In 1995 a wildfire burned approximately 223 acres of the west side of Green Mountain. The stand prior to the burn was dominated by ponderosa pine. Area burned included ponderosa pine plantations that had been dozer stripped and planted in the early 1960's. At the time of the fire, an understory of greenleaf manzanita and snowbrush was present. Conditions following the fire, including little live tree cover and scarified seed, favored the growth of greenleaf manzanita (Arctostaphylos nevadensis) and snowbrush (Ceanothus velutinus) from sprouts and seeds.

On remaining sites in the Kelsey Planning Area proposed for treatment, tree canopy cover ranges from 15 to 40 percent, and generally averages approximately 25 percent. Tree canopy cover is currently not high enough to eliminate greenleaf

manzanita, snowbrush, daho fescue, or Ross sedge from the sites. Viable seed for competing and unwanted vegetation is likely present in the soil.

If conditions exist that favor the presence of competing and unwanted vegetation, have past management actions exacerbated the situation?
To meet a variety of objectives, treatments within the past 10 to 30 years have reduced tree canopy cover. Reduced canopy cover has allowed greenleaf manzanita, snowbrush, fescue and sedge to persist at varying levels on the sites.

Within the Green Mountain Fire (Kelsey Proposed Treatment Unit 106), dead trees were salvage logged in 1996 with the Green Labor Fire Salvage Sale (Unit 1). While ground disturbance during harvest may have scarified viable seed in the soil, this would have been minor compared to the scarification that occurred with the fire.

Do natural controls exist on the site?
Tree canopy cover is the primary means of naturally controlling competing and unwanted vegetation. With the exception of the Green Mountain Fire, tree canopy cover is present on all sites and is exerting varying levels of influence on understory vegetation. While tree seedlings are present in the Green Mountain Fire, their canopy cover is currently not high enough to influence competing and unwanted vegetation.

Can management actions be taken that either encourage natural controls or help avoid the conditions that favor the presence of competing and unwanted vegetation?
Management actions that maintain and/or increase tree canopy cover would encourage natural control of competing and unwanted vegetation.

Is it feasible to undertake the management actions, and if not why? If undertaken, are impacts on other Forest Service objectives and goals acceptable?
Where group regeneration harvest is proposed (Table 2), it is not feasible to retain existing level of tree canopy cover. Treatment objectives would not be met. Treatment objectives include either 1) promoting deer hiding cover and vertical stand diversity within deer habitat (WL-5), or 2) evaluating alternative silviculture treatments in even-aged, second growth ponderosa pine stands (RSH).

It is also not feasible to retain existing tree canopy cover where stand regeneration harvest is proposed (Table 2). Treatment objectives to reduce dwarf mistletoe (FH-2) and restore ponderosa pine (PPR) would not be met. It may, however, be feasible in some cases to retain a reduced level of tree canopy cover. Depending on the level of dwarf mistletoe infection, the mistletoe reduction objective could be met by removing trees with moderate to high levels of dwarf mistletoe infection. Need for reforestation could be deferred by not thinning below minimum stocking levels. Retained tree density would not be sufficient to control competing and unwanted vegetation. With no need to reforest the site, control of competing and unwanted vegetation would not be necessary to assure seedling survival and growth. Treatment of brush could still be necessary to reduce risk of stand replacing wildfire.

Table 2. Objectives to be met by proposed regeneration harvest and natural fuels treatments.

Unit	Alternative	Forest Plan Allocation	Prescription	Natural Fuels Treatment	Treatment Objectives			
Group Regeneration Harvest								
14	2	DHB	8	MST/Underburn	WL-5	NF-9	FH-1	
21	2, 3	DHB, GFO	8	MST	WL-5	FH-1	NF-1	
259	2, 3	DHB	93	Underburn	RSH	WL-1	WL-6	NF-1
262	2, 3	GFO	93	Underburn	RSH	NF-4	WL-1	
267	2, 3	GFO, SV1	93	Underburn	RSH	NF-9	NF-2	
442	3	DHB	8	MST/Underburn	WL-5	NF-9	NF-6	
Stand Regeneration Harvest								
7	2	SV2, GFO	6	MST	FH-2	NF-2		
8	2	GFO	6	MST	FH-2	NF-1		
26	2, 3	SV4, SV1, GFO	6	MST	FH-2	NF-3		
27	2	GFO	6	MST	FH-2	NF-3		
36	2	SV2	7	Underburn	PPR	NF-9	NF-2	

58	2	GFO	6	MST	FH-2	NF-1		
59	2	GFO	6	Underburn	FH-2	WL-2	NF-1	
68	2	SV4, GFO	7	MST/Underburn	NF-3	NF-2	FH-1	PPR
258	2,3	DHB	92	MST	RSH	WL-1	WL-6	NF-1
261	2,3	GFO	92	MST	RSH	NF-4	WL-1	
268	2,3	SV1, SV4	92	MST	RSH	NF-9	NF-2	
Conifer Release								
106	2, 3	SV3	0	MST	FH-3	NF-1		

Forest Plan Allocation:

DHB: Deer Habitat
GFO: General Forest
SV1: Scenic Views, Retention, Foreground
SV2: Scenic Views, Partial Retention, Foreground
SV4: Scenic Views, Partial Retention, Middleground

Prescription:

0: Thin plantations
6: Stand regeneration harvest to reduce dwarf mistletoe.
7: Regeneration harvest to restore ponderosa pine.
8: Group Regeneration harvest. Over 30 to 40 percent of the stand, create openings 6 to 12 acres in size.
92: Uneven-aged regeneration harvest. Thin widely for ponderosa natural regeneration. Leave variety of sizes.
93: Group Regeneration harvest. Over 25 percent of the stand, create openings approximately 4 acres in size.

Treatment Objectives:

FH-1: Reduce risk of mountain pine beetle outbreak.
FH-2: Reduce level of dwarf mistletoe infection.
FH-3: Maintain/improve plantation growth.
NF-1: Reduce risk of high intensity/stand replacing wildfire.
NF-2: Create defensible/safe egress route.
NF-3: Reduce wildfire risk within urban interface zone.
NF-4: Protect long term study plots by reducing risk of spotting and crown fire.
NF-9: Create strategic fuel breaks.
PPR: Maintain or increase ponderosa pine dominance.
RSH: Evaluate alternative silvicultural treatments in even-aged, second growth ponderosa pine.
WL-1: Accelerate development of single-story late or old structure (LOS).
WL-2: Accelerate development of multi-story late or old structure (LOS).
WL-5: Promote deer hiding cover and vertical stand diversity within deer habitat.
WL-6: Increase herbaceous and forb species; reduce duff/liter layer.

Damage Thresholds

Table 3 displays action and damage thresholds for vegetative cover. Beyond these thresholds, tree survival and growth objectives would not be met.

The action threshold is the period in time during which an action should take place to keep or reduce vegetation below the damage threshold. Vegetation treatment at this time is usually less expensive and more effective than waiting until damage thresholds occur.

The damage threshold identifies how much associated vegetation is too much to permit meeting a site's management objectives. The damage thresholds for tree survival and growth are based on research data from studies on similar sites (McDonald and Fiddler 1989) and District operational experience. Above these threshold levels, unacceptable reductions in tree survival and tree height and diameter growth would occur. The thresholds for herbaceous vegetation and shrub cover are not additive. Total cover for a site (herbaceous vegetation and shrubs) should be determined and the thresholds (Table 3) for whichever one dominates applied.

Table 3. Action and damage thresholds for tree seedling/sapling growth and survival.

Objective	Herbaceous Cover Thresholds		Shrub Cover Thresholds	
	Action	Damage	Action	Damage
Tree Survival	10%	25%	25%	35%
Tree Growth	10%	10%	15%	20%

Deppmeier (2000, Page 11 to 13) summarizes results from studies assessing the effects of competing vegetation on tree survival and growth. This summary provides additional background information for the establishment of action and damage thresholds.

Alternatives Considered but Not Fully Developed

Recently the Bend-Fort Rock Ranger District analyzed alternatives for treating competing and unwanted vegetation growing around tree seedlings (USDA Forest Service 2000a). Treatment alternatives analyzed for controlling competing vegetation included: 1) No Action,
2) spot application of granular hexazinone, and 3) installation of 6 foot by 6 foot plastic mulch mats. Based on the analysis, the spot application of granular hexazinone was selected as the method for treating competing and unwanted vegetation (USDA Forest Service 2000b). It was decided this treatment would reduce or eliminate competing vegetation from around tree seedlings in an efficient and economic manner. It was found this treatment met the requirements for restocking trees while providing for worker safety and meeting other resource needs.

In this recent analysis, a number of treatment alternatives were considered but eliminated from further consideration. One of the alternatives was scalping (grubbing) the soil with hand tools. The analysis documented that while this treatment can be an effective means of removing grass, it has limited effectiveness because of its short duration of control. Additionally, the analysis stated scalping removes much of the nutrient rich humus layer of soil, thereby decreasing the amount of nutrients available to the seedlings.

Monitoring of herbicide application and the subsequent vegetation response has shown treatment effects have been as described in the environmental analysis (USDA Forest Service 2000a). In the intervening years since the analysis, its been recognized that costs associated with the use for vegetation mats would be higher that those displayed in the economic analysis for the project.

Based on this recent analysis and the associated findings, together with monitoring results, the following treatment alternatives for controlling competing and unwanted vegetation around tree seedlings were considered but not fully developed:

1) Installation of mulch mats around tree seedlings,
2) Scalping (grubbing) unwanted vegetation growing around tree seedlings, and
3) No treatment of competing and unwanted vegetation growing around tree seedlings. Poor seedling survival and growth would result from not treating competing and unwanted vegetation. This would reduce the potential to provide desired deer hiding and thermal cover. In some areas, reduced survival and growth would also reduce potential for meeting timber yield objectives.

A prevention strategy was also considered for treating competing and unwanted vegetation. An alternative incorporating this strategy was not fully developed. Prevention was considered not feasible for meeting treatment objectives (Prevention Analysis, Page 1 to 5).

Herbicide Treatment Description – Alternative 2 (Proposed Action) and Alternative 3

Within 1-2 years following natural fuels treatment (mechanical shrub treatment or underburning), if surveys indicate that shrubs, grasses, or sedges are re-establishing and have potential to exceed the action threshold (Table 3), vegetation would be treated with herbicide within the units identified in Table 4. Plant associations within units proposed for herbicide include the following: CPS2-11, CPS2-13, CPS2-17, and CPS2-12 (Table 1). A second application of herbicide would be done approximately 2 years following initial treatment if surveys indicate competing and unwanted vegetation again has potential to exceed the action threshold.

Treatment would consist of a spot application of a granular form of hexazinone (Pronone^{R}MG). Using a hand-held granular applicator, hexazinone would be applied as dry granules within a
3 foot radius of all planted ponderosa pine (200 to 250 trees per acre). Application rate would be equivalent to 20 pounds of product per acre or 2 pounds of active ingredient (a.i.) per acre. Approximately 13 to 16 percent of an acre would receive an

application of herbicide. Considering the percent of an acre to be treated, approximately 2.6 to 3.2 pounds of product would be applied per acre (.26 to .3 a.i. lbs/acre). Application would occur either in the spring after the ground thaws or in the fall before snowfall.

Pronone^{R}MG consists of particles of an insoluble clay-based material that is surface coated with hexazinone (SERA 1997). The granules have an outer coating of hexazinone-free material that is designed to minimize the formation of dust (SERA 1997).

Hexazinone is an herbicide that inhibits photosynthesis in plants. It is a water-dispersible, general herbicide providing both contact and residual control of many weeds, including annual and biennial weeds, brush, woody vines, and many types of perennial grasses. It can be applied over ponderosa pine without damaging it. Granular forms of this herbicide act through root uptake and movement in an upward direction through the plant.

Hexazinone has been registered for use for general weed control since 1975 and for forestry use since 1977 (U.S. EPA 1994). A Reregistration Eligibility Decision (RED) was completed in September 1994 (U.S. EPA 1994). The Tolerance Reassessment Progress and Risk Management Decision (TRED) for Hexazinone (U.S. EPA 2002) was approved on August 1, 2002.

Table 4. Units and amount of area proposed for herbicide treatment to facilitate reforestation.

Unit	Unit Acreage (Gross)	Alternative 2		Alternative 3	
		Reforestation Acres (Net[1])	Herbicide Treatment on Reforestation Acres (Net[2])	Reforestation Acres (Net[1])	Herbicide Treatment on Reforestation Acres (Net[2])
Group Regeneration Harvest					
14	205	72	11	--	--
21	112	39	6	39	6
259	27	7	1	7	1
262	69	17	2	17	2
267	69	17	2	17	2
442	269	--	--	94	14
Subtotal	--	152	22	174	25
Stand Regeneration Harvest					
7	80	32	5	--	--
8	46	18	3	--	--
26	102	41	6	41	6
27	47	19	3	--	--
36	14	6	1	--	--
58	41	16	2	--	--
59	15	6	1	--	--
258	46	12	2	12	2
261	44	11	3	11	3
268	84	21	3	21	3
Subtotal	--	182	29	85	14
Total Acres	--	334	51	259	39

[1]For group regeneration harvest, net acreage is 25 to 35 percent of gross unit acreage.
For stand regeneration harvest, net acreage is 40 percent of gross unit acreage.
[2]Assumes 15 percent of net reforestation acres.

Herbicide Mitigation Measures
District experience in a similar application of hexazinone indicates the following mitigation measures will be effective in limiting public exposure to the herbicide.

1. Public notification will be used for all applications requesting that people who know or suspect that they are hypersensitive to herbicides contact the Forest Service to determine appropriate risk management measures.

2. Areas treated with herbicides would be posted with public warning signs. The signs would be posted along roads, OHV trails, or other points where people would be likely to enter a unit. Signs would include the treatment date, the activity performed and who to contact for further information. Signs would remain up for at least 48 hours.

Effects and Risk Analysis

Components of a risk assessment include an evaluation of hazard, exposure, and risk. A methods information profile on herbicides (USDA 1994) defines these terms as follows:

Hazard: the characteristic of an object or substance that can inflict injury or illness.

Exposure: the opportunity to receive a dose, which is the amount of a potentially harmful substance actually encountered by an organism.

Risk: the likelihood of illness or injury based on the results of hazard and exposure evaluation.

Risks associated with the application of selected formulations of hexazinone were evaluated in a human health and ecological risk assessment (SERA 1997). This assessment (hereafter referred to as the SERA risk assessment) was commissioned by the Forest Service to assess the risk of using hexazinone in applications that are specific to Forest Service programs. In a report submitted to the Forest Service (SERA 2002, hereafter referred to as the SERA report), the following three specific toxicological endpoints considered in risk assessments were addressed: neurotoxicity, immunotoxicity, and endocrine disruption. The SERA risk assessment and the SERA report provide the basis for assessing risks associated with the proposed application of herbicide. Pronone^{R}MG, the product proposed for use with this project, is one of the commercial formulations containing hexazinone covered by the SERA risk assessment. The proposed application rate of the product (.26 to .30 a.i[18]. lbs/acre) is at the low end of the application rates (0.3 to 2.5 a.i. lbs/acre) displayed in the risk assessment (SERA 1997, Page 2-6, Table 2-3).

The Plantation Herbicide Environmental Assessment (USDA Forest Service 2000a) provides an additional basis for describing effects associated with proposed herbicide application. The assessment is applicable to the Kelsey proposal. The herbicide product, herbicide application method, and environmental conditions are similar in both proposals.

Human Health

Affected Environment

Of the units proposed of herbicide application (Table 4), Units 258 and 259 are closest to private land. Unit 258 is approximately 1,600 feet (.3 mile) south of private property and approximately 3,700 feet (.7 mile) southeast from human habitation[19]. Unit 259 is approximately 3,200 feet (.6 mile) south of private property and approximately 5,300 feet (1 mile) southeast from human habitation. These units are approximately 4,200 to 5,300 feet (.8 to 1 mile) southeast of the High Desert Museum. Remaining units proposed for herbicide application are 1 to 4.5 miles from the boundary of other landowners.

There are no developed recreation sites within or adjacent to units proposed for herbicide treatment. Dispersed recreational use would be the primary recreation use of the treatment areas. Dispersed recreation would include Off Highway Vehicle (OHV) use and hunting. The Kelsey Planning Area is not open to public woodcutting.

Alternative 1 – No Action

Direct, Indirect, and Cumulative Effects

There would be no effects other than those described for the broader no action alternative.

Alternative 2 (Proposed Action) and Alternative 3

Hazard Evaluation

Overview: The SERA risk assessment describes hazards associated with the use of hexazinone. The following are excerpts are from the hazard overview (SERA 1997, Page 3-1).

The toxicity of hexazinone is relatively well characterized in experimental mammals. The acute toxicity[20] of hexazinone is low, with oral LD_{50}[21] values in experimental mammals ranging from approximately 500 to 3500 mg/kg. There are no

[18] a.i. lbs/acre (Definition) – Active ingredient pounds per acre.

[19] Human habitation considered to be structures visible on 1995 Aerial Photos.

[20] Acute Toxicity (Definition) – the amount of a substance, as a single dose, to cause poisoning in a test animal (USDA 1992).

remarkable or systemic differences in sensitivity among various species. The effects observed in mammals after subchronic[22] or chronic[23] exposure to hexazinone are generally limited to decreases in body weight, increases in liver weight, and changes in blood enzyme levels associated with liver toxicity. At doses that are substantially greater than the threshold for systemic toxic[24] effects, hexazinone may cause reproductive effects, including kidney abnormalities and/or delayed ossification[25] as well as decreases in the survival rate of offspring in experimental mammals.

There are limited data suggesting that hexazinone may be a carcinogen. These data are limited to a 2-year bioassay in mice in which females but not males had a slight increase in the total number of malignant tumors. The U.S. EPA judged that this dose-response pattern is equivocal evidence (*not entirely negative, but not convincingly positive*) for carcinogenity and designated hexazinone as Class D not classifiable as to human carcinogenicity.

Both powdered and liquid formulations of hexazinone as well technical grade hexazinone are shown to be moderate to severe eye irritants. The available human data suggest that dust associated with the application of some batches of granular formulations may be sufficiently dense to cause symptoms of eye and respiratory irritation in workers.

Dermal exposure is the primary route of concern for workers. The available data indicate that the dermal toxicity of hexazinone is relatively low and that hexazinone is not well absorbed after dermal exposure. Nonetheless, an occupational study of workers applying a granular formulation of hexazinone indicates that dermal absorption will occur.

Mutagenicity
There is a lack of mutagenic activity of hexazinone in several *in vivo*[26] and *in vitro*[27] bioassays, although one bioassay for chromosomal damage was positive (SERA 1997, Page 3-4).

Neurotoxicity, Immunotoxicity, and Endocrine Disruption
According to the SERA report, "there is no scientific basis for asserting that hexazinone causes specific toxic effects on the nervous system, immune system, or endocrine function" (SERA 2002, Page xiii). The following are excerpts from this report.

<u>*Neurogical Effec*</u>The nervous system is the basis for learning and thinking, sensory perception and movement, behavior and emotion, and regulation of many of the important functions of the cardiovascular system and other internal organs. Chemically-induced impairment of the nervous system *(neurotoxicity)* can produce a variety of effects, collectively referred to as *neurologic effects*, which can encompass any of the above functions and behaviors. *Neurotoxicants* are chemicals that disrupt the function of nerves, either by interacting with nerves directly or by interacting with supporting cells in the nervous system. (SERA 2002, Page viii)

There is no evidence for hexazinone having a direct neurotoxic effect in humans or other animals. Studies designed specifically to detect impairments in motor, sensory, or cognitive functions in mammals or other species exposed subchronically or chronically to hexazinone have not been conducted. These studies have not been conducted because the clinical and experimental toxicology experience with hexazinone provide no reason to suspect a neurotoxicity potential. (SERA 2002, Page ix)

<u>Immunologic Effects</u>
Immunotoxicants are chemical agents that disrupt the function of immune system. These agents can impair immune responses *(immune suppression)* or produce inappropriate stimulation of immune responses *(hyperreactivity)*. Suppression of immune responses to microbes or abnormal cells can enhance susceptibility to infectious diseases or cancer. *Hyperreactivity* can give

[21] LD_{50} (Definition) – Lethal Dose – The dose of a chemical calculated to cause death in 50% of a defined experimental animal population over a specified observation period. The observation period is typically 14 days. (SERA 1997).
[22] Subchronic Exposure (Definition) – An exposure duration that can last for different periods of time, but 90 days is the most common test duration (SERA 1997).
[23] Chronic Exposure (Definition) – Long-term exposure studies often used to determine the carcinogenic potential of chemicals (SERA 1997).
[24] Systemic Toxicity (Definition) – Effects that require absorption and distribution of a toxic agent to a site distant from its entry point at which point effects are produced (SERA 1997).
[25] Ossification (Definition) – The natural process of bone formation (Webster 1984)
[26] In vivo (Definition) – Occurring in the living organism (SERA 1997)
[27] In vitro (Definition) – Isolated from the living organism and artificially maintained, as in a test tube (SERA 1997).

rise to *allergy* or hypersensitivity, in which the immune system or genetically predisposed individuals inappropriately responds to chemical agents (e.g., plant pollen, cat dander, flour gluten) that pose no threat to other individuals or *autoimmunity*, in which the immune system produces antibodies to self components leading to destruction of the organ or tissue involved. (SERA 2002, Page ix)

There is very little direct information on which to assess the immunotoxic potential of hexazinone. The only information with which to assess the potential immune suppressive effects of hexazinone is largely indirect. Hexazinone has been subject to a large number of standard toxicity studies required for pesticide registration by the U.S. EPA. Although these studies are not designed to specifically detect changes in immune function, significant effects on immune function would likely be evidenced by observable changes in lymphoid tissue as well as changes in differential blood cell counts and an increase in the incidence of animals with infection. No such effects are reported by the U.S. EPA in the RED and such effects were not encountered in the risk assessment prepared by SERA. While chronic studies on hexazinone cannot rule out the possibility of immunologic effects, they provide no evidence that such effects occurred. (SERA 2002, Page xi)

Endocrine Disruption

The endocrine system participates in the control of metabolism and body composition, growth and development, reproduction, and many of the numerous physiological adjustments needed to maintain constancy of the internal environment *(homeostasis)*. The endocrine system consists of endocrine glands, hormones, and hormone receptors. (SERA 2002, Page xi)

Hexazinone has not undergone evaluation for its potential to interact or interfere with the estrogen, androgen, or thyroid hormone systems. Extensive testing in experimental animals provides reasonably strong evidence against hexazinone being an endocrine disruptor. Epidemiological studies of health outcomes of hexazinone have not been reported, nor is there clinical case literature on human hexazinone intoxication. Nonetheless, several long-term experimental studies in dogs, mice, and rats have examined the effects of exposure to hexazinone on endocrine organ morphology, reproductive organ morphology, and reproductive function; treatment-related effects on these endpoints were not observed. In addition, hexazinone did not produce abnormalities in frog embryos at exposures below the LC_{50}. (SERA 2002, Page xiii)

Metabolites

The following are excerpts from the SERA risk assessment.

Hexazinone is metabolized extensively in plants and animals, with little parent product recovered in tissue. There is relatively little information available regarding the toxicity of the metabolites. The relative paucity of information about the toxicity of these metabolites does not have a significant impact on this risk assessment. The toxicity studies on which the hazard identification and subsequent dose-response assessment are based involve *in vivo* exposure to hexazinone, and, presumably, the subsequent formation of hexazinone metabolites. Therefore, the toxicological effects, if any, of the metabolites are likely to be captured by animal toxicology studies involving whole-body exposure to hexazinone. (SERA 1997, Page 3-8)

Inert Ingredients

The following are excerpts from a discussion on herbicide formulations in the Pesticide Fact Sheet for hexazinone (Information Ventures, Inc 1995).

Commercial hexazinone products generally contain one or more inert ingredients. An inert ingredient is anything added to the product other than an active ingredient. The U. S. Environmental Protection Agency (EPA) announced its policy on toxic inert ingredients in the Federal Register on April 22, 1987 (52 FR 13305). The EPA's strategy for the implementation of this policy included the development of four lists of inerts based on toxicological concerns. Inerts of toxicological concern were placed on List 1. List 1 inerts must be identified on the product label. Potentially toxic inerts/high priority for testing were placed on List 2. Inerts of unknown toxicity were placed on List 3 and inerts of minimal concern were placed on List 4.

The product label for Pronone MG (Pro-Serve, Inc 1994) indicates 10 percent of the product formulation is active ingredient (Hexazinone) and 90 percent is inerts. The Material Safety Data Sheet for PRONONE^{R}MG (Pro-Serve 1999) lists one inert ingredient: Pluronic L61. The Material Safety Data Sheet (MSDS) for Pluronic L61 (BASF Corporation 2002) indicates this ingredient is a surfactant. This surfactant (Pluronic L61) is included on the EPA's List 4B of inert ingredients found in pesticides (U.S. EPA 2003b). Inerts found on List 4B have sufficient data to substantiate they can be used safely in pesticide products (U. S. EPA 2003a). List 4B inerts are generally recognized as safe by the EPA.

The following excerpts are from the SERA risk assessment.

Based on references from the published literature, the major component of granular formulations of hexazinone appears to be clay. Based on the acute toxicity of these formulations relative to technical grade hexazinone, there is no indication that the

carriers contribute to the toxicity of the granular formulations of hexazinone. If anything, the granular formulations of hexazinone appear to be slightly less toxic than hexazinone itself. This is also evident in the aquatic toxicity studies using formulations relative to hexazinone itself. (SERA 1997, Page 3-10)

Exposure Evaluation
Workers: Occupational exposure generally involves inhalation and dermal exposure, with the dermal route generally contributing far more to exposure than the inhalation route (SERA, 1997, Page 3-11).

With the proposed application of hexazinone, workers would likely be exposed to doses less than those assumed in the SERA risk assessment. The proposed application rate of .26 to .32 pounds active ingredient per acre is less than the application rate (1 a.i. lb/acre) assumed in the
SERA risk assessment (SERA 1997, Page 3-15).

With the proposed application of herbicide, worker exposure to hexazinone would be limited by the following: method of application, vegetation and ground conditions, use of personal protective equipment, and restricted entry into the treatment area for 48 hours following herbicide application. The tool used for applying the herbicide would direct the herbicide down to the ground, minimizing potential for the herbicide to come in dermal contact with the worker. Herbicide would be applied on a relatively small percent of each site (approximately 13 to 16 percent of an acre). In a treatment area there would be a low potential of walking through an area treated with herbicide. Shrubs or grasses that resprout following prescribed underburn and mechanical shrub treatments would be generally less than 1 foot tall. With this vegetation condition and the application method, there would be limited potential for workers to have dermal exposure by rubbing against herbicide intercepted by vegetation. All sites proposed for application of herbicide are on relatively flat ground, with slopes ranging from 5 to 10 percent. Potential for falling and coming in contact with herbicide on the ground would be limited.

Greatest potential for inhalation of dust from the granular form of hexazinone would occur when loading the spot-applicator with herbicide. Use of a respirator or mask during the loading process would minimize the potential for dust inhalation.

Public
In the FEIS Characterization and Management of Risk (USDA Forest Service 1988) it was identified that members of the public may be exposed to herbicide drift, to vegetation with herbicide residues, and to accidental spraying. It also identified they could eat food or drink water with herbicides residues. These routes of exposure are similar to those analyzed in the SERA risk assessment. Under normal conditions, members of the general public should not be exposed to substantial levels of hexazinone (SERA 1997, Page 3-18).

With the proposed spot application of granular hexazinone, exposure of the public to the herbicide would be limited. There would be no potential for the public to receive a dermal dose of the herbicide from drift or from accidental direct spraying. Following herbicide application, potential for coming in contact with herbicide found on vegetation or the soil would be relatively low. Treatment areas would be signed to restrict entry for 48 hours. Herbicide would be applied on a small percent of each site (approximately 13 to 16 percent of an acre). Public use of the treatment areas is relatively low and infrequent. Given the type of vegetation in the proposed treatment areas, there is little to no potential the public would consume plants from the area that might have herbicide residues.

Potential for the public to be exposed to water with herbicide residues would be low. With the proposed method of herbicide application and the lack of surface water in the immediate vicinity of the treatment units, there is no potential the public would drink surface water contaminated with herbicide residues. Exposure by way of groundwater contamination should be minimal due to the great depth to groundwater (see effects on water, page 20).

Risk Evaluation
Overview: The U.S. Environmental Protection Agency (EPA) has conducted risk assessments for hexazinone as part of the reregistration process and has determined that the registration for this herbicide should be maintained because the herbicide can be used without significant risk to humans or wildlife (SERA, 2002, Page vii).

The SERA risk assessment (SERA 1997) used a hazard quotient to characterize risk for workers and the general public. The following excerpts from the assessment describe how the hazard quotient was determined and what interpretation can be made regarding the quotient.

Risk is characterized as the hazard quotient, the ratio of the anticipated level of the exposure to some index of acceptable exposure or exposure associated with a defined risk. Thus, if the hazard quotient is less than unity[28], concern for the exposure is minimal. As the hazard quotient increases above unity, concern also increases.
The index used in the hazard quotient is the reference dose (RfD[29]) for hexazinone.

Workers
Risk characterization for occupational exposure to hexazinone, excluding accidental or incidental exposures, is summarized in the SERA risk assessment (SERA 1997, Page 3-29, Table 3-5). Proposed spot application of hexazinone would be most similar to the treatment method displayed in the table titled "directed foliar and spot treatments". In the assessment, the hazard quotient calculated for this treatment method is 0.3 (with a range of 0.004 – 18). In the assessment, an application rate of 1 lb a.i./acre is assumed. Given the lower application rate proposed with this treatment (.26 - .32 lb a.i./acre), hazard quotients at the low end of the range would be expected.

Risk characterization for workers after accidental or incidental exposure to hexazinone is summarized in the SERA risk assessment (SERA 1997, Page 3-30, Table 3-6). For granular formulations, the assessment considered the potential for dust from the granules coming in contact with the skin and the hexazinone dissolving from the granules into perspiration. The longer-term accidental scenarios – wearing contaminated gloves and dermal contact with dust- yield hazard quotients that should be regarded with a high level of concern (SERA 1997,
Page 3-31). The potential for adverse reproductive effects in female workers is plausible (SERA 1997, Page 3-31).

Public
Risk characterization for the general public is summarized in the SERA risk assessment
(SERA 1997, Page 3-32, Table 3-7). Most routine exposure scenarios lead to estimated daily doses in the range of 0.001-0.006 mg/kg/day (SERA, 1997, Page 3-11). This is less than the most recently derived RfD for hexazinone of 0.05 mg/kg/day. Only the exposure scenario of a naked child receiving a direct spray of hexazinone resulted in a hazard quotient greater than unity. As discussed in the exposure analysis for this herbicide application, there would be no potential for this type of exposure to occur.

In characterizing the risk of hexazinone, the SERA risk assessment (SERA 1997, Page 3-33) identified a sensitive subgroup of people. The following excerpt is from the assessment.
Because hexazinone was demonstrated to induce fetal resorptions, pregnant women are an obvious group at increased risk. This group is given explicit consideration and is central to the risk characterization. There are no other reports in the literature suggesting subgroups that may be sensitive to hexazinone exposure. There is no indication that hexazinone causes sensitization or allergic responses. Nonetheless, this does not negate the possibility that some individuals with multiple chemical sensitivity may be sensitive to hexazinone as well as many other chemicals.

Cumulative Effects
Within the next 5 to 10 years, OHV trails may be developed within or adjacent to the following units proposed for herbicide treatment:
Alternative 2: Units 7, 8, 14, 21, and 259
Alternative 3: Units 21, 259, and 442
Where trails enter or are adjacent to areas treated with herbicide, signs would be posted for
48 hours to warn trail users (Mitigation Measure). Potential for trail users to be exposed to herbicide would be minimized. There would be no change in the risk evaluation done for members of the general public (Page 15, Section 6.1.3.3.3).

The U.S. EPA evaluated the dietary risks associated with hexazinone. It determined there is a reasonable certainty that no harm to any population subgroup will result from aggregate exposure to hexazinone when considering dietary, drinking water and residential exposure and all other non-occupational sources of pesticide exposure for which there is reliable information (U.S. EPA, 2002).

Terrestrial Plants
Affected Environment

[28] Unity (Definition) – the number 1 (Webster 1984).
[29] Reference Dose (RfD) (Definition) – a daily dose which is not anticipated to cause any adverse effects in a human population over a lifetime of exposure. These values are derived by the U.S. EPA. (SERA 1997)

Areas proposed for herbicide application are in the following plant associations (Volland 1985):
Ponderosa pine/bitterbrush/fescue (CPS2-11),
Ponderosa pine/bitterbrush-manzanita/needlegrass (CPS2-13), and
Ponderosa pine/bitterbrush-manzanita/fescue (CPS2-17).
Greenleaf manzanita, snowbrush, Idaho fescue, and Ross Sedge are the dominant species with potential to be competing and unwanted vegetation (See Prevention Analysis, Page 1 to 3).

Alternative 1 (No Action)
Direct, Indirect, and Cumulative Effects
There would be no effects other than those described for the broader no action alternative.

Alternative 2 (Proposed Action) and Alternative 3
Hazard Evaluation
The following excerpt is from the SERA risk assessment.
The toxicity to terrestrial plants is well characterized, as is true for most herbicides. Hexazinone acts by inhibiting photosynthesis. In addition, hexazinone also inhibits the synthesis of RNA, proteins, and lipids. Hexazinone is absorbed readily by plant roots, and once absorbed, is translocated readily in most species. Although some foliar absorption may occur, the major route of exposure involves the washing of hexazinone from the soil surface to the root system of plants, where hexazinone is absorbed readily. The differential toxicity of hexazinone to various plant species is based on variations in the ability of different plants to absorb, degrade, and eliminate the herbicide. (SERA 1997, Page 4-1)

Hexazinone would be toxic to non-conifer plants. It would be non-toxic to ponderosa pine. Expected toxicity is consistent with vegetation response observed on the Bend/Fort Rock Ranger District following the application of hexazinone.

Exposure Evaluation
Vegetation within approximately a three foot radius around ponderosa pine seedlings would be directly exposed to the herbicide. Approximately 13 to 16 percent of each unit proposed for herbicide application would be exposed to the herbicide. Nontarget terrestrial plants may be exposed to the herbicide through unintended direct deposition and soil transport (SERA 1997, Page 4-9).

Risk Evaluation
Outside the area of direct herbicide application, there would be limited potential for nontarget terrestrial plants to be exposed to hexazinone. Ground applications of granular formulations of hexazinone should be associated with little significant drift (SERA 1997, Page 4-19). There would be limited potential for nontarget plants to be exposed to herbicide through soil transport. Slopes are relatively gentle (5 to 10 percent) in the areas proposed for herbicide treatment. The areas also receive relatively low levels of precipitation. Monitoring of the granular application of hexazinone on the Bend/Fort Rock Ranger District has shown little mortality of vegetation has occurred beyond the circle of direct herbicide application (Matt Deppmeier, 2003, Reforestation Forester, Bend-Fort Rock Ranger District, Personal Communication).

Proposed herbicide application will not eradicate any plant species or population of vegetation. A relatively small percent of each treatment unit would be treated with herbicide.

Cumulative Effects
Reasonably foreseeable future actions, in combination with proposed herbicide application, will have no cumulative effects.

Terrestrial Animals

Affected Environment
There are no known bird nests within the units proposed for treatments. It may be assumed that the units would provide habitat either as forage, hiding cover, or nesting substrate for birds.

Alternative 1 (No Action)
Direct, Indirect, and Cumulative Effects
There would be no effects other than those described for the broader no action alternative.

Alternatives 2 (Proposed Action) and Alternative 3
Hazard Analysis

The following excerpts are from the SERA risk assessment (SERA 1997, Page 4-1):
The toxicity of hexazinone to terrestrial wildlife species, particularly invertebrates, is not well characterized. Consequently, the assessment of effects on terrestrial species is based primarily on the available data on experimental mammals. Exposure to hexazinone is associated with decreased weight gain and reproductive effects in several standard test species, including rats, dogs, and rabbits.

The SERA risk assessment (SERA 1997, Page 4-2) reported there is some evidence suggesting that soil microarthropods may be sensitive to hexazinone treatments. Two recent studies assessed the direct (toxic) and indirect (removal of vegetation) effects of herbicide application on soil microorganisms and arthropods. The following excerpts are from preliminary findings assessing the direct effects of hexazinone on soil biota and processes (Busse et al 2001).
No evidence was found of detrimental effects of hexazinone on microbial and arthropod populations when applied at the recommended field rate. Hexazinone had little or no measurable effect on microbial community size, activity, or function. There were no significant differences in numbers of mites, spiders, beetles, or springtails between hexazinone and control treatments. There were minor shifts in arthropod assemblage structure, but all appear to be transitory and none were statistically significant. Results suggest that hexazinone treatment does not disrupt microbial communities or soil arthropod assemblages. The results of this study raise no concern about direct toxic effects of hexazinone for the soil organisms and processes that were measured.
In an earlier study, the indirect effect of vegetation removal resulting from herbicide application was found to be inconsequential to soil biota (Busse et al 2001).

Exposure Analysis
The following excerpts are from the SERA risk assessment:
Terrestrial animals may be exposed to any applied herbicide from direct spray, the ingestion of contaminated media (vegetation, prey species, or water); grooming activities; indirect contact with contaminated vegetation; or inhalation. (SERA 1997, Page 4-4)

It is possible that in addition to consuming contaminated vegetation, certain wildlife species may directly consume granules that contain hexazinone, particularly those granules that are applied dry. For example, birds may consume pellets or granules based on size, color, or texture of the particles. Although there are no reports in the literature suggesting that birds will consume any of the granular formulations of hexazinone, there is no information suggesting that birds will avoid these granules. (SERA 1997, Page 4-8)

Risk Analysis
The U.S. EPA has conducted risk assessments for hexazinone as part of the reregistration process and has determined that the registration for this herbicide should be maintained because the herbicide can be used without significant risk to humans or wildlife (SERA, 2002, Page vii). The following excerpt is from the SERA risk assessment (SERA 1997, Page 4-18).
There is little indication that hexazinone is likely to cause adverse effects in terrestrial animal species. The consumption of contaminated water or vegetation yields hazard indices that are well below a level of concern at any plausible application rate either immediately after hexazinone applications or over prolonged periods after applications.

A potential exception to this exposure assessment involves a scenario in which birds consume hexazinone granules immediately after application; in which case, reproductive effects and possibly overt signs of toxicity might occur. The plausibility of this risk for birds, however, is questionable. There are no data indicating that birds will consume any of the granular formulations that contain hexazinone. Thus, a lower limit on the exposure assessment is zero. If birds were to consume these granules preferentially, exposure levels could be much higher. In that case, toxic effects including mortality could occur. Without additional information with which to improve the exposure assessment, this risk cannot be characterized further.

The minor reduction of vegetation associated with proposed herbicide application would have little to no effect on wildlife populations. Proposed application of herbicide would reduce vegetation on approximately 51 acres (Alternative 2) to 39 acres (Alternative 3). This is approximately 15 percent of each unit proposed for herbicide treatment. This acreage is less than 1 percent (0.1%) of the portion of the planning area that isn't in lava flows.

Cumulative Effects
Reasonably foreseeable future actions, in combination with proposed herbicide application, will have no cumulative effects.

Aquatic Species

Affected Environment

The Deschutes River, adjacent to the Kelsey Planning Area, is home to a variety of aquatic species. Within the Kelsey Planning Area, there is limited habitat for the following amphibians: the Pacific Chorus Frog and the Western Toad.

Alternative 1 (No Action)

Direct, Indirect, and Cumulative Effects

There would be no effects other than those described for the broader no action alternative.

Alternative 2 (Proposed Action) and Alternative 3

Hazard Analysis

The following excerpt is from the SERA risk assessment (SERA 1997, Page 4-1).

The toxicity of hexazinone to aquatic species is well-characterized. Comparable studies on aquatic algae and aquatic animals clearly indicate that most algal species are much more sensitive to hexazinone compared with fish and aquatic invertebrates. Other than lethality, the most common effect noted on aquatic animals is growth inhibition, which is also the most sensitive effect in experimental mammals. Only one study regarding amphibians was located, and it suggests that amphibians are less sensitive than fish or aquatic invertebrates to hexazinone.

Exposure Analysis

In the aquatic environment, exposure levels can be characterized simply as concentrations of hexazinone in water (SERA 1997, Page 4-14). With the proposed application of herbicide, there is limited to no potential for hexazinone to be transported into the Deschutes River. Aquatic species within the Deschutes River would not be exposed to the herbicide. There would be limited potential for amphibians to be exposed to hexazinone. Application of herbicide is not proposed in areas considered amphibian habitat.

Risk Analysis

With no habitat present in units proposed for herbicide treatment, there would be limited potential for amphibians to receive a toxic dose of hexazinone.

Cumulative Effects

Reasonably foreseeable future actions, in combination with proposed herbicide application, will have no cumulative effects.

Water

Affected Environment

The Deschutes River is adjacent to the northwest boundary of the Kelsey Planning Area. Within the planning area, there is no surface water and there are no known springs. During spring snow melt and storm events, very little above ground flow of water occurs. This is due to coarse soil textures with high infiltration rates, relatively low annual precipitation[30], and relatively flat ground. Within the planning area, groundwater is estimated to be 100 to 800 feet below the surface (Larry Chitwood. 2003. Geologist. Deschutes National Forest. Personal communication). Groundwater would be closest to the surface in the vicinity of Sunriver.

Hexazinone is persistent and mobile in soils and therefore could contaminate groundwater (Information Ventures, Inc. 1995). Movement of hexazinone through the soil profile was assessed on the Bend-Fort Rock Ranger District of the Deschutes National Forest between 1998 and 1999 (Herbicide Grass Control Demonstration Project, Deschutes National Forest). Sub-surface soil samples were taken at a depth of 15 centimeters (6 inches). Samples were taken 1 month, 6 months and 12 months following herbicide application. Sample results generally indicate the herbicide does not appear to be moving into the 15 cm depth and persisting
(Craigg 2000, Sussman 1998). Soil types in units proposed for herbicide treatment are similar to those in the demonstration project. Within the Kelsey Planning Area, movement of hexazinone through the soil profile is expected to be similar to that found in the demonstration project.

Alternative 1 (No Action)

Direct, Indirect, and Cumulative Effects

[30] Approximately 15 inches annual precipitation (Larsen 1976)

There would be no effects other than those described for the broader no action alternative.

Alternative 2 (Proposed Action) and Alternative 3
Direct and Indirect Effects
No effects on water quality are expected with the proposed application of herbicide.

Surface ground water contamination is not expected to occur. The closest application of herbicide to the Deschutes River would be approximately 1.7 miles away from the river (Unit 27, Alternative 2 and Unit 327, Alternative 3). With the manual application of herbicide, there is no potential for herbicide to be directly applied to the river. After application there would be limited to no potential for the herbicide to come in contact with the river. This is due to the distance of the units from the river and the limited potential for herbicide to be transported by overland flow of water.

Groundwater contamination is not expected to occur. Based on the soil sampling results from the Herbicide Grass Control Demonstration Project and the depth to the water table, herbicide would not be expected to move down to the level of groundwater.

Cumulative Effects
Reasonably foreseeable future actions, in combination with proposed herbicide application, will have no cumulative effects.

Soil
Affected Environment
Soil types in areas proposed for herbicide treatment were identified using the Deschutes National Forest Soil Resource Inventory (Larsen 1976). They include the following map units:
64, 65, 6B, 6J, LE, LG, LK, and LX. These soils are similar to those described in the Plantation Herbicide Environmental Assessment (USDA Forest Service 2000).

Soils have developed in volcanic ash deposits originating from Mt. Mazama (Crater Lake) and overlay other older volcanic materials. They have a sand or sandy loam soil surface texture. Thickness of the volcanic ash layer ranges from a depth of 28 inches to greater than 60 inches. Some of these soil types have a subsurface soil layer of finer residuum soil material over bedrock. Others have volcanic ash directly over bedrock. Others have volcanic ash directly over bedrock.

Water infiltration rate in these soil types is rapid[31]. Permeability is rapid[32] to very rapid[33] in the surface layers and rapid in subsurface layers. Organic matter contents in surface horizons ranges from 2 to 4 percent. Non of the soil types are considered sensitive as defined in the Deschutes Forest Plan, Appendix 14. Productivity on these soil types is generally moderate. Concern for reforestation includes frost, drought, and competition with brush, grasses, sedges.

Alternative 1 – No Action
Direct, Indirect, and Cumulative Effects
There would be no effects other than those described for the broader no action alternative.

Alternative 2 (Proposed Action) and Alternative 3
Direct and Indirect Effects
Hexazinone may remain in the soil at low concentrations for up to three years after application (Information Ventures, Inc. 1995).

The following information on soil effects is excerpted from the Plantation Herbicide Environmental Assessment (USDA Forest Service 2000a):
Hexazinone is broken down primarily by soil microorganisms and may also be degraded by light. Degradation rates for hexazinone depend on temperature and precipitation as well as soil type. According to the label, hexazinone is expected to

[31] Rapid Infiltration: water rarely ponds, enters soil surface very rapidly (Larsen, 1976).
[32] Rapid Permeability: water or air moves in and through the soil material at a rate of 5 to 20 inches/hour (Larsen, 1976)
[33] Very Rapid Permeability: water or air moves in and through the soil material at a rate greater than 20 inches/hour (Larsen, 1976)

degrade to one-half its concentration in one to six months. Soil sampling data collected in the Herbicide Grass Control Demonstration Project, Deschutes National Forest, confirmed that hexazinone was decomposing at this rate on soil types and under climatic conditions in the analysis area.

Absorption of hexazinone by the soil varies by soil texture from immobile to intermediate as classified by the Environmental Protection Agency. The coarse textured soils associated with proposed treatment areas can be expected to result in intermediate absorption. Absorption by the soil affects that movement of the chemical in the soil. Sampling was done in the Herbicide Grass Control Demonstration Project, Deschutes NF, to see if the hexazinone was moving down into lower soil layers over time. Based on the results, chemical residues of hexazinone did not appear to be moving into lower soil layers one year after application.

Rainfall is necessary for hexazinone to move from the ground surface into the soil. Although hexazinone is highly soluble in water, accumulation of this herbicide in overland or subsurface flows would be minimal. Annual precipitation, depth to groundwater and soil characteristics in the areas proposed for application are highly likely to limit the direct input of this herbicide into groundwater systems. The relatively high water holding capacity of coarse textured volcanic pumice and ash loamy sands, as well as sufficient organic matter levels and microbial populations to absorb and degrade this herbicide, would combine to limit the extraneous travel and persistence of this herbicide.

Cumulative Effects
Reasonably foreseeable future actions, in combination with proposed herbicide application, will have no cumulative effects.

Air Quality

Alternative 1 (No Action)
Direct, Indirect, and Cumulative Effects
There would be no effects other than those described for the broader no action alternative.

Alternative 2 (Proposed Action) and Alternative 3
Direct, Indirect, and Cumulative Effects
No effects on air quality are expected as a result the application of hexazinone. Hexazinone does not evaporate easily (Information Ventures, Inc. 1995). The burning of hexazinone-treated wood does not create additional toxic byproducts (compared to the burning of untreated wood) (Information Ventures, Inc. 1995).

Monitoring

Monitoring Item 1: Effectiveness of Treatment
Monitoring Type: Effectiveness. To aid in future project planning, document the following where treatments have been done to control competing and unwanted vegetation: 1) efficacy of treatment or no treatment, 2) unintended effects, and 3) lessons that could be applied to other projects.
Frequency/Duration: Within 1-2 years of vegetation treatment. As needed following that until plantation is certified as reforested.
Responsible Individual: Silviculture operations (Reforestation Forester or Technician)

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APPENDIX G

HYDROLOGY
RIPARIAN HABITAT CONSERVATION AREA (RHCA)
AND
RIPARIAN MANAGEMENT OBJECTIVES

RIPARIAN HABITAT CONSERVATION AREA WIDTH STANDARDS

The entire planning area follows the Forest Plan standards and guidelines and interim widths for RHCAs. RHCA standard widths are applied based on the category of stream as defined by INFISH. Interim widths that apply to the planning area are:

- Category 1 areas (fish-bearing streams) will consist of an area that incorporates the stream and the area on either side of the stream extending from the edges of the active stream channel to the top of the inner gorge, or to the outer edges of the 100-year floodplain, or to the outer edges of riparian vegetation, or to a distance equal to the height of two site potential trees, or 300 feet slope distance (600 feet, including both sides of the stream channel), whichever is greatest.
- Category 2 areas (perennial non-fish-bearing streams) will consist of an area that incorporates the stream and the area on either side of the stream extending from the edges of the active stream channel to the top of the inner gorge, or to the outer edges of the 100-year flood plain, or to the outer edges of riparian vegetation, or to a distance equal to the height of one site-potential tree, or 150 feet slope distance (300 feet, including both sides of the stream channel), whichever is greatest.
- Category 3 areas (ponds, lakes, reservoirs, and wetlands greater than 1 acre) will have an area that consists of the body of water or wetland and the area to the outer edges of the riparian vegetation, or to the extent of the seasonally saturated soil, or to the extent of moderately and highly unstable areas, or to a distance equal to the height of one site-potential tree, or 150 feet slope distance from the edge of the maximum pool elevation of constructed ponds and reservoirs or from the edge of the wetland, pond or lake, whichever is greatest.
- Category 4 areas (seasonally flowing or intermittent streams, wetlands less than one acre, landslides, and landslide-prone areas) will consist of a riparian area that includes the extent of landslides and landslide-prone areas, or the intermittent stream channel and the area to the top of the inner gorge, or the intermittent stream channel or wetland and the area to the outer edges of the riparian vegetation. The area from the edges of the stream channel, wetland, landslide, or landslide-prone area shall be the distance equal to the height of one-half site potential tree, or 50 feet slope distance, whichever is greater.
- In non-forested rangeland ecosystems, the interim RHCA width for permanently flowing streams is the extent of the 100-year floodplain.

Riparian Management Goals and Objectives (RMOs): RMO, have been established by INFISH to provide the criteria against which attainment or progress toward attainment of the riparian goals is measured. Interim RMOs provide direction for managers to conduct resource management activities across the landscape. It would be expected that objectives would be achieved over time. RMOs may be refined to better reflect conditions that are attainable in a specific watershed or stream reach based on local geology, topography, climate, and potential vegetation. This may only be done through watershed analysis or by amendment.

1. Water quality, to a degree that provides for stable and productive riparian and aquatic ecosystems;
2. Stream channel integrity, channel processes, and the sediment regime (including the elements of timing, volume, and character of sediment input and transport) under which the riparian and aquatic ecosystems developed;
3. Instream flows to support healthy riparian and aquatic habitats, the stability and effective function of stream channels, and the ability to route flood discharges;
4. Natural timing and variability of the water table elevation in meadows and wetlands;
5. Diversity and productivity of native and desired non-native plant communities in riparian zones;
6. Riparian vegetation, to:
   a. Provide an amount and distribution of large woody debris characteristic of natural aquatic and riparian ecosystems;
   b. Provide adequate summer and winter thermal regulation within the riparian and aquatic zones;
   c. Help achieve rates of surface erosion, bank erosion, and channel migration characteristic of those under which the communities developed.
7. Riparian and aquatic habitats necessary to foster the unique genetic fish stocks that evolved with the specific geo-climatic region;
8. Habitat to support populations of well-distributed native and desired non-native plant, vertebrate, and invertebrate populations that contribute to the viability of riparian-dependent communities.

Riparian Management Objective (RMO) Compliance: RMOs, as established by INFISH, have been established to provide the criteria against which attainment or progress toward attainment of the riparian goals is measured. Interim RMOs provide the target for management activities across the landscape. Objectives would be achieved over time rather than expecting to be met instantaneously.

APPENDIX H

ROADS ANALYSIS

Road	Length	Maintenance Level	Proposed Recommendation	Final Recommendation
1800012	1.550	2	A. Maintain at Current Level	**A. Maintain at Current Level**
1800029	0.100	2	A. Maintain at Current Level	**A. Maintain at Current Level**
1801800	1.700	2	A. Maintain at Current Level	**A. Maintain at Current Level**
1800013	1.550	2	A. Maintain at Current Level	**A. Maintain at Current Level**
1800018	1.230	2	A. Maintain at Current Level	**A. Maintain at Current Level**
1800019	1.340	2	A. Maintain at Current Level	**A. Maintain at Current Level**
1800020	1.520	2	A. Maintain at Current Level	**A. Maintain at Current Level**
1800028	0.100	2	A. Maintain at Current Level	**A. Maintain at Current Level**
1801014	1.740	2	A. Maintain at Current Level	**A. Maintain at Current Level**
1801350	0.430	2	A. Maintain at Current Level	**A. Maintain at Current Level**
1801400	1.510	2	A. Maintain at Current Level	**A. Maintain at Current Level**
1801450	0.510	2	A. Maintain at Current Level	**A. Maintain at Current Level**
1801460	0.910	2	A. Maintain at Current Level	**A. Maintain at Current Level**
1810031	0.280	2	A. Maintain at Current Level	***F. Decommission/Convert to Other Uses*** **
1810036	0.810	2	A. Maintain at Current Level	***F. Decommission/Convert to Other Uses*** **
1810200	3.460	1	A. Maintain at Current Level	***B. Upgrade Maintenance Level*** **
1810230	0.080	1	A. Maintain at Current Level	***A. Maintain at Current Level*** *
1810350	0.929	2	A. Maintain at Current Level	***A. Maintain at Current Level*** *
1815600	1.170	2	A. Maintain at Current Level	**A. Maintain at Current Level**
1815645	0.530	2	A. Maintain at Current Level	**A. Maintain at Current Level**
4001100	1.420	2	A. Maintain at Current Level	**A. Maintain at Current Level**
4001110	0.380	2	A. Maintain at Current Level	**A. Maintain at Current Level**
4001120	0.260	2	A. Maintain at Current Level	**A. Maintain at Current Level**
4001200	1.520	2	A. Maintain at Current Level	**A. Maintain at Current Level**
4001260	0.090	2	A. Maintain at Current Level	**A. Maintain at Current Level**
4001350	1.000	2	A. Maintain at Current Level	**A. Maintain at Current Level**
4001700	2.460	2	A. Maintain at Current Level	**A. Maintain at Current Level**
4001800	1.760	2	A. Maintain at Current Level	**A. Maintain at Current Level**
4001810	0.340	2	A. Maintain at Current Level	**A. Maintain at Current Level**
9700018	0.750	2	A. Maintain at Current Level	**A. Maintain at Current Level**
9700040	2.420	2	A. Maintain at Current Level	**A. Maintain at Current Level**
9700050	0.250	2	A. Maintain at Current Level	**A. Maintain at Current Level**
9700056	0.200	2	A. Maintain at Current Level	**A. Maintain at Current Level**
9700057	1.800	2	A. Maintain at Current Level	**A. Maintain at Current Level**
9700060	0.300	2	A. Maintain at Current Level	**A. Maintain at Current Level**
9700063	3.690	2	A. Maintain at Current Level	**A. Maintain at Current Level**
9700070	0.150	2	A. Maintain at Current Level	**A. Maintain at Current Level**
9700072	0.600	2	A. Maintain at Current Level	**A. Maintain at Current Level**
9700078	0.250	2	A. Maintain at Current Level	**A. Maintain at Current Level**
9700090	2.800	2	A. Maintain at Current Level	**A. Maintain at Current Level**
9701012	2.410	2	A. Maintain at Current Level	**A. Maintain at Current Level**
9701013	1.020	2	A. Maintain at Current Level	**A. Maintain at Current Level**
9701014	1.750	2	A. Maintain at Current Level	**A. Maintain at Current Level**
9701500	0.510	2	A. Maintain at Current Level	**A. Maintain at Current Level**
9701550	1.740	2	A. Maintain at Current Level	**A. Maintain at Current Level**
9701600	1.950	2	A. Maintain at Current Level	**A. Maintain at Current Level**

Road	Length	Maintenance Level	Proposed Recommendation	Final Recommendation
9701800	1.250	2	A. Maintain at Current Level	***A. Maintain at Current Level ****
9701900	0.470	2	A. Maintain at Current Level	**A. Maintain at Current Level**
9701950	2.160	2	A. Maintain at Current Level	***F. Decommission/Convert to Other Uses *****
9702015	1.000	2	A. Maintain at Current Level	**A. Maintain at Current Level**
9702017	4.080	2	A. Maintain at Current Level	**A. Maintain at Current Level**
9702018	0.315	2	A. Maintain at Current Level	**A. Maintain at Current Level**
9702101	0.500	2	A. Maintain at Current Level	**A. Maintain at Current Level**
9702300	0.460	2	A. Maintain at Current Level	**A. Maintain at Current Level**
9702500	0.700	2	A. Maintain at Current Level	**A. Maintain at Current Level**
9702600	0.520	2	A. Maintain at Current Level	**A. Maintain at Current Level**
9702617	0.700	2	A. Maintain at Current Level	**A. Maintain at Current Level**
9702621	0.640	2	A. Maintain at Current Level	**A. Maintain at Current Level**
9702650	0.150	2	A. Maintain at Current Level	**A. Maintain at Current Level**
9702655	1.700	2	A. Maintain at Current Level	**A. Maintain at Current Level**
9702660	0.490	2	A. Maintain at Current Level	**A. Maintain at Current Level**
9702664	0.950	2	A. Maintain at Current Level	**A. Maintain at Current Level**
9702800	3.830	2	A. Maintain at Current Level	**A. Maintain at Current Level**
9710012	0.660	2	A. Maintain at Current Level	**A. Maintain at Current Level**
9710013	1.050	2	A. Maintain at Current Level	**A. Maintain at Current Level**
9710020	1.330	2	A. Maintain at Current Level	**A. Maintain at Current Level**
9710100	0.760	2	A. Maintain at Current Level	**A. Maintain at Current Level**
9710140	0.570	2	A. Maintain at Current Level	**A. Maintain at Current Level**
9710200	0.910	2	A. Maintain at Current Level	**A. Maintain at Current Level**
9710220	0.800	2	A. Maintain at Current Level	**A. Maintain at Current Level**
9710230	1.200	2	A. Maintain at Current Level	**A. Maintain at Current Level**
9710240	0.660	2	A. Maintain at Current Level	**A. Maintain at Current Level**
9710250	0.400	2	A. Maintain at Current Level	**A. Maintain at Current Level**
9710270	0.720	2	A. Maintain at Current Level	**A. Maintain at Current Level**
9710385	1.100	2	A. Maintain at Current Level	**A. Maintain at Current Level**
9710400	1.100	2	A. Maintain at Current Level	**A. Maintain at Current Level**
9711410	0.250	2	A. Maintain at Current Level	**Reroute and Number: Junction 90 to junction 420**
9710440	0.610	2	A. Maintain at Current Level	**A. Maintain at Current Level**
9710441	0.490	2	A. Maintain at Current Level	**A. Maintain at Current Level**
9710445	3.090	2	A. Maintain at Current Level	**A. Maintain at Current Level**
9710467	1.440	2	A. Maintain at Current Level	**A. Maintain at Current Level**
9710490	0.740	2	A. Maintain at Current Level	**A. Maintain at Current Level**
9710491	0.470	2	A. Maintain at Current Level	**A. Maintain at Current Level**
9710492	0.380	2	A. Maintain at Current Level	**A. Maintain at Current Level**
9710494	0.170	2	A. Maintain at Current Level	**A. Maintain at Current Level**
9710496	1.700	2	A. Maintain at Current Level	**A. Maintain at Current Level**
9711012	0.450	2	A. Maintain at Current Level	**A. Maintain at Current Level**
9711100	0.910	2	A. Maintain at Current Level	**A. Maintain at Current Level**
9711150	1.910	2	A. Maintain at Current Level	**A. Maintain at Current Level**
9711200	0.470	2	A. Maintain at Current Level	**A. Maintain at Current Level**
9711290	0.230	2	A. Maintain at Current Level	**A. Maintain at Current Level**
9711293	0.150	2	A. Maintain at Current Level	**A. Maintain at Current Level**
9711294	0.930	2	A. Maintain at Current Level	**A. Maintain at Current Level**

Road	Length	Maintenance Level	Proposed Recommendation	Final Recommendation
9711300	0.190	2	A. Maintain at Current Level	**A. Maintain at Current Level**
9711400	1.670	2	A. Maintain at Current Level	***A. Maintain at Current Level****
9711450	0.570	2	A. Maintain at Current Level	***A. Maintain at Current Level****
9711460	1.700	2	A. Maintain at Current Level	***A. Maintain at Current Level****
9711480	0.380	2	A. Maintain at Current Level	***A. Maintain at Current Level****
9711486	0.420	2	A. Maintain at Current Level	***F. Decommission/Convert to Other Uses*** **
9711488	2.050	2	A. Maintain at Current Level	***F. Decommission/Convert to Other Uses*** **
9711500	0.380	2	A. Maintain at Current Level	**A. Maintain at Current Level**
9711540	0.150	2	A. Maintain at Current Level	**A. Maintain at Current Level**
9711800	0.530	2	A. Maintain at Current Level	***A. Maintain at Current Level****
9711840	0.610	2	A. Maintain at Current Level	***A. Maintain at Current Level****
9711880	0.870	2	A. Maintain at Current Level	**A. Maintain at Current Level**
9711900	0.450	2	A. Maintain at Current Level	***A. Maintain at Current Level****
9711930	2.410	2	A. Maintain at Current Level	***A. Maintain at Current Level****
9720013	0.200	2	A. Maintain at Current Level	**A. Maintain at Current Level**
9720190	1.830	2	A. Maintain at Current Level	**A. Maintain at Current Level**
9720420	0.530	2	A. Maintain at Current Level	**A. Maintain at Current Level**
9720440	0.640	2	A. Maintain at Current Level	**A. Maintain at Current Level**
9720550	0.680	2	A. Maintain at Current Level	**A. Maintain at Current Level**
9720700	1.170	2	A. Maintain at Current Level	**A. Maintain at Current Level**
9720701	1.610	2	A. Maintain at Current Level	**A. Maintain at Current Level**
9720720	0.470	2	A. Maintain at Current Level	**A. Maintain at Current Level**
9720760	1.380	2	A. Maintain at Current Level	**A. Maintain at Current Level**
9720860	1.520	2	A. Maintain at Current Level	**A. Maintain at Current Level**
9721012	2.460	2	A. Maintain at Current Level	**A. Maintain at Current Level**
9721013	0.500	2	A. Maintain at Current Level	**A. Maintain at Current Level**
9721014	0.280	2	A. Maintain at Current Level	**A. Maintain at Current Level**
9721300	2.390	2	A. Maintain at Current Level	**A. Maintain at Current Level**
9721330	0.180	2	A. Maintain at Current Level	**A. Maintain at Current Level**
9721335	0.720	2	A. Maintain at Current Level	**A. Maintain at Current Level**
9721500	0.760	2	A. Maintain at Current Level	**A. Maintain at Current Level**
9721560	2.650	2	A. Maintain at Current Level	**A. Maintain at Current Level**
9721600	0.470	2	A. Maintain at Current Level	**A. Maintain at Current Level**
9721650	2.200	2	A. Maintain at Current Level	**A. Maintain at Current Level**
9721700	1.420	2	A. Maintain at Current Level	**A. Maintain at Current Level**
9721790	2.020	2	A. Maintain at Current Level	**A. Maintain at Current Level**
9721800	0.660	2	A. Maintain at Current Level	**A. Maintain at Current Level**
9721900	0.760	2	A. Maintain at Current Level	**A. Maintain at Current Level**
9723100	0.660	2	A. Maintain at Current Level	**A. Maintain at Current Level**
9723400	0.830	2	A. Maintain at Current Level	**A. Maintain at Current Level**
9723500	0.680	2	A. Maintain at Current Level	**A. Maintain at Current Level**
9723600	0.200	2	A. Maintain at Current Level	**A. Maintain at Current Level**
9723670	0.200	2	A. Maintain at Current Level	**A. Maintain at Current Level**
1810210	0.190	1	E. Close	***A. Maintain at Current Level****
9711420	0.760	1	A. Maintain at Current Level	**B. Upgrade Maintenance Level**
1800030	2.200	2	A. Maintain at Current Level	***E. Decommission/Convert to Other Uses*** **
1800050	1.230	2	A. Maintain at Current Level	**A. Maintain at Current Level**

Road	Length	Maintenance Level	Proposed Recommendation	Final Recommendation
1800063	0.500	2	A. Maintain at Current Level	**A. Maintain at Current Level**
1801100	1.140	2	A. Maintain at Current Level	**D. Restrict Travel/Seasonal Closure**
1801199	1.000	2	A. Maintain at Current Level	**D. Restrict Travel/Seasonal Closure**
1801300	1.320	2	A. Maintain at Current Level	**D. Restrict Travel/Seasonal Closure**
1801540	1.000	2	A. Maintain at Current Level	**D. Restrict Travel/Seasonal Closure**
1801543	1.000	2	A. Maintain at Current Level	**D. Restrict Travel/Seasonal Closure**
1815200	2.420	2	A. Maintain at Current Level	***D. Close** **
1815230	1.290	2	A. Maintain at Current Level	***D. Close** **
1800063	1.200	2	A. Maintain at Current Level	**E. Close**
9700054	0.950	2	E. Close	**E. Close**
1801440	0.190	2	E. Close	**E. Close**
4001140	0.320	2	A. Maintain at Current Level	**E. Close**
4001250	0.490	2	A. Maintain at Current Level	**E. Close**
9702651	0.190	2	E. Close	**E. Close**
9702652	0.600	2	E. Close	**E. Close**
9702662	0.340	2	E. Close	**E. Close**
9711430	0.400	2	F. Decommission/Convert to Other Uses	**E. Close**
9720600	2.230	2	E. Close	**E. Close**
9702616	0.420	2	A. Maintain at Current Level	**E. Close past 618 junction**
9710460	0.110	2	A. Maintain at Current Level	**E. Close from 492 junction to 9710**
9710461	0.110	2	A. Maintain at Current Level	**E. Close from 9710 to 460.**
1810290	1.040	2	E. Close	**E. Close**
1810300	1.330	2	E. Close	***E. Close** **
1810330	0.300	2	E. Close	***E. Close** **
1815236	0.270	2	E. Close	**E. Close**
1815239	0.150	2	E. Close	**E. Close**
1815640	1.700	2	E. Close	**E. Close to junction of 643**
1815643	0.200	2	E. Close	**E. Close**
4001050	1.700	2	E. Close	**E. Close**
4001051	1.700	2	E. Close	**E. Close**
4001105	0.340	2	E. Close	**E. Close**
4001130	0.380	2	E. Close	**E. Close**
4001270	0.490	2	E. Close	**E. Close**
4001300	2.220	2	A. Maintain at Current Level	**E. Close**
4001310	1.440	2	E. Close	**E. Close**
4001320	0.610	2	E. Close	**E. Close**
4001720	1.000	2	E. Close	**E. Close**
4001815	1.286	2	E. Close	**E. Close**
4001830	0.370	2	E. Close	**E. Close**
4001850	0.470	2	E. Close	**E. Close**
9701525	0.470	2	E. Close	**E. Close**
9702615	0.350	2	E. Close	**E. Close**
9702618	0.150	2	E. Close	**E. Close**
9702619	0.640	2	E. Close	**E. Close**
9702630	0.190	2	E. Close	**E. Close Gate at 600 junction**
9702631	0.200	2	E. Close	**E. Close**
9702635	0.660	2	E. Close	**E. Close**

Road	Length	Maintenance Level	Proposed Recommendation	Final Recommendation
9702670	0.350	2	E. Close	**E. Close**
9710380	1.440	2	E. Close	**E. Close**
9711360	0.280	2	E. Close	**E. Close**
9711545	0.380	2	E. Close	**E. Close**
9711550	0.120	2	E. Close	**E. Close**
9711560	1.820	2	E. Close	**E. Close**
9711600	2.880	2	E. Close	***E. Close* ***
9711820	0.980	2	E. Close	***E. Close* ***
9711860	0.570	2	E. Close	**E. Close**
9711910	0.830	2	E. Close	***F. Decommission/Convert to Other Uses****
9720400	0.530	2	E. Close	**E. Close**
9720725	0.380	2	E. Close	**E. Close**
9720730	0.720	2	E. Close	**E. Close**
9720750	0.340	2	E. Close	**E. Close**
9721225	1.000	2	E. Close	**E. Close**
9721230	2.560	2	E. Close	**E. Close**
9721530	0.610	2	E. Close	**E. Close**
9721850	1.080	2	E. Close	**E. Close**
9723300	0.190	2	E. Close	**E. Close**
9723350	0.470	2	E. Close	**E. Close**
9723630	0.570	2	E. Close	**E. Close**
9723680	0.640	2	E. Close	**E. Close**
9723800	0.600	2	E. Close	**E. Close**
9711485	0.420	2	E. Close	***F. Decommission/Convert to Other Uses****
1800022	0.100	2	F. Decommission/Convert to Other Uses	**F. Decommission/Convert to Other Uses**
1800050	0.100	2	A. Maintain at Current Level	**F. Decommission/Convert to Other Uses**
1801850	1.700	2	A. Maintain at Current Level	**F. Decommission/Convert to Other Uses**
1801390	0.430	2	F. Decommission/Convert to Other Uses	**F. Decommission/Convert to Other Uses**
1810032	0.190	2	F. Decommission/Convert to Other Uses	***F. Decommission/Convert to Other Uses****
1810280	0.350	3	F. Decommission/Convert to Other Uses	**F. Decommission/Convert to Other Uses**
9710280	0.570	2	F. Decommission/Convert to Other Uses	**F. Decommission/Convert to Other Uses**
9710290	1.970	2	F. Decommission/Convert to Other Uses	**F. Decommission/Convert to Other Uses**
9701170	0.630	2	A. Maintain at Current Level	**F. Decommission/Convert to Other Uses**
9711412	0.650	2	F. Decommission/Convert to Other Uses	**F. Decommission/Convert to Other Uses**
9702640	0.057	2	A. Maintain at Current Level	**Decommission from river - 300ft.**
9702645	0.057	2	A. Maintain at Current Level	**Decommission from river - 300ft.**
9711410	0.470	2	F. Decommission/Convert to Other Uses	**F. Decommission/Convert to Other Uses**
9711410	0.350	2	F. Decommission/Convert to Other Uses	**F. Decommission/Convert to Other Uses**
9711410	0.600	2	F. Decommission/Convert to Other Uses	**E. Close**
9700017	0.750	1	Currently Closed Road, M.L. Level 1	**A. Maintain at Current Level**
9702200	1.990	1	Currently Closed Road, M.L. Level 2	**A. Maintain at Current Level**
9702125	1.000	1	Currently Closed Road, M.L. Level 3	**A. Maintain at Current Level**
9702612	0.320	1	Currently Closed Road, M.L. Level 4	**A. Maintain at Current Level**
9711440	0.570	1	Currently Closed Road, M.L. Level 5	***A. Maintain at Current Level****
9711520	0.800	1	Currently Closed Road, M.L. Level 6	**A. Maintain at Current Level**
9711543	0.400	1	Currently Closed Road, M.L. Level 7	**A. Maintain at Current Level**
9711546	0.190	1	Currently Closed Road, M.L. Level 8	**A. Maintain at Current Level**

Road	Length	Maintenance Level	Proposed Recommendation	Final Recommendation
9702605	0.500	1	Currently Closed Road, M.L. Level 9	**A. Maintain at Current Level**
9702620	0.190	1	Currently Closed Road, M.L. Level 10	**A. Re-enforce closure**
9710170	2.080	1	Currently Closed Road, M.L. Level 11	**A. Re-enforce closure**
9711330	0.490	1	Currently Closed Road, M.L. Level 12	**A. Re-enforce closure**
9711340	0.420	1	Currently Closed Road, M.L. Level 13	**A. Re-enforce closure**
9711380	0.250	1	Currently Closed Road, M.L. Level 14	**A. Re-enforce closure**
9711390	1.890	1	Currently Closed Road, M.L. Level 15	**A. Re-enforce closure**
9721200	0.420	1	Currently Closed Road, M.L. Level 16	**A. Re-enforce closure**
1810030	1.520	2	F. Decommission/Convert to Other Uses	***F. Decommission/Convert to Other Uses*****
1810033	0.970	2	F. Decommission/Convert to Other Uses	***F. Decommission/Convert to Other Uses*****
1810038	0.760	2	F. Decommission/Convert to Other Uses	***F. Decommission/Convert to Other Uses****
4001400	0.300	2	A. Maintain at Current Level	**Private – Remove from Database**
4001230	0.380	2	A. Maintain at Current Level	**Private – Remove from Database**
4001240	0.200	2	A. Maintain at Current Level	**Private – Remove from Database**

*** 18 Fire EIS: Concurrence**
**** 18 Fire EIS: Decision**
*****M.L.: Maintenance Level**

KELSEY ROAD ANALYSIS SUMMARY			
	Current Road System	**Recommended Road System – Prior to 18 Fire**	**Recommended Road System - Following 18 Fire EIS**
Planning Area: Acres	**45,605**	**45,605**	**45,605**
Kelsey: Square Miles	**71.3**	**71.3**	**71.3**
Total Open Road Miles	**271.4**	**196.2**	**185.3**
Miles per Square Mile	**3.8**	**2.8**	**2.6**
Current Closed and Decommissioned Roads: Miles		**19.7**	**19.7**
Road Closure: Miles		**46.2**	**48.5**
Road Decommission/Convert to Other Uses: Miles		**9.3**	**17.8**
Total Close/Decommission Road Miles		**75.2**	**86.1**
Total Open Road Miles		**196.2**	**185.3**
Total Kelsey Road Miles		**271.4**	**271.4**
Maintain Roads at Current Maintenance Level: Miles		**159.9**	**156.6**
Decrease Road Maintenance Level: Miles		**1.0**	**4.2**

APPENDIX I

RESPONSE TO COMMENTS

INITIAL SCOPING COMMENTS (PAGE 190)
30-DAY COMMENT PERIOD (PAGE 192)

RESPONSE TO INITIAL PUBLIC SCOPING COMMENTS

Thinning and Fuels Reduction Treatments

Comment: Encourage more emphasis on commercial thinning – widen tree spacing and reduce fuel loading for prescribed burning, restore vigor to suppressed trees, enhance opportunity for more forage. Seedlings to old growth should be managed together. Dense stands of ponderosa and lodgepole pine are creating forest health hazards. Overall forest health should be your priority.
Response: *These comments are addressed within the alternatives.*

Comment: Size and age should not be the factors you base management decisions on.
Response: *Tree size and age are only two of the factors that have been used in developing proposed treatments. The goals of the various resources include size and age in determining the moving toward the desired condition of each resource.*

Comment: Do salvage sales in areas where beetle kill has occurred.
Response: *Salvage sales have occurred in areas of substantioal beetle kill. Within the planning area, beetle kill is presently low within a high risk forest. Proposed activities include reducing beetle kill risk through tree density reduction.*

Comment: There is agreement for the need to transition toward an increase in late and old structure, however, commercial logging has never resulted in such a transition. It hasn't been shown that commercial harvest will promote late and old structure
Response: *Commercial thinning is a component of a transition toward an increase in late and old structure. Thinning to reduce density to improve individual tree growth, reduce the risk of insects and disease to trees, reduce the risk of fire, and improve wildlife habitat for both big game and species dependent on late and old structure ponderosa pine would be done through both commercial and precommercial thinning. A reduction in density generally favors increased tree growth, in both diameter and height, with the potential to reach large tree status quicker than without thinning..*

Comment: Do not support scientific studies that provide for the destruction of forests.
Response: *The proposed Oregon State University research project is intended to analyze results of tree responses to proposed treatments. Results would benefit all natural resource specialties including the development of late and old structure ponderosa pine for wildlife needs, scenic views, and commercial harvest when and where appropriate. Results would also add to known existing publications regarding the growth/regeneration response that could occur with similar proposed activities.*

Comment: Timber management in Newberry National Volcanic Monument should be designed to be consistent with the goal of returning the area to natural ecological processes. Thinning to allow prescribed burns should not have a commercial orientation to timber prescriptions. Substantial work needs to be done to return the National Monument to a condition where natural ecological processes can proceed.
Response: *Prescribed burning is, ultimately, the preferred method to reduce natural fuels and maintain a low wildfire risk within Newberry National Volcanic Monument. Initially, mechanical treatments are necessary to reduce the risk of a high intensity prescribed burn that could result in large tree mortality.*

Comment: Support vegetation thinning to increase the winter sun on Cottonwood Road.
Response: *This comment is addressed within the alternatives. Thinning is proposed to improve public safety on Cottonwood Road by increasing the winter sun to reduce road ice.*

Comment: High levels of natural fuels are creating risks to stands of timber, winter habitat of mule deer, private property and power lines.
Response: *This comment is addressed within the alternatives. The proposed action alternatives address natural fuels reduction through a variety of treatments.*

Wildlife and Habitat

Comment: Stand density lacking mosaic of openings for big game and sharp-shinned and Coopers hawks. Lacks open, park like stands for other species such as white-headed woodpecker.
Response: *An alternative has been developed with a ratio of 60:40 forage:cover ratio in wetter sites and 70:30 forage:cover ratio in drier sites with cover in 5-30 acre patches less than 1200 feet apart. Thinned areas would encourage development of shrubs, forbs, and late and old structure habitat that would benefit species that appear to require open, park like stands. It is proposed to create small openings of two (2) to 12 acres in two (2) units that would be planted with seedlings to create structural diversity in deer habitat. Connectivity and old structure corridors would be identified. Summer, transition, and winter range forage would be enhanced.*

Riparian

Comment: Encourage wide riparian buffers through fencing and signing and even minimal amounts of overstory removal if no negative impacts will occur to aquatic species.
Response: *A narrow width of riparian vegetation exists along the Deschutes River that is the western boundary of the planning area. Most of the proposed treatments would be located outside of those areas that are considered riparian. Proposed treatments are primarily located within upland vegetation although some of the units would be within the Riparian Habitat Conservation Area (RHCA) that extends 300 feet from the rivers edge. No negative impacts would be expected to occur to aquatic species as a result of the proposed treatments. The*

proposed treatments would improve vegetative conditions and reduce the risk of a high intensity wildfire within the RHCA. Fencing and signing this area would not be necessary.

Socio-Economic
Comment: An assessment of the social structure over the next 50-100 years is just as important as the desire to restore natural functions/processes. Manage the forest for existing and future values (out 50 years) instead of historic conditions.
Response: *The short- and long-term strategy of proposed vegetative treatments are designed to: provide continued deer winter range; reduce the wildfire risk along the Wildland Urban Interface and within the overal planning area; provide and enhance late and old structure ponderosa pine for wildlife and human aesthetic pleasure; improve overall scenic views; and reduce the risk of insect vectors and disease pathogens.*

Other Comments
Comment: An EIS is the appropriate analysis for this project. Request a full EIS due to potential environmental effects and size of area involved.
Response: *It has been determined through an in-depth analysis of resources and the associated effects on the human environment, that a significant impact would not occur and an environmental assessment is the appropriate document for the Kelsey planning area.*

Comments/Responses for Kelsey 30 Day Comment Period

Introduction
A 30-comment period for the Kelsey proposed action was provided for interested and affected publics, including appropriate local, state, and federal government agencies and Tribes. This period lasted from May 6, 2004 to June 7, 2004. During this period, the Forest Service received comments from different sectors of the public, with a range of concerns and questions. Some comments resulted in a clarification of discussion in the Environmental Assessment. The responsible official will consider the comments in the decision-making process.

The Forest Service received 9 separate pieces of mail during the comment period, from 7 sources. All comments were reviewed and substantive comments received the focus during this comment analysis. The complete comment record is kept within the Kelsey Project public record and is available for review at the Bend/Fort Rock Ranger District, Bend, Oregon. The following table lists the comment letters received. The EA responded to the comments with further analysis or clarification within the document where it was appropriate.

Table 1. Comments Received During the EA 30-Day Comment Period.

Letter	Author	Organization
1	Dennis Krakow	Individual
2	Joani Dufourd	Central Oregon Motorcycle and ATV Club
3	John Morgan	Ochoco Lumber Company
4	John H. Salzer	Sunriver Owners Association
5	Doug Heiken	Oregon Natural Resources Council
6	Larry Ulrich	Individual
7	Karen Coulter	Blue Mountain Biodiversity Project

Comments
Each comment is followed by a number in parentheses. The first number corresponds to the letter number listed in Table 1. The second number corresponds to an assigned comment number.

Comment Response
Similar comments were combined using a title or theme to help the reader easily find responses to similar comments. Comments have been grouped by the following titles or themes:

Table 2. Comment groupings and associated page number.

Title or Theme of Comments	Page Number	Title or Theme of Comments	Page Number
Fuel Reduction	211	Implementation	223
Noxious Weeds	217	Unit Specific Thinning Prescriptions	226
TES Plants	218	NEPA	227
Wildlife Habitat	218	Economic Analysis	229
Forest Health	220	Cultural Resources	230
Forest Health/Fuels Reduction	221	303 (d)	230
Scenic Views	221	Soils	230
Public Health/Herbicides	221	Grazing	232
Roads	222	Literature Cited by Respondents	234
OHV (Off Highway Vehicles)	223	Literature Cited by Forest Service	235

Responses are written to address public comments. In general, the agency responded in the following five basic ways to comments as prescribed in 40 CFR 1503.4.

1. Modifying alternatives including the proposed action.
2. Develop and evaluate alternatives not previously given serious consideration.
3. Supplementing, improving, or modifying the analysis.
4. Making factual corrections.
5. Explaining why the comments do not warrant further response.

Fuel Reduction

Comment	Response
We prefer that fire be used as much as possible instead of mechanical treatment as a tool for fuel reduction. (5-3) (Note: Respondent was called to clarify what was meant by "mechanical treatment". Respondent's primary concern was with commercial harvest. Less concerned with mechanical shrub treatment.)	**Response 1:** With Alternative 2, fuels reduction objectives would be achieved using prescribed fire (separately or in combination with mechanical shrub treatment) on 48% (4,789 acres) of the total acres proposed for treatment. With Alternative 3, prescribed fire would be used on 46% (5,165 acres) of the total treatment acres. No commercial harvest is proposed on these acres. Mechanical shrub treatments may be necessary to reduce fire intensity, scorch heights and spotting potential. With Alternative 3, commercial harvest (mechanical treatment) is proposed on 1,758 acres to meet a primary treatment objective of fuels reduction. The feasibility of using only fire (separately or in combination with mechanical shrub treatment) on these acres was considered. Commercial harvest was found necessary to meet the purpose and need for action on all but 219 of these acres (Unit 313). This was not considered a large enough difference to warrant developing a separate alternative. <u>Details of Alternative Considered</u> Foregoing use of commercial thinning would not be reasonable on approximately 1,358 acres. On approximately 1,296 of these acres (Units 23, 39, 41, 45, 49, 152, 225, 227, 254, 277, 312, 368, 405, 424, 446, and 447) there is a purpose and need to reduce risk of bark beetle outbreak in addition to reducing fuels. To make the stands more resilient to beetle attack, tree density must be reduced. On approximately 62 acres (Unit 269), fuel treatment objectives are to create a strategic fuelbreak and create a defensible/safe egress route along the Cottonwood Road and Highway 97. To meet the egress route objective, tree density must be reduced. On all these acres, use of fire to accomplish desired density reduction would be clearly unreasonable. To achieve desired thinning, a relatively high intensity fire would be necessary. Such a fire would result in higher level of density reduction than is desired. Scorch heights associated with this type of fire would put surviving trees at an increased risk of bark beetle attack. Scorch heights and tree mortality would not be desirable within scenic view allocations. Foregoing use of commercial thinning would also not be reasonable on an additional 140 acres (Units 78, 206, 224, and 430). These acres proposed for treatment are located within the wildland urban interface by Sunriver and along the Highway 97 corridor. No past thinning has occurred within these stands. Ladder fuels are present. Use of fire within the urban interface without prior thinning would pose too great a threat of torching. Use of fire would result in crown scorch levels higher than is visually desired. Scorch heights associated with this type of fire would put surviving trees at risk of bark beetle attack. Foregoing use of commercial thinning would not meet fuel reduction objectives in the short or long term on approximately 41 acres (Unit 42). Within this stand of ponderosa and lodgepole pine, prescribed fire would likely kill the lodgepole pine (approximately 18 lodgepole pine trees per acre with an estimated volume of 1,025 board feet per acre). In the short term, snags in this area would not meet the objective of creating a defensible/safe egress route along road 9720, the primary access route to Lava Cast Forest. In the long term as these snags fall, the increase of coarse down woody would not meet the fuels objective. Mortality level may not meet the visual quality objectives. Snags by road 9720 would be a safety concern. On approximately 219 acres (Unit 313), the objective of creating a strategic fuelbreak could be met, though not as effectively, by forgoing the use of commercial thinning and using only prescribed fire in combination with mechanical shrub treatment.
"We support prescribed fire as a fuel management technique but fire management must be carefully planned so as to minimize effects on wildlife, soil, site productivity, and large trees, down woody debris, and snags." (5-22) (see Tiedemann, A.R., Klemmedson, J.O., and Evelyn L. Bull, Solution of forest health problems with prescribed Fire: Are forest productivity and wildlife at risk?)	**Response 2:** Tiedemann et.al. (2000) question the use of prescribed fire to convert large areas of forest to seral conditions emulating conditions assumed to exist before European settlement. They question the use of fire based on its effects on forest productivity and wildlife resources. In the abstract they state "before implementing prescribed fire widely, we need to understand the range of its effects on all resources and values. … It would seem prudent to examine present forest conditions and assess their potential to provide desired resource outputs and values. Once this is achieved, the full complement of forest management tools and strategies, including prescribed fire, should be used to accomplish the desired objectives. We suggest a more conservative approach until prescribed fire effects are better understood." The proposed use of prescribed fire in the Kelsey Planning Area has been carefully planned. Objectives of prescribed burns have been defined. Prescribed burns have been strategically

	located to modify fire behavior within the Wildland Urban Interface, along major roads, and around Old Growth Areas and other areas of concern. In selecting areas for prescribed fire, consideration has been given to balancing the need to modify fire behavior with the need to maintain wildlife habitat and other resource values. Mitigation measures and project design criteria have been specified to minimize effects prescribed fire could have on a variety of resources.
"ONRC supports use of prescribed fire, …careful thinning and removal of small diameter material and flammable brush in ecologically appropriate locations in order to help restore fire regimes." (5-10)	**Response 3:** No response is necessary.
"SROA supports prompt implementation of Alternative 3 in the Sunriver WUI. … SROA Environmental Committee members have reviewed all proposed Alternative 3 treatments and believe they are an appropriate approach to fuel treatment in the Sunriver WUI." (4-10) "Alternatives 1 and 2 are not acceptable to us because they provide inadequate fuels treatment around Sunriver." (4-11)	**Response 4**: Alternative 3 has been identified as the Agency Preferred Alternative. A final decision will be based on how each factor of the project purpose and need is met by each alternative, the manner in which each alternative responds to the key issues raised, and the public responses received during the 30 day comment period.
"We … appreciate the changes made in Alternative 3 from the original Alternative 2… These changes will enhance wildfire protection in the Wildland Interface (WUI) area of the Deschutes National Forest near Sunriver." (4-9)	**Response 5:** No response is necessary.

Fuel Reduction (continued)

Comment	Response
"Fuel reduction must focus on the smallest fuels … Recent fuel reduction modeling done by researchers at the University of Washington and published by the Rural Technology Institute provides some important lessons for the agency's fuel reduction efforts …: 1. Thinning trees smaller than 12 inches can help reduce fire risk … 3. Removing trees over 12 inches can actually make fire risk worse than doing nothing at all. … (see) Larry Mason, Kevin Ceder, Heather Rogers, Thomas Bloxton, Jeffrey Comnick, Bruce Lippke, James McCarter, Kevin Zobrist, Investigation of Alternative Strategies for Design, Layout and Administration of Fuel Removal Projects: Rural Technology Initiative; July 2003; … See especially RTI Appendix pages B-13,14." (5-4)	**Response 6:** With Alternatives 2 and 3, where fuel reduction is an objective, thinning would generally be from below, retaining the best, most dominant trees with the least amount of dwarf mistletoe infection. Thinning from below is defined as the removal of trees from the lower crown classes to favor those in the upper crown classes (Helms, 1998). With proposed thinning from below, the smallest diameter trees in the stand and/or the shortest trees in the stand would generally be priority for removal. Where removal of trees from the lower crown class would not reduce stocking to desired levels, trees from the dominant and codominant crown classes would be removed to favor the best trees of those same crown classes. In some cases, dominant and codominant trees to be removed would be greater than 12 inches dbh. Thinning from below will generally result in the average stand diameter being larger after thinning than it was prior to thinning. Mason et.al. (2003) modeled four harvest treatments to compare relative effects on fire risk. The four harvest treatments were: 1) Remove 9" and under trees *(9 and under)*. All trees less than or equal 9"dbh were harvested. 2) Remove 50% BA, from below *(Half BA)*. Basal area was reduced by half by removing the smallest trees (thinning from below). 3) Leave 45 sq.ft. of BA, from below *(BA 45)*. This treatment was intended to simulate restoration of savannah-like conditions. 4) Remove 12" and greater, from above *(12 and over)*. This treatment was intended to simulate harvest designed to maximize economic return by taking the largest and most valuable trees that are 12" dbh and larger.

	For both harvest treatments with a basal area target, thinning was from below with the smallest trees being removed. An upper diameter limit for harvest was not specified. These two treatments (Half BA and BA 45) are similar to much of the thinning being proposed in Kelsey Alternatives 2 and 3. Modeling results from the Fremont would be most applicable to conditions on the Deschutes National Forest. As stated by Mason et.al. (2003), "treatment simulation results indicate the thinning treatment Half BA and BA 45, may be the most effective in reducing fire risk in high and moderate risk forests." Greatest reduction of risk occurred with the BA45 treatment.
"… the agency should use a 12 inch diameter limit to enhance public confidence that this project is truly about restoring fire regimes …" (5-7)	**Response 7:** See Response 6.
"… large trees should be retained, because they are fire resistant and they help suppress ladder fuels, and maintain more favorable fuel conditions below the canopy (e.g., moist, cool, less windy)." (5-8)	**Response 8:** All trees greater than or equal to 21 inches dbh would be retained. See Response 6.
"Fuel reduction … must consider the long-term costs of maintaining treatments. … Recent fuel reduction modeling done by researchers at the University of Washington and published by the Rural Technology Institute provides some important lessons for the agency's fuel reduction efforts …: 2. The ingrowth must be treated in order to retain the fuel reduction benefits of the original thinning. If ingrowth is not treated … thinning is worse than doing nothing at all…. (see) Larry Mason, Kevin Ceder, Heather Rogers, Thomas Bloxton, Jeffrey Comnick, Bruce Lippke, James McCarter, Kevin Zobrist, Investigation of Alternative Strategies for Design, Layout and Administration of Fuel Removal Projects: Rural Technology Initiative; July 2003; …See especially RTI Appendix pages B-13,14." (5-5) "…the agency NEPA analysis must: a. Disclose whether and how ingrowth will be treated; b. disclose the cumulative effects of such treatments; c. Disclose the uncertainties of future funding and the consequences if the ingrowth is not treated." (5-9) "The Environmental Assessment (EA) … is deficient and inadequate re: NEPA requirements in the following ways: … the EA does not disclose that opening the canopy through mature tree logging and heavy logging would increase the growth of small dbh trees, increasing fuel loading and fire risk and could also stress remaining trees and regrowth through soil impacts, leading to increased incidence of bark beetles." (7-14)	**Response 9:** Thinning, particularly in combination with prescribed fire, will create conditions favorable for the ingrowth of tree seedlings, shrubs, and grasses. Within 8 to 25 years, re-treatment of understory vegetation, by prescribed fire or mechanical means, will be necessary to maintain undergrowth at desired levels. Maintenance treatments needed within the next 3 to 5 years are proposed with this project. With Alternative 2 and 3, approximately 497 acres of underburning and/or mechanical shrub treatment are proposed to maintain low fuel loadings where the understory has been previously treated (by prescribed fire or mechanical means). In modeling the relative effects of harvest treatments, Mason et.al. (2003) produced results for four harvest treatments with and without regeneration to simulate either controlled burn fuel removal or fire risk impacts associated with accumulating fuel loads from ingrowth. Simulations with regeneration were modeled to have a stocking level of 500 trees per acre 4 years after a treatment. The ingrowth simulations by Mason et.al. (2000) indicate "15 to 20 years after fuel reduction treatments, fire risk begins to increase drastically, suggesting that entries for ingrowth removals should commence 10-15 years after treatment to prevent future risk increases". While the simulations with regeneration for the "Half BA" and "BA 45" treatments indicate fire risk increases with no treatment of the ingrowth, the simulations indicate 35 years after treatment the number of stands with high fire risk remains less than with the no action treatment. In the Kelsey planning area, levels of ingrowth similar to those modeled by Mason et.al. (2003) would be most likely occur where lodgepole pine is a component of the stand or surrounding stands. Where lodgepole pine is absent, ingrowth in ponderosa pine stands thinned to 40 to 60 BA/Acre, would be expected to average approximately 50 tree/acre. Increase in fire risk due to tree ingrowth would be expected to be slower in the Kelsey planning area than in the simulations done by Mason et.al. (2003).
"We also recommend that regular, scheduled brush treatment be started once initial treatment is completed." (4-15)	**Response 10**: Re-treatment of understory vegetation will be needed 8 to 25 years from the implementation of proposed Kelsey treatments. Such maintenance treatments are not "ripe" for decision. Maintenance treatments for fuels treatments proposed with Alternative 2 and 3 would be addressed in future environmental assessments and decisions.
"Recent fuel reduction modeling done by researchers at the University of Washington and published by the Rural Technology Institute provides some important lessons for	**Response 11:** Comment is not specific to proposed actions. Neither action alternative proposes post-fire salvage. A separate NEPA document is being prepared for the 18 Fire Salvage Recovery Project.

the agency's fuel reduction efforts …: 4. Fuel reduction efforts should focus on live green stands, not post-fire salvage. … The modeling shows that typical stands following stand replacing wilfire remain at low fire risk for 20 years, and even after 20 years these post-fire stands exhibit far lower fire risk than any of the other treatments of "green stands" that did not burn." (5-6)	
"Fall burning should be considered because that is when nature would have done most of the burning. … (see) Tiedemann, A.R., Klemmedson, J.O., and Evelyn L. Bull, Solution of forest health problems with prescribed Fire: Are forest productivity and wildlife at risk?..." (5-23)	**Response 12:** Most of the burning would take place in March and April, due to the low elevation of the Kelsey project area and the need to have adequate fuel moisture to help ensure retention of coarse woody debris and surface organic matter. Due to past fire suppression practices, fuels have increased well above historic conditions. In areas where fire would be used, the first entries would use low intensity prescribed fire to gradually reduce fuel loadings. Prescription windows (i.e. soil moisture, temperature, and flame length) for this type of fire are more favorable in the spring. Conditions in the spring make it more likely treatment objectives will be met. There is a narrow window in the fall when conditions are favorable for implementing low intensity prescribed burns. Conditions quickly change from being too hot and dry to being too cool and wet. There are years when there is not a fall burn window. Fall prescribed burns normally occur in areas that have had prior fuel reduction treatments. Limiting prescribed burning to the fall would reduce the opportunities for accomplishing fuels reduction on a large number of acres. Teidemann et.al. (2000) identify the forest floor as an important component of forest ecosystems. In presenting thoughts about burning the forest floor, they state, "The dilemma, in terms of the forest floor alone, is not 'burning or no burning'; it involves figuring out when and how to burn… Clearly, the cost of burning to forest-floor resources is less when the upper layer is burned than when lower layers are burned." They further state "…if the goal of management is to minimize losses of these resources (forest-floor properties, e.g. decomposition activity, microbial biomass, concentration and mass of nutrients) during a prescribed burn, fire should be planned when the upper layer of forest floor is dry enough to carry a fire, but lower layers are wet enough not to be consumed." In Kelsey, these conditions are most likely to be present in the spring.
"The effects of spring burning on the life-cycles of plants and wildlife must be fully considered in the NEPA process. … (see) Tiedemann, A.R., Klemmedson, J.O., and Evelyn L. Bull, Solution of forest health problems with prescribed Fire: Are forest productivity and wildlife at risk?..." (5-24)	**Response 13**: Season of burning can influence wildlife, as well as other resources (Wisdom and Thomas (1996) in Tiedemann et.al (2000)). Tiedmann et.al (2000) briefly describe possible adverse effects spring and fall burns can have on wildlife, soils, and vegetation. Spring burning has the potential to disrupt the breeding cycles of many wildlife species. There is a short period of time when spring burning could overlap with the nesting period of landbirds (April 1 to August 15). Mitigations have been developed to reduce effects on neotropical migrant birds, raptors, shrub habitat, cave habitat, snags and down logs. These measures include burning when wind direction would carry smoke away from known nest sites and retaining 10 to 20 percent of the brush untreated. Monitoring on the district has shown positive effects in bitterbrush sprouting under cool moist soil after spring burns. Busse et al (2000) found evidence that low-severity prescribed burning slightly reduces growth of thinned, pole-sized ponderosa pine stands in central Oregon. Mean periodic annual increment for basal area and volume both declined as a result of spring underburning. The season of year may play an important role in how ponderosa pine stands respond to fire (Busse et.al., 2000). Root activity is generally greater near the surface

	in the spring compared to the fall. The potential for fine-root mortality and reduce tree growth is greater for spring burns. Busse states "changes in both nutrient capitol and exposed mineral soil were kept to a minimum, while factors showing the strongest correlation to tree-growth reduction (crown scorch and potential root damage) can be considered ephemeral in nature." Swezy and Agee (1991) studied the effects of prescribed fire on old-growth ponderosa pine. Their study showed a higher mortality rate in early-season burns compared with late-season burns. They suggest without careful consideration of seasonal phenology and fuel moisture conditions, even low-intensity prescribed fire can kill old-growth ponderosa pines.
"We support efforts to limit the initiation and spread of crown fires through the reduction of fine surface fuels and (partial) treatment of ladder fuels to increase the crown base height but we oppose efforts to heavily thin the overstory canopy in an effort to control crown-to-crown fire spread. The most significant effect of this type of heavy thinning is to increase the warming and drying of ground fuels and to increase the growth of ladder fuels, both of which significantly detract of the risk reduction objectives and are expensive to treat." (5-16) "The NEPA document must address … that there is very little scientific support for aggressive thinning to reduce fire hazard. …there is some scientific evidence that thinning can make the fuel hazard worse instead of better. …(see) Graham, Russell T.; McCaffrey, Sarah; Jain, Theresa B. (tech. eds.) 2004. Science basis for changing forest structure to modify wildfire behavior and severity … " (5-18) "Thinning also increases wind and light penetration of the canopy and causes fuels to dry out which make them more prone to burn and increases the time it takes woody material to decompose. Removing medium and large trees also removes shade and resource competition that helps suppress the growth of small trees and brush known as 'ladder fuels'" (5-19)	**Response 14:** Developed alternatives represent a range of responses to the issue pertaining to wide thinning. Wide thinning is proposed to meet the following fuel objectives: 1) create defensible/safe egress routes, 2) reduce wildfire risk within urban interface zone, and 3) create strategic fuelbreaks. Other objectives to be met by wide thinning include: 1) increase sunlight on Cottonwood Road to reduce ice in winter, 2) maintain or accelerate development of ponderosa pine old growth within Newberry National Volcanic Monument (NNVM), 3) evaluate alternative silvicultural treatment in even-aged, second growth ponderosa pine, and 4) accelerate development of single-story late or old structure outside NNVM. During scoping an issue was identified that stands thinned to relatively wide spacing (30-35 foot spacing) would not fully utilize site growth potential. This pertained primarily to the general forest allocation, where an objective is to have all stands utilizing site growth potential. In response to the issue, acres proposed for wide thinning were reduced in Alternative 3. Approximately 3,190 acres would be thinned to relatively wide spacing with Alternative 2. This is 56% of the total acres proposed for commercial harvest or precommercial thinning. With Alternative 3, thinning to wide spacing is proposed on 1,887 acres. This is 28% of the total acres proposed for commercial harvest or precommercial thinning. Wide thinning in Alternative 3 was retained within scenic views foreground and Newberry National Volcanic Monument to minimize the need for future mechanical entries and to maintain or accelerate the development of the large tree component of late or old structure. Stands with lower tree density can be more resistant to crown fire spread than comparable stands with higher tree density. Thinning to reduce canopy bulk density to less than 0.10 kg m^{-3} is generally recommended to minimize crown fire hazard and for the most part below this point, active crown fire is difficult to achieve (Graham et.al. 2004). Agee (1996) calculated crown bulk density measures below which crown fire spread would be very unlikely. At the highest rate of spread assumed, crown fire spread would be very unlikely at crown bulk densities less than 0.037 kg m^{-3}. At a rate of spread approximating that of significant wind-driven fires, crown fire spread would be very unlikely at crown bulk densities less than 0.074 kg m^{-3}. Crown bulk density displayed for ponderosa pine at different stocking levels (Agee 1996) indicates for a given average stand diameter, lower crown bulk densities correspond to lower tree density. Proposed wide thinning would reduce crown bulk densities to an average of .038 kg m^{-3} (Average range .016-.068 kg m^{-3}). Thinning can increase the warming and drying of ground fuels. The following descriptions are from Graham et.al. (2004). Thinned stands (open tree canopies) allow incoming solar radiation to penetrate the forest floor, which then increases surface temperatures, decreases fine fuel moisture, and decreases relative humidity

	compared to unthinned stands – conditions that can increase surface intensity (that is, how fast the fire is consuming fuel and producing energy). An increase in surface fire intensity may increase the likelihood that overstory tree crowns may ignite. Therefore it is important that the gap between the surface and crown fuels be maintained through either prescribed fire or pruning so that if a fire should occur, the potential for crown fire initiation is minimized. Potential fire intensity and/or severity in thinned stands are significantly reduced only if thinnings are accompanied by reducing the surface fuels (woody fuel stratum) created from the thinning operations. Surface fuels resulting from proposed wide thinning would be reduced by whole tree yarding, lopping/scattering, and/or piling. The gap between surface and crown fuels would be further increased by burning and mechanical shrub treatment. With Alternative 2, wide thinning would be followed by prescribed fire and/or mechanical shrub treatment on all but 11 acres (Unit 65). With Alternative 3, wide thinning would be followed by prescribed fire and/or mechanical shrub treatment on all but 37 acres (Units 65 and 366).
"The NEPA analysis must address the complex effects of thinning including tendencies to reduce and increase fire hazard. … (see) USDA Forest Service; Influence of Forest structure on Wildfire Behavior and the Severity of Its Effects, Nov 2003." (5-17)	**Response 15:** See Response 14. A Forest Service overview (2003) titled "Influence of Forest Structure on Wildfire Behavior and the Severity of Its Effects" states the following regarding the effects of thinning on fire behavior and severity: "Thinning opens stands to greater solar radiation and wind movement, resulting in warmer temperatures and drier fuels throughout the fire season. While this openness can encourage a surface fire to spread, such fires do little ecological damage. Where human values are threatened, these types of low-intensity fires are relatively easy to control and less likely to support a crown fire even under severe weather conditions."
"Plantations are a fire hazard. … The March 2003 Wildfire Effects Evaluation Project for the Umpqua National Forest clearly documents this disproportionate fire intensity of young managed vs. mature unmanged stands. ("The young vegetation, including plantations, experienced a disproportionately high amount of stand replacement mortality caused by crown fires as compared to older, unmanaged forests. … Plantations had a tendency to increase the rate of fire spread and increased the overall area of stand replacement fire effects by spreading to neighboring stands." P 4 "This early seral vegetation pattern, and the types and arrangement of fuels present, increased the fire's rate of spread and the area of stand replacement fire effects." P64.) http://www.fs.fed.us/r6/umpqua/publications/weep/weep.html" (5-21)	**Response 16:** With Alternative 2, approximately 279 acres would be reforested following proposed harvest treatments. With Alternative 3, approximately 212 acres would be reforested. These acreages are less than 1 percent of the forested portion of the Kelsey planning area (35,879 acres). In the majority of these areas, harvest would be followed by prescribed fire or mechanical shrub treatment. In all cases, natural fuels immediately surrounding patch cuts would be reduced by prescribed fire or mechanical shrub treatment. The reforested stands would have a negligible effect on overall fire behavior in the planning area. The Umpqua Wildfire Effects Evaluation Project was reviewed. The situation on the Umpqua differs from the Kelsey Project Area. Topography of the affected area included steep, south facing slopes. Topography in Kelsey is level to rolling. On the Umpqua, the extent, and dispersed pattern, of managed, regenerated stands prior to the fire was outside the range of natural variability. The Kelsey EA includes site specific analysis comparing the amount of stand initiation structural stage to historic range of variability (HRV). Stand reinitiation following proposed treatments is at most 1% above HRV.
"The Environmental Assessment (EA) … is deficient and inadequate re: NEPA requirements in the following ways: …science indicating that the most flammable fuels are less than 3" dbh and that logging larger trees (12-20"dbh+) may actually increase the risk of high intensity fire is not cited, disclosed or analyzed… Logging of larger trees removes the least flammable trees from the landscape, can dry out microclimate conditions, increasing fire intensity and can increase wind speeds and leave behind highly flammable slash at ground level, also increasing fire intensity." (7-5)	**Response 17:** No specific studies were cited to support this comment. See Responses 6, 14, and 15.
"The NEPA document fails to acknowledge the paucity of scientific support for commercial logging to reduce fuels and reduce fire effects and fails to recognize that logging often increases fine fuel loads while removing the large logs that	**Response 18:** Dombeck (2001) states "Commercial timber harvest has a firm place on our national forests to help meet our Nation's need for wood fiber. … The goal of commercial timber harvest is the cost-effective removal of commercial-grade timber, not small-diameter trees that are

are relatively less prone to burn. … Consider … Domback on Fires in 2001 – How Can We Reduce the Fire Danger in the Interior West (Fire Management Today, Winter 2001, page 11) " (5-39)	relatively worthless on the market. Commercial timber harvest won't solve our forest health problem because that isn't its purpose." He raises the question "does commercial timber harvest reduce fuel loads?" Carey and Schumann (2003) assessed existing research on the effectiveness of hazardous fuel reduction in changing wildfire behavior. They state "the research community has not addressed commercial logging as a method for reducing wildland fuels. Most of the research on logging and fire behavior focuses on the build-up of fuel that results from harvest and on methods for treating slash." They found that available studies suggest logging slash is a key factor in predicting subsequent fire risk. Within the Kelsey Planning Area, the majority of stands proposed for commercial harvest have been previously thinned. Small diameter trees with little to no commercial value (trees <5" dbh) have already been removed. In stands that haven't been thinned, non-commercial size trees would be cut during post-sale thinning operations. Commercial harvest as proposed would generally be a thinning from below (see Response 6). Stands not thinned from below would be those where treatment objectives are to create openings or reduce dwarf mistletoe infection. To move stands in the Kelsey Planning Area towards desired future conditions, it is necessary in many cases to reduce tree density. Commercial fiber removal can be an effective means of reducing stand density to meet a variety of treatment objective. Commercial harvest will not increase fuel loadings, as the purchaser of any commercial timber sale assumes responsibility for the disposal of slash resulting from the purchaser's operation.

Noxious Weeds

Comment	Response
"Please comply with Executive Order 12112 of February 3, 1999…"(5-37)	**Response 19:** The USDA Forest Service *Guide to Noxious Weed Prevention Practices* (July, 2001) referenced in the Botany Biological Evaluation and Noxious Weed Risk Assessment (Kelsey Vegetation Management EA, Appendix E) states: This Guide to Noxious Weed Prevention Practices supports implementation of the February 3, 1999 Executive Order 13112 on Invasive Species. In the Botany Report, required weed prevention practices, mitigations, and recommendations are listed that will reduce the risk of the introduction and spread of noxious weeds in the Kelsey Planning Area.
"We are especially concerned about the high risk of noxious/exotic weed spread with the action alternatives and ask that all units with known noxious weed populations be dropped for any soil disturbing or burning activity to avoid weed spread." (7-31)	**Response 20:** Required weed prevention practices (#1) and mitigations (#s 1-6) to reduce the risk of the introduction and spread of noxious weeds are listed in the Noxious Weed Risk Assessment section of the Botany Report (Draft EA, page 112). The Mitigation Measures section (Draft EA, page 96) and the Project Design Criteria (PDC) section (Draft EA, page 98) list prevention practices to reduce the risk of weed introduction and spread in the Kelsey Project area.
"A number of treatment units near US 97 and Cottonwood Road contain known noxious weed sites. … We ask that equipment used in infested areas be sterilized in order to prevent the spread of noxious weeds between units during project implementation." (4-8)	**Response 21**: The Botany Report, Section 2: Noxious Weed Risk Assessment, Mitigations, addresses contract provision WO-C/CT 6.36 requiring that equipment be cleaned prior to beginning operations. Also, Mitigation #s 4 and 5 address cleaning vehicles and equipment used in prescribed burning units. The Forest Service does not specify the method of cleaning, just that equipment and vehicles be free of soil and plant parts.
"Opening up the canopy and disturbing the soil through road building and logging as proposed	**Response 22**: The weed prevention practice required by Forest Service policy to include equipment cleaning contract provisions in all timber sale contracts, road packages, stewardship pilot projects and service contracts was inadvertently left out of the Project Design Criteria (PDC). This required

in this project could spread non-native weeds far and wide." (5-35)	weed prevention practice is included in the Final EA.
"The invasive weed sites in the analysis area and along all log and gravel haul routes should be fully inventoried and documented as part of the NEPA process for this project. In the absence of valid and complete weed survey information, harvest and road and fuel treatment activities planned as part of this project might exacerbate the problem instead of contain it. (5-36)	**Response 23:** Documentation of all known weed sites in the project area is current through the 2002 field season (EA, Table 58, page 126 and Appendix E). Mitigation Measures 1-3 on page 96 of the Draft EA and Project Design Criteria, Draft EA, page 98 address weed prevention practices that will be implemented for harvest, road, and fuel treatment activities.
"Consider how weeds were addressed in the MIDDLE NORTH UMPQUA WATERSHED ANALYSIS; Version 1.0, January 2001; North Umpqua Ranger District, Upqua National Forest; Chapter 4, pages 88-89". (5-40)	**Response:** The Middle Fork North Umpqua Watershed document has been reviewed. The situation in the Middle Fork North Umpqua Watershed is different from that in the Kelsey Project Area. The plant species and habitats considered in the Middle Fork North Umpqua Watershed Analysis are not the same as those that occur in the Kelsey Project Area. For example, the invasive species cat's ear daisy (Hypocharis radicata), dogtail hedgehog grass (Cynosurus echinatus), ox-eye daisy (Leuchanthumum vulgare), Himalayan blackberry (Rubus discolor), and meadow knapweed (Centaurea prantensis) have not been found to occur in the Kelsey area. Also, the dry meadow habitats that have been extensively grazed in the past, considered in the Middle Fork, do not occur in the Kelsey Area. Site-specific analysis for the Kelsey Project for the noxious weeds and other invasive plant species is discussed in the EA on page 125. The invasive plant species and habitats that are in the Kelsey area are discussed in those section of the EA.

TES Plants

Comment	Response
"How would Castilleja chlorotica populations be protected in Kelsey sale units? How many populations are within units? We request full avoidance of these plants." (7-39)	**Response 24:** See Appendix E, BOTANY BIOLOGICAL EVALUATION (BE) AND NOXIOUS WEED RISK ASSESSMENT, Page 107-114. See specifically ***Survey Results*** and ***Determination*** headings in Section 1: Biological Evaluation of the Botany Report. As stated in the Botany Report, all proposed units in the Kelsey Planning area were surveyed in 1998 and 2000 and no sites for PETS (Proposed, Endangered, Threatened, and Sensitive) plants, including *Castilleja chlorotica,* were found in any proposed Kelsey project units or within units associated with other projects in the planning area.

Wildlife Habitat

Comment	Response
Viewing wildlife in Sunriver is a significant recreation experience for visitors and residents of Sunriver. We desire to maintain wildlife levels as are experienced today. The proposed treatments do not appear to adversely affect wildlife in Sunriver." (4-16)	**Response 25:** No response is necessary.
"The Environmental Assessment (EA) … is deficient and inadequate re: NEPA requirements in the following ways: … the scarcity of down wood and standing snags as well as structural/vertical diversity across the sale area suggests that allowing more insect defoliation and mistletoe to occur across the area might be beneficial to provide this diversity and soil nutrient recycling, which would also benefit management indicator species (MIS) dependent on down wood and/or standing snags, such as Pileated, Blackbacked, Sapsucker and other woodpeckers and American Marten." (7-9)	**Response 26:** Approximately 48% of the forested area within the Kelsey Planning Area has been classified as imminently susceptible to bark beetle attack (Alternative 1 – No Action, EA Page 53). Following implementation of proposed treatments, this amount would be reduced to approximately 35% (Alternative 3, EA Page 53) to 38% (Alternative 2, EA Page 53). Tree mortality associated with bark beetle attack will continue to occur across the Kelsey Planning Area and would be expected to be highest within areas classified as imminently susceptible. As discussed in the effects analysis (EA Page 54), tree mortality associated with panodora moth defoliation would be highest within areas classified as imminently susceptible to bark beetle. Alternative 2 proposes harvest treatments that would reduce dwarf mistletoe on approximately 3,980 acres, or 11% of the forested portion of the planning area. Alternative 3 would reduce dwarf mistletoe on approximately 4,381 acres, or 12% of the forested portion of the planning area. Dwarf mistletoe will remain as a part of the landscape following proposed harvest. The current low level of snags and logs, together with the remnant average tree size, provides

	marginal quality habitat for MIS species mentioned. Proposed treatments will aid in the development of higher quality habitat for these species in the long-term. In the short-term, with mitigations for snags and logs, there would still be marginal habitat.
"…we are concerned that Northern Goshawk obviously need more nesting habitat (denser, with large trees), not more openings for foraging." (7-19)	**Response 27:** Known goshawk nest stands have been protected. In addition, post-fledging areas (PFAs) have been identified and any treatments within them address the needs of the PFA and are consistent with the Eastside Screens. Long-term effects consider that goshawk nesting habitat will improve with improved tree growth and larger trees.
"Nesting habitat would … be degraded for other MIS." (7-20)	**Response 28:** Some potential nesting habitat for sharp-shinned hawks, and Cooper's hawks will be degraded. These short-term effects will likely result in better habitat in the long-term
"Out of a total of 17 connective corridors to LOS, 8 to 10 would be degraded by the action alternatives. No logging should be allowed in connective corridors. Only 20% resulting canopy closure would render these areas ineffective as travel corridors." (7-23)	**Response 29:** Designation of LOS connectivity corridors has been refined. A map of the LOS connectivity corridors has been included in the EA. Where harvest units overlap connectivity corridors, thinning prescriptions have been modified to retain canopy closures within the top one-third of site potential. Treatment effects on LOS connectivity corridors have been changed to reflect the final corridor map.
"There have been no population surveys for several MIS apparently. This makes it impossible to determine viability thresholds and ensure no upward trend toward ESA listing (Endangered Species Act)." (7-18)	**Response 30:** Habitat assessments for MIS species were conducted. A survey for the northern goshawk was conducted. Although absolute determinations about the population size or viability cannot be made without a comprehensive, statistically-sound study, some basic determinations about effects to the species can be made based on the knowledge of the species' habitat requirements, and habitat suitability before and after the activity.
"Standards for CWM (down wood) are not being met and would be further depleted by the action alternatives." (7-25)	**Response 31:** Proposed harvest activities would retain all existing coarse down woody material. Use of prescribed fire has greatest potential to reduce CWM. Implementing prescribed fire in the spring when CWM has higher moisture content and controlled ignition patterns (ie. Not directly lighting a down log) are mitigation measures and project design criteria that would minimize loss of CWM during prescribed burns. (bps) In the Ponderosa Pine/Douglas-fir (PPDF) Small Tree Habitat Types (DecAID definition), currently CWM are being met (1-2% cover desired; 1.4% estimated to be existing). In other tree size habitat and the lodgepole habitat types it appears to be already below. Project Design Criteria was incorporated in order to at least retain what exists.
"DecAid was not intended by its authors to apply to site-specific planning or assure viability of species and is inappropriately used in the Kelsey EA." (7-24)	**Response 32**: Consistent with Forest Plan direction as modified by the Screens, snag guidelines have been developed using the best current science. The levels displayed in the EA are within the ranges given by DecAID, a tool that can be used to help make decisions on snags and downed wood habitat. DecAID was not used for predicting species viability. It is based on scientific research and does not rely on modeling the biological potential of wildlife populations As quoted from the home page of DecAID website (Introduction "What is the DecAID advisor?"): "The DecAID Advisor is a planning tool intended to help advise and guide managers as they conserve and manage snags, partially dead trees, and down wood for biodiversity. DecAID is an advisory tool to help managers evaluate effects, of forest conditions and existing or proposed management activities on organisms that use snags and down wood. DecAID can also allow managers to decide on snag and down wood sizes and levels needed to help meet wildlife management objectives." It is in this manor that the tool was used to more accurately provide the resource (snags and logs) within the capability of the land and the species known to inhabit. Page 61 of the EA (and pages 21-23 of the Wildlife Report) states that the desired management levels for snags and down wood were based on plant association (although Kelsey is largely pure ponderosa pine), size of trees, topography, and fire regime. DecAID does not have information for lodgepole stands, thus the level within the Forest Plan (as amended by the Screens) was used. In comparison of using the DecAID tool to establish a management level and what the Forest Plan establishes as a management level, the following results: Plant Assoc./Stand Type Mgmt Level #snags/ac 10-19.9" #snags/ac > 20" PIPO 100% 2.11 0.14

	(LRMP direction)			
	PPDF Small/Med trees (DecAID)	50%	1.6	1.1
	PPDF Small/Med trees (DecAID)	80%	4.8	2.5
	PPDF Large Tree (DecAID)	50%	2.9	3.6
	This illustrates that using DecAID actually manages for higher snag levels.			

Forest Health

Comment	Response
"The Environmental Assessment (EA) … is deficient and inadequate re: NEPA requirements in the following ways: … 'Imminently susceptibility' to beetle 'attack' is a catch-all to excuse commercial logging that is not analyzed in a non-biased way. Also not disclosed in the EA is … that most of the trees in question are now green, apparently healthy and already widely spaced (and mostly ponderosa pine) with low fuel loading. These realities call into question the whole purpose and need of the project and should be disclosed and analyzed. 'Imminent susceptibility' is thus being used to justify logging in healthy green stands in the name of 'forest health' and fuel reduction." (7-12)	**Response 33:** The Deschutes Science Team (for the Forest Health Restoration Program) prepared a white paper that defines and describes procedures for classifying stands as immininently susceptible to insect attack and wildfire (1998 Deschutes National Forest Integrated Natural Fuels Management Strategy, Appendix J). The definition and procedures were to provide a base for consistent interpretation and application of "imminent susceptibility" for all Forest vegetation treatment projects. According to the white paper, descriptions of stands imminently susceptible to bark beetle attack were "developed by Pat Cochran (Research Scientist, PNW) from pertinent published literature and his research over the past decades correlating stocking level densities, stand growth and development and bark beetle attack in the forest of Central Oregon". Procedures described in the white paper were used to classify stands within the Kelsey Planning Area in terms of susceptibility to bark beetle attack. Detailed description of the methods used can be found in the Revised Silviculture Report, Page 15. Approximately 70-75% of the stands proposed for commercial thinning have been thinned in the past. Tree spacing in these stands averages 18 feet. The remaining stands proposed for commercial thinning have not been previously thinned. Tree spacing averages 10 feet. While stands appear healthy, tree density is high enough to put them at risk to bark beetle attack. With Alternative 2, approximately 75% of the acres proposed for commercial thinning are classified as imminently susceptible to bark beetle attack. With Alternative 3, approximately 78% of the acres proposed for commercial thinning are classified as imminently susceptible. The Deschutes LRMP identifies that management strategies should emphasize prevention of pest problems rather than suppression activities (Standard and Guide FH-3). Management strategies for beetles identified in the LRMP (Table 4-29) include keeping stands in vigorous condition by controlling stocking levels through thinning and prescribed burning. Commercial thinning is proposed to meet objectives other than reducing susceptibility to bark beetle attack. Past thinning has created a primarily single-storied stand structure in which few understory trees are present to serve as ladder fuels. Shrubs and needlecast are present and can contribute to individual tree torching and crown fire initiation. The recent 18 Fire, which burned through similar stand conditions, graphically portrays how susceptible these stand structures are to wildfire.
"Any increase in insects, defoliators and disease could spread to Sunriver and adversely impact Ponderosa and Lodgepole Pine stands in Sunriver. The proposed treatments should help protect Sunriver from such invasions." (4-17)	**Response 34:** No response is necessary.

Forest Health/Fuels Reduction

Comment	Response
"We support management activities that will reduce forest fuel loads and activities that will improve forest health conditions. Thinning of small diameter trees is not enough. Thinning of larger diameter trees is also important. … Thinning to accomplish crown spacing and to reduce ladder fuels needs to be	**Response 35:** Alternative 3 incorporates management activities mentioned by the respondent. One size class of trees would not be included in thinning activities: trees greater than or equal to 21 inches dbh would be retained during all thinning/harvest activities. This is consistent with the Deschutes LRMP as amended by the

done too. Thinning should provide wide enough spacing to release (trees) which will improve growth and restore vigor to the stands. Stands containing infestations of dwarf mistletoe should be targeted for removal. Thinnings need to be both pre-commercial and commercial. Thinning activities should address all ages and size classes. … Incorporate the items mentioned above into your preferred alternative, Alternative 3, as well as some of the higher acres to be treated as stated in the modified proposed action in Alternative 2." (3-2)	Eastside Screens. The Regional Forester recently (June 11, 2003) issued guidance for implementing Eastside Screens. While the direction indicates some flexibility in implementing 21" diameter limitations is appropriate, it confirms the objective of increasing the number of large trees and LOS stands on the landscape. Harvest of trees greater than or equal to 21 inches dbh is not presently necessary to meet the identified purpose and need for action. All or portions of 5 units totaling approximately 140 acres were included for harvest in Alternative 2 but not in Alternative 3 (Units 70, 71, 80, 117, and 146). Treatments were not included in Alternative 3 to better provide cover in the Ryan Key Elk Area, Deer Habitat, and connectivity corridors.

Scenic Views

Comment	Response
"Commercial logging should not be used to artificially "enhance" scenic views. Recreational visitors are attracted to natural, not logged forest." (7-35)	**Response 36**: According to the Deschutes LRMP, the goal in the scenic view allocation is to provide Forest Visitors with high quality scenery that represents the natural character of Central Oregon. The LRMP allows for the removal of trees to create vista points or enhance a unique landscape feature (S&G M9-5). Thinning, whether commercial or pre-commercial, along with prescribed fire, are two effective tools being used to achieve scenic view objectives on the Deschutes NF. Mitigation measures (EA, Page 34), including low cut stumps and slash treatment, have been identified to help assure desired visual conditions are met following proposed thinning treatments.

Public Health/Herbicide

Comment	Response
"We are concerned re: the public health and safety impacts of herbicide use (which should have been more fully disclosed) and find adequate grounds in the EA for determination that herbicide use could and should be avoided." (7-32)	**Response 37:** In the Final Kelsey EA, more information from the herbicide risk assessement (Appendix F) has been included in the main body of the EA. The following excerpts for exposure and risk evaluation for the public is from Appendix F. With the proposed spot application of granular hexazinone, exposure of the public to the herbicide would be limited. There would be no potential for the public to receive a dermal dose of the herbicide from drift or from accidental direct spraying. Following herbicide application, potential for coming in contact with herbicide found on vegetation or the soil would be relatively low. Treatment areas would be signed to restrict entry for 48 hours. Herbicide would be applied on a small percent of each site (approximately 13 to 16% of an acre). Public use of the treatment areas is relatively low and infrequent. Given the type of vegetation within the proposed treatment areas, there is little to no potential the public would consume plants from the area that might have herbicide residues. Potential for the public to be exposed to water with herbicide residues would be low. With the proposed method of herbicide application and the lack of surface water in the immediate vicinity of the treatment units, there is no potential the public would drink surface water contaminated with herbicide residues. Exposure by way of groundwater contamination should be minimal due to the depth to groundwater. The U.S. Environmental Protection Agency (EPA) has conducted risk assessments for hexazinone as part of the reregistration process and has determined that registration for this herbicide should be maintained because the herbicide can be used without significant risk to humans or wildlife (SERA, 2002, Page vii). The U.S. EPA evaluated the dietary risks associated with hexazinone. It determined there is a reasonable certainty that no harm to any population subgroup will result from aggregate exposure to hexazinone when considering dietary, drinking water and residential exposure and all other non-occupational sources of pesticide exposure for which there is reliable information (U.S. EPA, 2002).
"Competing vegetation is not a sufficient reason to justify herbicide use." (7-33)	**Response 38:** Damage thresholds have been identified (Appendix F) quantifying how much associated vegetation is too much to permit meeting a site's management objectives. The damage thresholds for tree survival and growth are based on research data from studies on similar sites and District operational experience. Above these threshold levels, unacceptable reductions in tree survival and tree height and diameter growth would occur. As proposed, within 1-2 years following natural fuels treatment (mechanical shrub treatment or underburning), if surveys indicate that shrubs, grasses, or sedges are re-establishing and have potential to exceed the action threshold, vegetation would be treated using spot application of a granular form of hexazinone. A second application of herbicide would be done approximately 2 years following initial treatment is surveys again indicate competing and unwanted vegetation again has potential to exceed the action threshold.
"…Ceanothus and	**Response 39:** The nature and role of vegetation within the areas proposed for herbicide application are

Manzanita (the main "competing" vegetation) are both recognized to play positive roles in pine seedling establishment and health." (7-34)	described in Appendix F. For both greenleaf manzanita (Arctostapylos patula) and snowbrush (Ceanothus velutinus), it is recognized that these shrubs can provide benefits in the establishment of tree seedlings. It is also recognized, however, that these shrubs can limit seedling establishment. Growth of ponderosa pine seedlings is severely limited by manzanita, primarily due to competition for water. Established tree seedlings seldom die from the suppressing effects of competing vegetation, but growth loss can be substantial. In one study, greenleaf manzanita crown density of only 25% resulted in a nearly 60% loss in tree productivity. Snowbrush can also limit conifer growth, with soil moisture depletion probably the major factor. Snowbrush may have a competitive advantage because it can absorb water from relatively dry soil. In addition to manzanita and snowbrush, Idaho fescue (Festuca idahoensis) and Ross sedge (Carex rossii) have also been identified as vegetation with potential to compete with ponderosa pine seedlings for water. Idaho fescue is a vigorous, native, long-lived perennial, cool-season bunch grass. Ross sedge is a native, long-lived perennial graminoid.

Roads

Comment	Response
"The ineffectiveness of various methods of road closure are not disclosed; neither is the proposed methods of closure. We request more full decommissioning of roads and permanent road closures." (7-29)	**Response 40**: The ineffectiveness of some methods of closures was brought up for big game. It is in response to this ineffectiveness that a mitigation measure to establish a seasonal closure on big game winter game was developed.
"We urge the agency to avoid road building…" (5-11)	**Response 41:** There is no proposed permanent road building with the Kelsey EA.
"Forest Plan standards for road density are not being met with this project and should be." (7-27)	**Response 42:** With mitigation for a seasonal closure, the road density in MA-7 will be met.
"We oppose the construction of temporary roads." (7-28)	**Response 43:** No temporary road construction would be necessary with Alternative 2. Approximately 0.5 mile of temporary road construction would be needed with Alternative 3. In the Decision Notice, the Forest Supervisor could authorize implementation of Alternative 3 with a modification eliminate commercial harvest in EA units 232 and 233 (approximately 46 acres). Such a modification would eliminate the need for temporary road construction, while foregoing the opportunity to reduce beetle risk.
"Road 020 near the Woodside Ranch subdivision should be closed to the public. Limiting access will help fireproof the area. Many people camp along 030, use campfires and stay longer than the allowed lengths of stay. … The decommissioning of Roads 030 and 022 will direct more traffic onto 020. … (Road) 020 should be closed to the public and left available for firefighting." (1-2)	**Response 44:** Roads were identified for closure or decommissioning under the Kelsey Roads Analysis. Road 020 was not identified for closure to maintain administrative access for management activities. Other roads that were identified for closure or decommissioning may have been eliminated from decision under this EA. Roads that were identified under the roads analysis will be analyzed under a future document.
"What concerns me is closing of roads in the Kelsey EA. This area is close to town and is needed for recreation. …. Roads are invaluable for getting fire engines in to the head of a fire. (6-2)	**Response 45:** A roads needs analysis was completed for this project. In identifying road for closure, an effort was made to balance the need to reduce wildlife habitat fragmentation with the need to provide access for recreation, fire suppression, and other administrative purposes. In both action alternatives, the number of roads proposed for closure have been reduced. Only road closures necessary to mitigate effects to wildlife and associated with proposed vegetation treatments remain in the action alternatives. These roads were identified for closure in the roads needs analysis. A separate NEPA document could be done to look specifically at access management in the Kelsey Planning area. Additional road closures may be possible in the Kelsey planning area.
"Close only roads that are in bad locations. Roads can be a tool for administrative uses, recreational uses, and fire suppression activities. Unnecessary closing of roads can be very costly." (3-3)	**Response 46:** Refer to response 45

"We agree with the proposed closing and decommissioning of roads along the river and north of Sunriver. The numerous uncontrolled roads surrounding Sunriver increase the fire threat from human causes. The most effective means to prevent fires is to prohibit uncontrolled use." (4-18)	**Response 47:** No response is necessary.
"ONRC supports closing and decommissioning roads." (5-2)	**Response 48:** No response is necessary.

OHV (Off Highway Vehicles)

Comment	Response
"When the 1801 play area was closed to urban interface OHV activity, there were projects in place to absorb the loss of the historic use of that riding area. … The displacement of those recreationists was acceptable because of the planned addition of another play area, and additional mileage in the trail system, located further away from existing homes. … Where are these expansions now? While we see no additional riding areas in the planning phase, we are now to lose even more, with the proposed closure of 56 miles of old roads and a seasonal closure? Now, the existing trails will be closed with no replacement." (2-1)	**Response 49:** In both action alternatives, the number of roads proposed for closure would be reduced. Only road closures necessary to mitigate effects to wildlife and associated with proposed vegetation treatments remain in the action alternatives. A future NEPA document will likely address the needs and desires of OHV users. Until that time, the Administrative closure of the 1801 Play Area will remain in effect and OHV use will continue as is presently occurring.
"The fact that these closures (roads and seasonal closure) are lumped together with a vegetative management EA does not give much value or credibility to our sport. We do not see much analysis or forethought in the decisions or in the alternatives. What happened with the access EA that was supposed to deal with our issues?" (2-2)	**Response 50:** Refer to response 49
"Several miles of user created single track trails … GPS mapped … were supposed to be utilized as a trail system. Closing these roads and trails is unacceptable. … OHV riding is a fast growing sport. … We need more trails, not less. The more designated trails you have, the less problem you have with cross-country travel..." (6-3)	**Response 51:** Refer to response 49
"…the EA mentions the planned OHV play area and trails increasing use of the area. The EA does not specify where these will be located and what measures will be taken to prevent OHV users from driving off those designated trails. (1-3)	**Response 52:** Refer to response 49
"Having OHV areas in the Kelsey project seems to be in conflict with achieving the wildlife and forest health goals of the project." (1-8)	**Response 53:** OHV use within the Kelsey planning area has been occurring for many years. A future NEPA document will address the conflicts that are occurring. It is important to reduce conflicts and allow recreation use, both motorized and non-motorized, to occur where it is determined to be appropriate.
"…continuing the OHV closure that now exists is correct. The closure should continue since OHV users have clearly shown how they destroy vegetation thoroughly and quickly." (1-7)	**Response 54: T**he Administrative closure to OHV use along the southern urban growth boundary of Bend will remain in effect.
"ONRC strongly supports limiting OHVs to open roads and closing all other areas. (5-1)	**Response 55:** No response is necessary.

Implementation

Comment	Response
"A few of the stands around Sunriver appear to be predominately Lodgepole Pine. Thinning in these units should be directed towards releasing Ponderosa Pine." (4-3)	**Response 56:** Proposed thinning would favor retaining ponderosa pine over lodgepole pine.
"These roads (Cottonwood Road and South Century Drive) provide a scenic entry to Sunriver and thinning activities should be screened from public view as much as possible. Winter thinning over the snow should be considered." (4-6)	**Response 57:** South Century Drive (County Road 40) has a scenic view allocation of foreground retention. The majority of the Cottonwood Road, except for the portion by Highway 97, has a scenic view allocation of partial retention middleground. Treatments along these roads have been designed to be consistent with Forest Plan Standards and Guidelines for the scenic view allocation. Mitigation measures (EA, Page 34) applicable to foreground retention areas have

	been identified to help assure desired visual conditions are met following proposed thinning treatments. The mitigation measures have been changed to apply also to the entire length of Cottonwood Road.
"We urge the agency to … prioritize such activities (prescribed fire, thinning and removal of small diameter material and brush) in the wildland-urban interface." (5-12) "We encourage early treatment of all units north of Sunriver to the Deschutes River and east of Sunriver to US 97. The treatment areas of highest concern are those located adjacent to our boundaries. The areas we recommend for highest priority treatment are units 78, 206, 222, 225, 227, 368 and treatment units along our principal escape routes of Cottonwood Road and South Century Drive." (4-1) "Cottonwood Road and South Century Drive are primary escape routes from Sunriver. The thinning of tracts adjacent to these roads should have high priority for implementation. Thinning on the south side of Cottonwood Road will also improve winter driving safety." (4-5) "We (SROA) now ask the Forest Service to improve the condition of the forests that surround Sunriver. Prompt implementation of the Kelsey treatments in the Sunriver WUI is a good first step." (4-13)	**Response 58:** In the spring of 2004, the Deschutes National Forest developed a Five Year Action Plan to accelerate vegetation treatments that improve Condition Class for the Ochoco and Deschutes National Forests. The goal is to change fire behavior on the landscape to improve public safety and restore and maintain fire-dependent ecosystems. The Kelsey project area is part of the Five Year Strategy. The Central Oregon Fire Council is a collaborative, interagency group dedicated to providing leadership and strategic guidance for consistent implementation of the goals, actions, and policies in the National Fire Plan and the Federal Wildland Fire Management Policy. Members of this council represent the USDA Forest Service, USDI Bureau of Land Management, Confederated Tribes of Warm Springs, and the Oregon Department of Forestry. Other members represent county governments, fire protection organizations, and homeowners. One role of the council is to collaborate annually on the selection of ecosystem and WUI projects within respective jurisdictions. Selection of projects by the council will serve to prioritize treatments in the Kelsey Planning Area along with vegetation treatments in other portions the central Oregon geographic area. Project implementation would begin as early as Fall 2004 and be completed within 5 to 10 years.
"We encourage mechanical shrub treatment to reduce fuels adjacent to Sunriver. If underburning is used instead, we request that it be conducted when conditions minimize smoke intrusion into Sunriver. We also request that this type of work not be during times of the year when tourist visitation is high." (4-2) (Note: Called to clarify what time period was considered the "tourist season". Use increases starting Memorial Day. The tourist season peaks from July 4th to Labor Day. Any holiday weekend can also see an increase in visitors.	**Response 59:** In both Alternatives 2 and 3 mechanical shrub treatment is proposed immediately adjacent to the boundary with Sunriver. Underburning is, however, proposed in the vicinity of Sunriver and potential exists for smoke intrusion to occur. It is customary to ignite prescribed burns when predicted wind direction will carry smoke away from urban areas. It is common, however, in the evening for diurnal winds to carry smoke back towards the Deschutes River. Consequently, smoke incursion into Sunriver is likely in the evening. Amount of residual smoke in the evening is dependent on how many down logs and tree stumps are smoldering. Conditions favorable for prescribed burning would generally be outside of the time period when tourist visitation is high.
"We request that thinning activities that produce unacceptable noise within Sunriver be restricted on weekends and holidays during the tourist season and that Sunriver roads not be used as haul roads." (4-4)	**Response 60:** According to Deschutes County Noise Control Ordinance (DCC 8.08.050), generally accepted, reasonable and prudent forest practices do not constitute nuisances under DC 8.08. Sunriver's Noise Ordinance for outdoor construction limits work to the hours between 7:30 am and 7:00 pm, Monday through Saturday. Work is not allowed on the following holidays: New Years Day, Memorial Day, Independence Day, Labor Day, Thanksgiving and Christmas. A mitigation measure has been added to limit noise associated with harvest and mechanical fuel treatment proposed within one-quarter mile of Sunriver. Operations occurring during tourist season (Memorial Day through Labor Day) that produce unacceptable noise would be limited as follows: 1) Saturday operating hours 7:30 am to 7:00 pm, and 2) No operations on Sundays or holidays (Memorial Day, Independence Day, and Labor Day). The mitigation measure would apply to the following units: Alternative 2: 30, 68, 69, 78, 80, 81, 83 Alternative 3: 78, 81, 83, 206, 223, 224, 225, 226, 227, 368, 369
"The Environmental Assessment (EA) … is deficient and inadequate re: NEPA requirements in the following ways: …the EA does not disclose … 'leave tree' marking on the ground which could …	**Response 61:** The Kelsey EA states trees greater than or equal to 21 inches dbh would be retained (Pages 7 and 17) during harvest operations. Method used to designate trees less than 21 inches dbh for removal would vary depending on stand conditions, harvest prescription, and visual quality objectives. Designation

lead to trees greater than 21 inches dbh being logged … contrary to assurances in the EA that healthy trees over 21" dbh would not be logged… A contract provision prohibiting the cutting of these trees (unmarked, over 21" dbh) is unlikely to be effective given the current scarcity of old growth trees available for logging, timber industry desire for old growth logs and the unmarked status of the trees… Orange-marking is either entirely absent for these trees or confined to orange 'X's spray painted on ground needles and twigs – markings that may be absent by the time the area is logged…" (7-7)	methods include using paint or contract language, separately or in combination. Where objectives would be met best through cut tree designation, marking guidelines would indicate no trees greater than or equal to 21 inches dbh are to be marked for removal. Where objectives would be met best through leave tree designation, paint and contract language would be used in combination to designate trees for removal. Trees less than 21 inches dbh designated for cutting would be those trees less than 21 inches dbh not marked with paint (above and below stump height). Trees greater than or equal to 21 inches dbh would not be designated for cutting in the timber sale contract. The timber sale contract must always designate the trees to be *cut*. It does not designate trees to be left. The premise of the timber sale contract is that *all* trees must be left, except those trees that are designated by the contract for cutting. Designating trees to be cut by specifying a species and diameter in the timber sale contract is a very common and well-established way to designate trees for cutting. It has been successfully employed throughout the Region for many years. The contract provision is quite clear, and the results are measurable on the ground. The sale administrator will measure the diameter of butt logs in the decks and the diameter of cut trees on the ground near where they were felled to ensure they are within the contract specifications. The administrator will also measure stump diameters. Using known correlation factors between stump diameter and dbh, the administrator will know whether trees greater than the contract specifications could have been cut. If all trees over 21 inches were painted orange, the sale administrator would be doing the same inspection, but would be looking for paint instead of the diameter of the tree. If a logger intended to steal a tree marked with orange paint greater than 21 inches, they would remove the paint and hide it. The sale administrator would not see the orange paint in the deck. But the logger cannot not shrink the tree: it will still be over 21 inches. Using leave tree diameter designation in conjunction with orange paint allows more efficient use of crew time, limits their exposure to the potential hazards of the paint, and gives the contract administration team the necessary tools to confirm that the contract specifications are being followed. Paint marks on "ground needles and twigs" are used by marking crews to facilitate the efficient marking of a stand, and designate nothing in terms of the timber sale contract.
"All logging should be done without leaving painted dots on the remaining trees. It does not improve the appearance of the forest if one sees a sea of paint dots on the trees." (1-1)	**Response 62:** Designation of trees for cutting would be accomplished either by contract designation or by painting trees to be cut or retained. In selecting the designation method, consideration would be given to what method assures desired conditions following harvest are achieved and the associated costs of designation. The Kelsey EA includes a mitigation measure to lessen the visual impacts where marking trees to be retained would best meet objectives.
"We (SROA) are prepared to do what it takes to get fuels treatment work done in the forestlands surrounding Sunriver. … We would like to assist you in obtaining adequate resources to do the work" (4-14)	**Response 63:** No response is necessary.
"I am assuming that the oldest trees will be left standing, unless they are closer to each other than the target. This seems to be necessary to achieve the multiple stories desired." (1-6)	**Response 64:** See Response 6 and 8.

Unit Specific Thinning Prescription

Comment	Response
Kelsey EA Unit 23: "Recommendations for unit: DROP – already open parklike w/ low fuel loading." (7a-1)	**Response 65:** Kelsey EA Unit 23 has been previously thinned. It averages 120 trees per acre (average spacing 19 feet). The stand is classified as imminently susceptible to bark beetle attack. Thinning from below is proposed in both Alternatives 2 and 3. If stand density is not reduced, the stand will remain imminently susceptible to bark beetle attack.
Kelsey EA Unit 87: (NNVM, Benham Falls Day Use Area).	**Response 66:** In the Decision Notice, the Forest Supervisor could authorize implementation of one of the action alternatives (Alternative 2 or 3) modified to exclude or change the proposed treatment around Benham Falls.

"Recommendation: Leave alone entirely – high quality OG habitat & high recreational use/scenic." (7a-3) "Diverse tree heights, snags, different tree species add to the texture, visual appeal and naturalness of the Benham Falls area recreational experience. Logging would degrade these values." (7b-3) "Small diameter precommercial thinning would be enough to reduce fire risk – most density is from trees 3" dbh or less." (7b-4) "Unimpeded views of large old growth ponderosa pine from recreational trails were easy to find without any further logging needed." (7b-5)	The NNVM Comprehensive Management Plan identifies Areas of Concern and Opportunity. These areas were developed as a planning tool to help implement ecosystem management in NNVM. They provide an integrated, spatial perspective on the Monument's values, which is useful for planning site-specific projects. Resources designated as project "drivers" are those resources that would likely lead to planning a project within a particular Area of Concern and Opportunity. Benham Falls day-use area is within Concern and Opportunity Area 6 in the Lava Butte Zone. Six key drivers are identified for the area: heritage resources (sites occur), recreation, scenery, soils (sensitive riparian soils), vegetation and wildlife. The vegetation driver identifies existing old-growth ponderosa pine at the recreation site. It identifies opportunities for old-growth restoration and reintroducing fire in highly visible areas. It also identifies protection/restoration of riparian communities. In Area 6, the vegetation planning issue identifies opportunities for restoration/enhancement of existing old growth and prescribed fire in blackbark near Benham Falls. "Old-growth ponderosa pine," as used in the identified drivers and issues refers to both "historic," fire-based and "ecological," fire-suppressed ecosystems. The appropriate or desirable type of old-growth character for a given stand needs to be determined based on wildlife needs, fire hazard/risk, scenic quality, recreation and other site- or Area-specific issues. The NNVM Comprehensive Management Plan includes a section titled "Project Priority Areas by Resource". This section was designed as a tool to help prioritize where within NNVM a particular type of project or activity would be most appropriate. For the vegetation resource, Concern and Opportunity Area 6 is ranked third in priority (in list of 14 areas). Alternatives 2 and 3 propose thinning and underburning in the stand surrounding Benham Falls day use area (unit 87). The stand is classified as imminently susceptible to bark beetle. Ladder fuels contribute to risk of stand replacement wildfire. Thinning would consist primarily of removing lodgepole pine from around large diameter ponderosa pine and smaller diameter ponderosa pine with potential for future growth. Thinning would be restricted to non-conventional methodology, such as horse or all terrain vehicle (ATV) logging. Proposed thinning is designed to enhance and highlight big yellow bark pine trees that are being suppressed and hidden by smaller and crowding trees. Limited number of smaller trees, those that are not directly competing with the big trees, would be maintained for diversity of age and size classes. By reducing competition, thinning is expected to maintain or enhance large tree vigor as well as visually shows case them. Because of its designation as a recreational day use area, the high recreational use of the Benham Falls area, and its accessibility for a majority of the year, this unit would not be considered "high quality old growth habitat". It does have the structural components of quality old-growth habitat, however the level of human disturbance warrants a less than high-quality rating for habitat
Kelsey EA Unit 129: "Recommendations for unit: Thinning up to 7" dbh, removal of some smaller down wood leading into canopy" (7a-2) "While there is some density in this sale unit of even-aged trees that could lead to pine beetle outbreak, most density is from the smallest trees and could be thinned without using heavy equipment to protect soils from further damage." (7b-2)	**Response 67:** As proposed, this stand would be thinned from below. No trees greater than or equal to 21 inches dbh would be designated for removal. The recommendation to remove only trees less than or equal to 7 inches dbh would not meet a stated need to reduce risk to bark beetle attack. Based on stand exam information, removing trees less than or equal to 7 inches dbh would reduce the average stand density index to 159. With the growth that would occur within one year, stand density index would exceed the upper management zone (160). The stand would continue to be classified as imminently susceptible to bark beetle attack.

NEPA

Comment	Response
"Ochoco Lumber Company supports your purpose and need for action in the Kelsey planning area. We encourage management treatments that will sustain, enhance, and protect long-term productivity and resiliency of forest ecosystems; while protecting urban interface areas from catastrophic wildfires." (3-1)	**Response 68:** No response is necessary.

"I am very much in favor of restoring our forests to 'pre white man' condition. Mechanical mowing, thinning, logging, prescribed burning etc, We need to do this." (6-1)	**Response 69:** No response is necessary.
"The Environmental Assessment (EA) … is deficient and inadequate re: NEPA requirements in the following ways: … The "No Action" alternative discussion is biased in favor of logging/action alternatives in several places in the EA by not presenting benefits to soils, wildlife, water quality, recreation, scenic view, etc that could accrue by not implementing the action alternatives, as well as not disclosing the various impacts of logging." (7-11)	**Response 70:** The EA analysis was based primarily on the high risk of: high intensity, stand replacement wildfire, widespread insect infestations, and the dispersal of disease pathogens and the resulting effects to various resources if one or more of these events occurred. Alternative 1 (No Action) does present what is likely to occur with no proposed activities. The present benefits to the other resources would be substantially compromised if the natural high intensity disturbance events occurred. The effects discussion of the various resources also discloses the benefits of implementing the proposed activities.
"This project has significant effects and requires and EIS. The scale of this project is large and will cause significant effects including detrimental changes to soil and water quality, destruction of uninventoried roadless characteristics, killing of mature and old-growth forest, loss of wildlife habitat, etc. This project also has many conflicting and competing objectives and outcomes that complicate the analysis… This project proposes a wide variety of actions that can have both positive and negative effects over a variety of temporal and geographic scales. … This project is also controversial…" (5-38) "The Environmental Assessment (EA) … is deficient and inadequate re: NEPA requirements in the following ways: … the scale of this project, the diversity of 'Purposes and Needs,' its proximity to a large population center and high recreational use of the area warrants preparation of a full Environmental Impact Statement…" (7-3)	**Response 71:** The Kelsey Proposed Action is not one of the four classes of actions requiring an EIS as described in FSH 1909.14, Chapter 21, Section 20. Laws or regulations do not require an EIS for the types of actions being proposed (Class 1). Aerial application of chemical pesticides is not proposed (Class 2). The proposed action would not substantially alter the undeveloped character of an inventoried roadless area (Class 3). There are no inventoried or uninventoried roadless areas within the Kelsey Planning Area. The proposed action is not a major Federal action that may significantly affect the quality of the human environment (Class 4). The significance of environmental effects of a proposed action determines whether an EIS must be prepared (FSH 1909.15, Chapter 10, Section 17). If the proposed action may have significant environmental effects, an EIS is to be prepared (FSH 1909.15). If an action may not have significant environmental effects, an environmental assessment (EA) is to be prepared. The effects of actions similar to those being proposed for the Kelsey project have been analyzed on the Bend/Fort Rock Ranger District. Most recently, the Fall Decision Notice and Finding of No Significant Impact (May 18, 2004) documented there would be no significant effects of implementing thinning, prescribed fire, and mechanical shrub treatment. Similar to the Kelsey Planning area, the Fall planning area is close to Bend, has high recreational use, is close to surface water, and has soils similar to those found in the Kelsey planning area. The Plantation Herbicide Decision Notice and Finding of No Significant Impact (June 30, 2004) documented there would be no significant effects of the spot application of granular hexazinone to treat competing and unwanted vegetation. Based on these analyses, actions proposed in the Kelsey Project may not have significant effects. Based on the Kelsey Environmental Assessment, a determination will be made whether an EIS will need to be prepared.
"The Environmental Assessment (EA) … is deficient and inadequate re: NEPA requirements in the following ways: inadequate range of alternatives – no 'restoration only/no commercial logging' alternative; insufficient range of difference between the … two action alternatives…" (7-1) "We can't support either of the action alternatives and ask for a "Restoration only/No Commercial logging alternative." (7-2) "It would be better to just do a controlled prescribed burn at the right time of year without logging. The EA should have considered such an alternative." (5-20)	**Response 72:** In requesting a "restoration only" alternative, the respondents have not identified the desired results (goal) of such an alternative. It is not clear what condition(s) they want restored in the Kelsey Planning area. In the publication titled "The Use of Fire in Forest Restoration", Carl E. Fiedler (1996) describes the goal of restoration in ponderosa pine forests as follows: "A primary goal of restoration treatments in ponderosa pine … forests is to create more open stand structures, thereby improving tree vigor and reducing vulnerability to insects, disease, and severe fire. An additional goal in some stands is to manipulate existing species composition and site conditions to favor regeneration of ponderosa pine…". This primary goal is captured in the purpose and need for action identified for the Kelsey Planning area. Objectives of proposed thinning include: improving tree vigor and reducing vulnerability to bark beetle, mistletoe, and severe fire. Proposed regeneration harvest treatments would create site conditions to favor regeneration of ponderosa pine. During initial scoping for the Kelsey project, an issue was identified

	concerning the use of mechanical treatment within Newberry National Volcanic Monument. An alternative was considered that would decrease the amount of mechanical treatment, including commercial harvest, within the Monument. This alternative was eliminated from detailed study. In response to recent comments, a no commercial logging alternative outside the Monument was considered but eliminated from detailed study. Such an alternative would not respond to the purpose and need. Reduction of stand density is necessary to create more open stand structures that would meet a variety of objectives including: making stands more resistant to wildfire and bark beetle attack, opening up views of scenic features, and reducing shade on the Cottonwood Road. To achieve desired density reduction with fire would be clearly unreasonable - a relatively high intensity fire would be necessary. Such a fire would result in higher level of density reduction than is desired. Scorch heights associated with this type of fire would put surviving trees at an increased risk of bark beetle attack. Scorch heights and tree mortality would not be desirable within scenic view allocations. To achieve desired density reduction, it has been demonstrated on the District that cutting trees is an effective and feasible method. Carl E. Fiedler (1996) states, "a primary advantage of cutting is that it allows for the controlled removal of specific trees in terms of number, size, species, and location. Cutting trees also allows them to be used for forest products, generating income to offset treatment costs." Commercial fiber removal is an effective means of reducing stand density to meet a variety of treatment objectives. Commercial harvest will not increase fuel loadings, as the purchaser of any commercial timber sale assumes responsibility for the disposal of slash resulting from the purchaser's operation.
""The Environmental Assessment (EA) … is deficient and inadequate re: NEPA requirements in the following ways: …the impacts of logging … are … not disclosed or analyzed throughout the Kelsey EA despite heavier cutting being proposed…." (7-4)	**Response 73:** Effects of thinning treatments to the various resources are discussed throughout the EA.
"The Environmental Assessment (EA) … is deficient and inadequate re: NEPA requirements in the following ways: …There is … no substantive analysis of cumulative effects of the planned timber sale … in combination with other ongoing and foreseeable projects/impacts identified." (7-17)	**Response 74:** The Final EA has attempted to better disclose the cumulative effects for each specialty that are discussed in the Chapter 3 – Environmental Consequences, beginning on page37..
"The Environmental Assessment (EA) … is deficient and inadequate re: NEPA requirements in the following ways: …various euphemisms for heavy logging used in the EA could mislead the public and constitute 'full disclosure' violations - eg 'thinning" and "regeneration". (7-10)	**Response 75:** Terms used in the EA to describe proposed harvest activities (eg "thinning" and "regenerated") have been reviewed. Where needed to improve clarity, these terms have been changed or explained in more detail.
"The Environmental Assessment (EA) … is deficient and inadequate re: NEPA requirements in the following ways: … There is a high range of potential board foot volume for Alts 2 and 3 – what determines whether alt 3 results in 12.6 mmbf or 19.0 mmbf?" (7-13)	**Response 76:** Volume estimates are based on the number of acres proposed for harvest and the estimated average volume per acre that would be removed with each harvest prescription. For a given harvest prescription, average volume cut per acre will vary between stands depending on existing stand condition. For example, a harvest prescription that calls for thinning from below to 60 BA/Ac would result in a higher volume per acre being removed from a stand with 120 BA/Ac than from a stand with 90 BA/Ac. With Alternative 2, an estimated 13.6 $\pm$ 2.7 mmbf of timber would be removed. With Alternative 3, and estimated 15.8 $\pm$ 3.2 mmbf of timber would be removed. These estimates reflect a 20 percent sampling error. The sampling error reflects the variability between stands proposed for harvest.
"The Environmental Assessment (EA) … is deficient and inadequate re: NEPA requirements in the following ways: … The EA does not disclose any scientific studies … to substantiate many of its claims, such as	**Response 77:** As described in the Revised Silviculturist Report for the Kelsey Planning Area (Page 9), proposed thinning would maintain or accelerate tree diameter growth. Fewer large diameter trees would be expected to die as a result of bark beetle attack. With the trees growing faster in diameter and with

that of commercial logging "accelerating" the growth of remaining trees/LOS structure despite attendant removal of mature trees that would otherwise become larger and develop into LOS." (7-15)	fewer of the largest diameter trees dying, the large tree component of the late and old structural stages would be achieved faster than if no density control had occurred. This is substantiated by research conducted in central Oregon. Cochran and Barrett (1999) reported on 30 year growth of ponderosa pine thinned to different stocking levels. Their results show the greatest increase in diameter occurred in stands thinned to the widest spacing. The study shows thinning can produce large-diameter trees relatively quickly and can lower the probability of serious bark beetle outbreaks. Cochran et. al (1994) state thinning increases the growth of leave trees and may be used to accelerate the development of stands designated to eventually have old-growth characteristics. Commercial logging would be the tool used to accomplish proposed commercial thinning. As stated in the EA (Page 7 and 17), trees greater than 21 inches dbh would not be designated for harvest.
"The Environmental Assessment (EA) … is deficient and inadequate re: NEPA requirements in the following ways: …Available science is not disclosed in the EA which would reveal the natural role of bark beetles, mistletoe and fire in the forest. Benefits of allowing natural succession and natural processes (eg. fire, insect defoliation,etc.) to occur is not analyzed." (7-8)	**Response 78:** No specific studies were cited to support this comment. The comment is not specific to the proposed action. The effects analysis for the no action and action alternatives displays what effects implementation of the alternatives would have on bark beetles, mistletoe and fire.
"It appears that the project would violate the intent of management plans for the Newberry Volcanic Monument and the 1996 Upper Deschutes Wild and Scenic River and State Scenic Waterway Management Plan." (7-40)	**Response 79:** Consistency with Newberry National Volcanic Monument (NNVM) Comprehensive Management Plan standards and guidelines was evaluated for the following: natural ecological succession, re-establishment of historic ponderosa pine old growth, habitat diversity, integrated insect/disease management, mechanical treatments, and the Mokst Butte Research Natural Area. Consistency with the schedule set forth in the plan for the amount and timing of restoration treatment was also evaluated. Consistency with the vegetation standards and guidelines from the Upper Deschutes Wild and Scenic River and State Scenic Waterway Comprehensive Management Plan (Wild and Scenic River Plan) was evaluated. Proposed actions were compared to probable actions identified in the FEIS for the Wild and Scenic River Plan as being likely needed to achieve the goals or Standards and Guidelines of the plan. Proposed treatments are consistent with these plans. The consistency evaluation has been included as Appendix B to the environmental assessment.

Economic Analysis

Comment	Response
"Social/economic factors … need to be considered and given high priority in the … alternative selected." (3-4)	**Response 80:** See Response #4
"The value of Sunriver to the Central Oregon economy would be seriously degraded by major wildland fires in or near Sunriver." (4-12)	**Response 81:** No response necessary.
"The Environmental Assessment (EA) … is deficient and inadequate re: NEPA requirements in the following ways: …There is no cost/benefit analysis of ecological impacts associated with planned logging." (7-16)	**Response 82:** The proposed actions were analyzed for significance in both context and intensity in accordance with 40 CFR 1508.27. The activities that will occur with implementation of the Kelsey Vegetation Management EA will not significantly impact the human (natural or physical) environment (Decision Notice and Finding Of No Significant Impact, pages 4-6) and therefore an EIS is not necessary.
"The economic assessment is inadequate (NEPA) in that it fails to reveal and analyze hidden subsidies to the timber industry (eg. road construction and maintenance, timber sale planning and marking) as well as not assess the countering economic values of higher quality recreation, water quality, wildlife habitat, etc. from not logging." (7-38)	There are no known hidden subsidies for the timber industry. The economic analysis does not include the costs of potential appeals and litigation. The analysis for each resource describes the benefits that that resource would realize from implementing the proposed activites

Cultural Resources

Comment	Response
"No cultural "resource" sites should be logged or harmed." (7-30)	**Response 83:** Mitigation Measures, page 34 would protect cultural resources.

303(d)

Comment	Response
"303(d) listing for the River corridor should prohibit logging in RHCAs/riparian zones (Clean Water Act). Red band trout (sensitive – listed) could be affected negatively." (7-26)	**Response 84:** The proposed thinning that would be done within the RHCA would have the additional benefit of protection of the red band trout habitat in the Deschutes River by reducing stand density to reduce the risk of high intensity wildfire. A high intensity wildfire could reduce the habitat of fish through an increase in sedimentation, turbidity, and temperature.

Soils

Comment	Response
"Soil productivity must be zealously guarded in order to protect our forests for future generations." (5-30)	**Response 85:** It is important to maintain or improve soil condition and productivity. Mitigations listed on pages 32-33 provide guidelines to provide soils protection.
"Units with sensitive soils and existing soil impacts beyond or close to Forest Plan standard limits should be dropped – no heavy equipment or soil disturbance should be allowed." (7-22)	**Response 86:** Units that have steep slopes, sensitive soils (14, 81, LK, LG), will have specific unit mitigation measures applied to mitigate possible effects that would cause unacceptable damage to soils and to meet Regional and Deschutes National Forest Land and Resource Management plan.
"Soil disturbance caused by logging, road building, skid trails, and pile burning … causes erosion that adversely impacts both soil and water resources. The existing level of soil disturbance has not been measured and disclosed in the EA so the Agency cannot say with any factual basis whether forest plan standards will be met. … Existing soil impacts must be measured and future impacts estimated so that an adequate cumulative effects analysis can be prepared…." (5-32) "Cumulative impacts to soils are not sufficiently analyzed ..." (7-6)	**Response 87:** The cumulative impacts on the soil resource from past practices are accounted for in the existing condition and predicted condition summaries for proposed activity units (beginning on page 86, Table 49, page 104 and Table 50, page 107) Units in which elevated levels of detrimental disturbance are present prior to entry are identified as likely to exceed the 20% Standard following the implementation of harvest and fuels treatment activities. Mitigation measures are proposed to rectify detrimental compaction incurred under this project in order to maintain soil productivity on site, pages 32-33.
Kelsey EA Unit 129. "Dirt bike damage to soils, with redundant trails, soil displacement, ruts – rampant throughout unit and not quantified under 'soil impacts' in the EA." (7b-1)	**Response 88:** Unit 129 has 3281 feet of OHV user trail. This equates to approximately .45 acres which equal .0084 percent of the unit. The impacts to soils has been incorporated into the existing condition and is displayed in tables 49, page 102 and 50, page 107**.**
"The area near Road 18 is used by people on foot. Any thinning should be done so as to minimize soil disturbance." (1-5)	**Response 89:** All thinning activities are done to minimize disturbance.
"In areas proposed for thinning, compaction may occur in landings, haul roads, and skid trails. The compacted areas should be scarified, and compacted landings and rutted haul roads should be ripped up following use. On flatter topography it may be desirable to restrict thinning operations to winter and over the snow operations." (4-7)	**Response 90:** Subsoiling of compacted areas will occur where necessary to reduce effects to soils from commercial thinning activities. Thinning activities will occur if it is determined that the soil resource would not be irreparably harmed.
"The action alternatives would continue to violate Forest Plan standards for soil impacts with no guaranteed mitigation (eg. no guaranteed funding) or guaranteed success for any mitigation done. (7-21) "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." (5-29)	**Response 91:** There are project design criteria to minimize increasing the amount of detrimental soil disturbance. These measures include use of designated skid trails and logging over snow and/or frozen ground. Dominant soils within the planning area are well suited for tillage treatments. The winged subsoiling equipment used locally has been shown to lift and shatter compacted soil layers in greater than 90 percent of the compacted zone with one equipment pass (Craigg, 2000). Under 40 CFR 1508.2, mitigation measures may be used to rectify the impact by restoring the affected environment. Subsoiling treatments would be used to reduce the amount of compacted soil on closed roads, log landing decks and major skid trails. Required mitigation is prioritized to ensure that adequate funding is received through either deposits or appropriated funds. Required soils mitigation included in vegetation management projects

	implemented with timber sales is typically included with deposits made by the purchaser of the sale. If the Responsible Official selects an action alternative for implementation, the management requirements, BMPs, and mitigation measures would be implemented regardless of the funding source. The Bend/Fort Rock District has an extensive subsoiling program and follow-up implementation monitoring to ensure that required subsoiling mitigation gets accomplished.
"In modern forestry, soils are chronically impacted yet very slow to recover leading to cumulative impacts. Cumulative soil impacts caused by this project and all past and future projects (including livestock grazing, roads, landings, fuel treatments, fires, OHVs etc) is also a significant issue. See http://www.cof.orst.edu/cof/teach/for341/Cumulative%20Effects%20of%20Forestry%20on%20Soils/CHAPT6Soils.htm … See http://www.subtleenergies.com/ormus/bmnfa/ Soilcmts.htm" (5-34)	**Response 92:** Many uses of the Forest have occurred during post-European settlement. Activities associated with firm fiber removal and other traditional uses have impacted soils in the planning area. Many areas that have not had recurring use have likely recovered soil integrity. Other uses, such as OHV use, will be addressed on a planning area, District wide, Forest wide, or on a larger scale that will provide more long-term protection for the soil resource and allow what many public participants consider a viable recreational use. Soil impacts will be mitigated as described in Mitigations, EA page 33.
"Use of ground-based logging equipment almost always compacts soil causing reduced site productivity, drastically altered soil food web relationships, reduced infiltration, and increase surface runoff. … The EA needs to consider these impacts and consider alternative ways to avoiding these impacts." (5-14) "Ground-based logging causes higher incidences of root damage and scarring of residual trees (compared to skyline systems)." (5-31)	**Response 93:** The majority of project-related soil impacts would be confined to known locations in heavy use areas (i.e., roads, log landings, and main skid trails) that can be reclaimed through soil restoration treatments. Based on these disturbed area estimates, the percentages of detrimental soil conditions would increase above existing conditions by approximately 8 to 14.1 percent in all activity areas. However, none of these activity areas would exceed Regional policy and the LRMP standard of 20 percent detrimental soil conditions following implementation of project and restoration activities for area that have not harvested previously. For areas that have been previously harvest and exceed the 20 percent from this proposed activity have to be restored to either 20 percent or to the existing conditions prior to this activity.
"Spring burning can … be very harmful to soil and the thousands of creatures that live all or part of their lives in the soil profile. The EA needs to consider these impacts and consider alternative ways to avoiding these impacts." (5-15)	**Response 94:** Spring burning would occur with appropriate moisture levels so that a very hot burn does not occur.
"Logging will kill trees and cut off the supply of photosynthate which forms the basis of this (soil) 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." (5-33) (See Ingham, Elaine and Amaranthus et.al. 1990.)	**Response 95:** Thinning of both commercial and non-commercial trees would temporarily reduce photosynthate. Thinning treatments would reduce stand density, would reduce the risk of stand replacement wildfire (which would remove most photosynthate), and would provide long term source for photosynthate. Much of the unusable stemwood and tops would likely be machine piled and burned on log landings. There would be no machine piling or burning of logging slash in random locations of activity areas. Although this method removes potential sources of woody debris off-site, it would not cause additional soil impacts because burning would occur on disturbed soils that already have detrimental conditions. Prescribe underburning would occur during moist cold weather conditions that would cause light burn to soil duff layers and would not effect soils nutrients.

Grazing

Comment	Response
"This project does nothing to address the threat that livestock grazing causes to forest health." (5-25)	**Response 96:** Two grazing allotments are within the Kelsey Planning Area: the Coyote Allotment and the Sugar Pine Allotment. The Kelsey Project does not make a decision on grazing in these allotments. A decision on the status of the Coyote Allotment was made in The Decision Notice on the Cinder Hill EA (signed on July 7, 2004). The Cinder Hill EA assessed the effects of livestock grazing on forest

	health. The Sugar Pine Allotment is currently vacant and will remain so until an environmental assessment is completed.
"The NEPA document describes the effects "on" range resources (e.g., fences and transitory range) but fails to disclose or analyze the effects "of" livestock on forest health and the desired future condition of vegetation composition." (5-26)	**Response 97:** According to Forest Service Handbook, 1909.15 Chapter 10, Section 15, an environmental analysis is to estimate the direct, indirect, and cumulative environmental effects that would result from implementing each of the alternatives. The alternatives in the Kelsey project do not include a proposal for livestock use. Consequently, the direct and indirect effects of livestock on forest health and vegetation composition have not been analyzed. The alternatives do have potential to affect range resources. These effects are disclosed in the Kelsey Environmental Assessment. Cumulative effects of proposed treatments and livestock grazing have been analyzed and are documented in the Kelsey EA. Effects of livestock on forest health and vegetation composition are disclosed in the Cinder Hill Environmental Assessment which was completed to support a decision on grazing use in the Cinder Hill, Coyote, and Pine Mountain Allotments.
"The combination of fire suppression, past high-grading, and livestock grazing together caused the overstocked condition of the stands in the analysis area. Logging and prescribed fire will only partially address the problem. To be effective, livestock grazing must also be eliminated." (5-13)	**Response 98:** Tree density is generally attributed to fire exclusion by most of the recent publications on forest health of which tree density is a component (Belsky & Blumenthal 1997). Livestock can contribute to stand density by removing some of the herbaceous understory during the grazing season. Removal of these fine fuels can reduce the ability of a low intensity ground fire to kill regenerating trees. Belsky & Blumenthal (1997) presented examples of areas where livestock grazing in the arid west has been the main variable in stands of Ponderosa pine that exhibit tree density problems. Locally, areas east and west of highway 97 have had little or no grazing for over 50 years and exhibit similar tree density issues found on the active upland allotments on the east side of the District.
"We request that vacated livestock allotments be left vacant permanently and canopy not be opened further to enhance forage. (7-36)	**Response 99:** There are two grazing allotments within the Kelsey Planning Area. The Sugar Pine Allotment was last grazed in 1996 and has been vacant since that time. The Coyote Allotment was last grazed in 1991 and has been vacant since that time. A decision on the status of the Coyote Allotment was made in The Decision Notice on the Cinder Hill EA (signed on July 7, 2004). The Sugar Pine Allotment will remain vacant until an environmental assessment is completed. An assessment of the Sugar Pine Allotment is not on the most recent Schedule of Projects for the Deschutes/Ochoco National Forests. A decision on the status of the Sugar Pine Allotment is outside the scope of this project. Kelsey treatments that would open tree canopy are proposed to meet objectives other than enhancing forage production. These objectives include reducing wildfire and bark beetle hazard. As discussed in the Kelsey EA, treatments proposed to reduce wildfire and bark beetle hazard would result in enhanced forage production.
"Grazing and logging cause cumulative effects that must be considered together in one NEPA document." (5-28) "… there was a recent EA concerning the use of livestock to manage shrubs in part of the Kelsey area. There was no mention of that in this EA. … How are the two plans to be integrated?" (1-4)	**Response 100:** It was recently decided (July 7, 2004 Decision Notice for Cinder Hill EA) that the portion of the Coyote Allotment in the Kelsey Planning area would be: 1) managed as a Forage Reserve and 2) livestock (sheep and goats) would be used as needed to meet specific vegetation objectives such as reducing wildfire hazard. As a Forage Reserve, livestock grazing (cattle) would occur only in instances when areas in other allotments become unavailable due to wildfire or resource concerns. Such grazing would be temporary and would not be expected to occur commonly. With the Kelsey alternatives (including the no action alternative), use of livestock (sheep or goats) to reduce natural fuels would not occur. The recent decision for the Coyote Allotment will not result in reasonably foreseeable actions within the Kelsey Planning Area. Cumulative effects of treatments proposed in the Kelsey EA and reasonably foreseeable grazing in the Coyote Allotment have been analyzed and are documented in the Kelsey EA.
"Grazing reduces the density and vigor of grasses which usually outcompete tree seedlings, leading to dense stands of fire-prone small trees. Cows also decrease the abundance of fine fuels which are necessary to carry periodic, low intensity ground fires. This reduces the frequency of fires, but increases their severity. … The NEPA document failed to address	**Response 101:** Scientific evidence exists which suggests grazing causes increased tree densities because livestock consume and lower the density of grasses that would otherwise compete with tree seedlings for space, water, and nutrients (Belsky&Blumenthal 1997). To examine the effect of livestock exclusion on tree density, the District Range Conservationist evaluated study enclosures on the east side of the Bend/Fort Rock Ranger District. These enclosures were established in the 1950's and 1960's to track range condition as affected by livestock and deer exclusion. Three types of enclosures were established: 1) deer/elk/livestock use excluded, 2) livestock use excluded, 3) deer/elk/livestock use allowed. Many enclosures are located in mule deer winter range habitat. No drastic differences were observed in vegetation in or outside of the enclosures. This differs from some enclosures the Forest Range Specialist has observed in other parts of the state. Shrubs inside the deer/elk/livestock enclosures generally exhibit a slightly taller growth form, but often have large percentages of decadent material in their crowns. It appears shrubs provide greater browse capacity inside the enclosure, but any actual difference would need to be measured, as it is often not observable. The number of pine trees seems similar in most

these issues and failed to consider alternative ways of avoiding these impacts by not grazing. … See Belsky, A.J., Blumenthal, D.M., 'Effects of Livestock Grazing on Stand Dynamics and Soils in Upland Forest of the Interior West,' Conservation Biology, 11(2), April 1997. http://www.onda.org/library/papers/standdynamics.pdf … See also Werthner, George, Livestock Grazing and Fire http://www.onda.org/library/papers/Livestock_Grazing_and_Fire.pdf" (5-27)	enclosures with a slight increase in number of trees in some of the deer/elk/livestock enclosures. Tree density appears to be more a factor of past stand management activities and/or specific micro-site differences as opposed to livestock grazing. In the case of the Fort Rock enclosures, if a connection were to be made, increases in tree regeneration in the absence of mule deer use appears more likely. The Kelsey project does not make a decision on grazing. Changing the status of the vacant allotments is outside the scope of this project. A decision on the Coyote Allotment was made in the Decision Notice for the Cinder Hill EA. The Cinder Hill EA included a no grazing alternative.
"We request a copy of the Cinder Hill EA." (7-37)	**Response 102:** Not specific to proposed action. The EA has been sent to respondent.

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